1.2.1 Percentage of new courses introduced out of the total number of courses across all programmes offered during the last five years

Academic Year	Total Count	Link
2023 – 2024		
Subject List	169	Open
Syllabus		Open
2022 – 2023		
Subject List	72	Open
Syllabus		Open
2021 – 2022		
Subject List	118	Open
Syllabus		Open
2020 – 2021		
Subject List	88	Open
Syllabus		Open
2019 – 2020		
Subject List	114	Open
Syllabus		Open
Total	**561**	

Year- 1 (2023-2024)			
Sl.No	**Name of the programme**	**Name of the Course**	**Course Code**
Civil Engineering			
1	BE Civil Engineering	Geo-Informatics Laboratory	23CE523
2	BE Civil Engineering	Building Information Modelling Laboratory	23CE623
3	BE Civil Engineering	Design and Drawing (Concrete & Steel)	23CE722
4	BE Civil Engineering	Basics of Structural Dynamics	PEC
5	BE Civil Engineering	Climate change and adaptation	PEC
6	BE Civil Engineering	Marine Pollution and Control	PEC
7	BE Civil Engineering	Instrumental Method of Analysis	PEC
8	BE Civil Engineering	Air and Water Quality Modelling	PEC
9	BE Civil Engineering	Irrigation Engineering	PEC
10	BE Civil Engineering	Remote sensing and GIS	PEC
11	BE Civil Engineering	Advanced Surveying	PEC
12	BE Civil Engineering	Transportation Systems Planning & Management	PEC
13	BE Civil Engineering	Transportation Economics and Finance	PEC
14	BE Civil Engineering	Road Safety Engineering	PEC
15	BE Civil Engineering	Professional Practices for Civil Engineers	PEC
16	BE Civil Engineering	Building Information Modelling	PEC
17	BE Civil Engineering	Ground Improvement Techniques	PEC
18	BE Civil Engineering	Design of Deep Foundation	PEC
19	BE Civil Engineering	Geo Environmental Engineering	PEC
20	BE Civil Engineering	Slope Stability and Landslides	PEC

Sl.No	Name of the programme	Name of the Course	Course Code
21	BE Civil Engineering	Earth retaining Structures	PEC
22	BE Civil Engineering	Foundations in Expansive Soils	PEC
23	BE Civil Engineering	Advanced Foundation Engineering	PEC
24	BE Civil Engineering	Reinforced Soil Structures	PEC
25	BE Civil Engineering	Heritage of Tamil	23FYH121
26	BE Civil Engineering	Tamil's & Technology	23FYH222
27	BE Civil Engineering	Alternative Building Materials from Waste	OCC
28	BE Civil Engineering	Sustainability in Construction	OCC
29	BE Civil Engineering	Detailing of Steel Structures Using TEKLA	OCC
30	BE Civil Engineering	Pre – Engineered Building Detailing	OCC
31	BE Civil Engineering	Basic Plumbing	OCC
32	BE Civil Engineering	Green Building Rating	OCC
33	BE Civil Engineering	Drone Surveying	OCC
34	BE Civil Engineering	Archaeology of India	OCC
35	BE Civil Engineering	Retrofitting and Rehabilitation of Heritage Structures	OCC
36	BE Civil Engineering	Soft Skills – II – Design Thinking	23MC301
37	BE Civil Engineering	Community Service and Engineering	23MC402
38	BE Civil Engineering	Seminar and Technical Writing	23MC502
39	BE Civil Engineering	Hackathon	23MC601
MECHANICAL ENGINEERING			
40	BE Mechanical Engineering	Advanced Solid State Joining	19MEOC16
41	BE Mechanical Engineering	Design of Electric vehicle (Four wheeler)	19MEOC17

Sl.No	Name of the programme	Name of the Course	Course Code
42	BE Mechanical Engineering	Geometric Dimensioning and Tolerancing in Design	19MEOC18
43	BE Mechanical Engineering	Heating Ventilation and Air-Conditioning System Design	VAC
Electrical and Electronics Engineering			
44	B.E.Electrical and Electronics Engineering	OOPS and C++ Laboratory	23EE323
45	B.E.Electrical and Electronics Engineering	Human Values and Professional Ethics	23MC321
46	B.E.Electrical and Electronics Engineering	Design Thinking	23MC322
47	B.E.Electrical and Electronics Engineering	Induction Programme	23MC301
48	B.E.Electrical and Electronics Engineering	Power System Simulation Laboratory	PCC
49	B.E.Electrical and Electronics Engineering	Electric Vehicles	PCC
50	B.E.Electrical and Electronics Engineering	Power and Energy Laboratory	PCC
51	B.E.Electrical and Electronics Engineering	Electric Vehicle Laboratory	PCC
52	B.E.Electrical and Electronics Engineering	IoT Laboratory	PCC
53	B.E.Electrical and Electronics Engineering	Industrial Automation Laboratory	PCC
54	B.E.Electrical and Electronics Engineering	Reverse Engineering and Product Realization Laboratory	PCC

Sl.No	Name of the programme	Name of the Course	Course Code
B.E.Electronics and Communication Engineering			
55	B.E.Electronics and Communication Engineering	Introduction to Machine Learning	PCC
56	B.E.Electronics and Communication Engineering	Problem Solving Skills and Practices	23EC122
57	B.E.Electronics and Communication Engineering	Electrical Engineering and Instrumentation Laboratory	23EC121
58	B.E.Electronics and Communication Engineering	Devices and Circuits Laboratory	23EC222
Computer Science Engineering			
59	BE Computer Science Engineering	Front End Web Development	PEC
60	BE Computer Science Engineering	DevOps	19CSE08
61	BE Computer Science Engineering	Cloud Computing	19CSE07
62	BE Computer Science Engineering	Open Source Systems and Software	19CSE04
63	BE Computer Science Engineering	Cryptocurrency and Blockchain Technologies	19CSE06
64	BE Computer Science Engineering	Deep Learning	19CSE05
65	BE Computer Science Engineering	Cyber Security	19CSE09
66	BE Computer Science Engineering	Tamils and Technology	23FYH222
67	BE Computer Science Engineering	Java Programming	23CS314

Sl.No	Name of the programme	Name of the Course	Course Code
68	BE Computer Science Engineering	Java Programming Laboratory	23CS323
69	BE Computer Science Engineering	Design and Analysis of Algorithm	PCC
70	BE Computer Science Engineering	Design and Analysis of Algorithm Laboratory	PCC
71	BE Computer Science Engineering	Web Technology Laboratory	
72	BE Computer Science Engineering	Exploratory Data Analysis Laboratory	
73	BE Computer Science Engineering	Network Security Laboratory	
74	BE Computer Science Engineering	Big Data Analytics Laboratory	
75	BE Computer Science Engineering	Digital Marketing	PE2
76	BE Computer Science Engineering	Enterprise Resource Management	PE3
77	BE Computer Science Engineering	Software Project Management	PE5
78	BE Computer Science Engineering	Recommender Systems	PE7
79	BE Computer Science Engineering	Engineering Economics and Management	PE8
80	BE Computer Science Engineering	Customer Relationship and Management	PE9
81	BE Computer Science Engineering	Soft Computing	PE10

Sl.No	Name of the programme	Name of the Course	Course Code
82	BE Computer Science Engineering	Multimedia and Animation	PE11
83	BE Computer Science Engineering	Knowledge Engineering	PE16
84	BE Computer Science Engineering	Robotic Process Automation	PE18
85	BE Computer Science Engineering	Quantum Computing	PE19
86	BE Computer Science Engineering	Introduction to Customer Relationship Management	OE1
87	BE Computer Science Engineering	Fundamentals of Software Engineering	OE2
88	BE Computer Science Engineering	Internet Programming	OE3
89	BE Computer Science Engineering	Introduction to Data Warehousing	OE4
99	BE Computer Science Engineering	Introduction to Embedded Systems	OE5
Chemical Engineering			
100	B.Tech.Chemical Engineering	Heat Power Engineering	23CH211
101	B.Tech.Chemical Engineering	Introduction to Chemical Engineering	23CH213
Information Technology			
102	B.Tech Information Technology	COMPUTATIONAL THINKING	23IT214
103	B.Tech Information Technology	Statistics for Data Science and	
104	B.Tech Information Technology	Embedded Systems and IoT	
105	B.Tech Information Technology	Embedded Systems and IoT Lab	
106	B.Tech Information Technology	Data Mining Lab	

Sl.No	Name of the programme	Name of the Course	Course Code
107	B.Tech Information Technology	Open Source Systems Lab	
108	B.Tech Information Technology	Artificial Intelligence Laboratory	
109	B.Tech Information Technology	Data Visualization Laboratory	
110	B.Tech Information Technology	Cyber-Physical Systems	
111	B.Tech Information Technology	Full Stack Development	
112	B.Tech Information Technology	Full Stack Development laboratory	
113	B.Tech Information Technology	DevOps Laboratory	
114	B.Tech Information Technology	Image and Video Analytics	
115	B.Tech Information Technology	User Experience (UX) Design for Extended Reality (XR)	
116	B.Tech Information Technology	Cloud Native Application Development	
117	B.Tech Information Technology	Health Informatics	
118	B.Tech Information Technology	Social Network Analysis	
119	B.Tech Artificial Intelligence & Data Science	Human Values Professional Ethics	23MC321
Software Systems			
120	M.Sc Software Systems	DevOps & Security Practices in IT	20MSSOC1

Sl.No	Name of the programme	Name of the Course	Course Code
Data Science			
121	M.Sc. Data Science	Operations Research	21MDS51
122	M.Sc. Data Science	Big Data Computing	21MDS53
123	M.Sc. Data Science	Artificial Intelligence	21MDS54
124	M.Sc. Data Science	Elective - I (Natural Language Processing)	21MDSE2
125	M.Sc. Data Science	Big Data Computing Laboratory	21MDS56
126	M.Sc. Data Science	Elective Lab - I (Natural Language Processing Laboratory)	21MDSEL2
127	M.Sc. Data Science	Communication Skills	21MDS57
128	M.Sc. Data Science	Stochastic Models	21MDS61
129	M.Sc. Data Science	Data Mining	21MDS63
130	M.Sc. Data Science	Software Engineering	21MDS64
131	M.Sc. Data Science	Elective- II (Business Intelligence)	21MDSE1
132	M.Sc. Data Science	Elective- II (Enterprise Computing)	21MDSE22
133	M.Sc. Data Science	Cloud Computing Laboratory	21MDS65
134	M.Sc. Data Science	Data Mining and Visualization Laboratory	21MDS66
135	M.Sc. Data Science	Elective Lab - II (Business Intelligence Laboratory)	21MDSEL1
136	M.Sc. Data Science	Elective Lab - II (Enterprise Computing Laboratory)	21MDSEL9
Decision and Computing Sciences			
137	M. Sc. Decision and Computing Sciences	Applied Statistics for Business Decisions	22MDC31
138	M. Sc. Decision and Computing Sciences	Financial Analysis and Reporting	22MDC32

Sl.No	Name of the programme	Name of the Course	Course Code
139	M. Sc. Decision and Computing Sciences	Database Management Systems	22MDC34
140	M. Sc. Decision and Computing Sciences	Object Oriented Programming	22MDC35
141	M. Sc. Decision and Computing Sciences	Digital Marketing Laboratory	22MDC36
142	M. Sc. Decision and Computing Sciences	Database Management Systems Laboratory	22MDC37
143	M. Sc. Decision and Computing Sciences	Object Oriented Programming Laboratory	22MDC38
144	M. Sc. Decision and Computing Sciences	Operations Research for Business	22MDC42
145	M. Sc. Decision and Computing Sciences	Financial Engineering	22MDC43
146	M. Sc. Decision and Computing Sciences	Advanced Data Structures and Algorithms	22MDC44
147	M. Sc. Decision and Computing Sciences	Financial Engineering Laboratory	22MDC47
148	M. Sc. Decision and Computing Sciences	Advanced Data Structures and Algorithms Laboratory	22MDC48
149	M. Sc. Decision and Computing Sciences	Personality Development	22MDC49
150	M. Sc. Decision and Computing Sciences	Full Stack Web Application Development	17MDCE53
151	M. Sc. Decision and Computing Sciences	Full Stack Web Application Development Laboratory	17MDCEL4
Artificial Intelligence			
152	M.Sc. Artificial Intelligence and Machine Learning	EXPLANAIBLE AI	19MAME20

Sl.No	Name of the programme	Name of the Course	Course Code
153	M.Sc. Artificial Intelligence and Machine Learning	FEDERATED LEARNING	19MAME21
154	M.Sc. Artificial Intelligence and Machine Learning	GENERATIVE ADVERSIAL NETWORKS	19MAME22
155	M.Sc. Artificial Intelligence and Machine Learning	Blockchain Technologies	20MSSE04
156	M.Sc. Artificial Intelligence and Machine Learning	Generative Ai Lab	19MAMEL07
157	M.Sc. Artificial Intelligence and Machine Learning	Software Testing Lab	19MAMEL08
158	M.Sc. Artificial Intelligence and Machine Learning	Machine Learning Operations Lab	19MAMOCO4
159	M.Sc. Artificial Intelligence and Machine Learning	Innovation,Startsups And Entrepreurship	19MAMOCO5
160	M.Sc. Artificial Intelligence and Machine Learning	Economics Of Banking And Finance Markets	19MAMON01
161	M.Sc. Artificial Intelligence and Machine Learning	Introduction To Industry 4.0 And Industrial Internet Of Things	19MAMON02
162	M.Sc. Artificial Intelligence and Machine Learning	Etihcal Hacking	19MAMON03
163	M.Sc. Artificial Intelligence and Machine Learning	Affective Computing	19MAMON04
Master of Computer Applications			
164	Master of Computer Applications	Object Oriented Programming with Java	23MCA131

Sl.No	Name of the programme	Name of the Course	Course Code
165	Master of Computer Applications	Advanced Machine Learning Techniques	23MCA211
166	Master of Computer Applications	Agile Methods for Software Development	23MCA212
167	Master of Computer Applications	Full Stack Web Development Laboratory	23MCA222
168	Master of Computer Applications	Soft skills – I	23MCA223
MASTER OF BUSINESS ADMINISTRATION			
169	MBA - MASTER OF BUSINESS ADMINISTRATION	BUSINESS SIMULATION LAB	23MBA321

23CE523	GEO-INFORMATICS LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

1. Starting up a GIS map and layer editing & exploring
2. Using tools: Hyperlink, identify and navigate
3. Exploring feature- attribute relationship
4. Exploring benefits of the feature-attribute relationship
5. Creating a map layout
6. Reversing a map layout
7. Finding places by using coordinates
8. Determination of Measurements on maps using Mercator projection, Mollweide projection and Winkel Tripel projection
9. Implementation of Vector and Raster data in ArcMap
10. Working with geographic data and exploring
11. Exploration of Query data based on attributes and locations
12. Analyzing data using Buffer and Overlay
13. Analyzing the GIS analysis process using tools, query and combinations

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Apply fundamental GIS functionalities to launch and manipulate GIS maps, edit layers, and utilize tools like hyperlink, identify, and navigate with accuracy

CO2: Analyze feature-attribute relationships and assess the connections between geospatial features and their attributes

CO3: Apply design principles to create visually appealing and informative map layouts.

CO4: Identify the dimensions and distances on maps using different projections

CO5: Integrate vector and raster data, perform attribute and location-based queries, and utilize buffer and overlay tools.

TOTAL: 60 PERIODS

TEXT BOOK:

1. ,"An Introduction to Remote Sensing" by Kevin Munett,2023.
2. "Remote Sensing and Image Interpretation‖ by John Jensen and John Chipman, 2015

REFERENCES:

1. "Geographic Information Systems and Science" by Paul Longley et al, 2019.
2. "Mastering ArcGIS Pro" by Alison Knapp, 2023.

23CE623	BUILDING INFORMATION MODELLING LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Introduction to BIM
2. Level of Detail (LOD) BIM Concepts
3. Evolution and development of BIM & object-based parametric modeling
4. 2D and 3D Exercises
5. Infrastructure Modelling
6. Detailed Architectural BIM Modeling
7. Introduction to GEOBIM exercises
8. Project Scheduling with BIM
9. Generating Good for Construction (GFC) Documentation
10. Mini project

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Apply the fundamental principles of Building Information Modeling (BIM)

CO2: Assess the construction processes through Building Information Modelling (BIM)

CO3: Analyze project delivery methods using BIM and related digital technologies

CO4: Prepare detailed architectural BIM models considering materials, spatial relationships, and Level of Detail (LOD)

CO5: Develop project schedules and project management documentation using BIM

TOTAL: 30 PERIODS

REFERENCES:

1. ¯Project Management using Primavera‖ by Harris P.E., Eastern Harris Publications, 2nd Edition,2008.
2. M.S. Project – Microsoft Press, 1st Edition, 2003
3. ¯BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors‖ by Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston, John Wiley & Sons, 2008.
4. ¯BIM and Construction Management: Proven Tools, Methods, and Workflows‖ by Brad Hardin, Sybex, 2009.
5. ¯Building Information Modeling: BIM in Current and Future Practice‖ by Karen Kensek and Douglas Noble, First Edition, Wiley, 2014.

23CE722	DESIGN AND DRAWING (CONCRETE & STEEL)	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

CONCRETE

Detailed design and drawing of the following structure

1. One way floor slab and two way floor slab.
2. Continuous beams.
3. Column with footing
4. Dog legged staircase
5. Water tanks – Underground & On-ground (Rectangular & circular)
6. Retaining walls – (Cantilever & Counterfort)

STEEL

Detailed design and drawing of the following structure

1. Bolt Connections - framed, stiffened seat & unstiffened seat connections
2. Welded Connections - framed, stiffened seat & unstiffened seat connections
3. Tension and compression splices
4. Battened and Laced Columns
5. Column bases
6. Welded plate girders
7. Gantry girder

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Outline the reinforcement sketch for the slabs, beams, columns, footings, joints, water tanks and retaining walls as per IS Provisions.

CO2: Calculate the bar bending schedule of steel elements and quantitate

CO3: Outline the details of connections, splices, columns, column bases and plate girders of steel structures

CO4: Apply the software tools for detailing the structural concrete and steel elements.

CO5: Apply the software tools for bar bending schedule for the structural concrete and steel elements.

TOTAL: 60 PERIODS

TEXT BOOK:

1. "Structural Design and Drawing" by Krishnamurthy,D., CBS Publishers and Distributors, Delhi, 2020.
2. "Design of Steel Structures" by Subramanian.N, Oxford University Press, New Delhi, 2022.
3. "Limit State Design of Steel Structures" by Duggal.S.K, Tata McGraw Hill Publication, 2018.
4. "Structural Design and Drawing" by Krishnaraju, N., Oxford University Press, 2022.

REFERENCES:

1. "Design of Steel Structures by Limit State Design" by Bhavikatti.S.S, I.K International Pvt. Ltd., New Delhi 2023.

COURSE CODE	BASICS OF STRUCTURAL DYNAMICS	L	T	P	C
		3	0	0	3

MODULE I PRINCIPLES OF VIBRATION ANALYSIS 9

Mathematical models of single degree of freedom systems - Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Transmissibility.

MODULE II DYNAMIC RESPONSE OF TWO DEGREE OF FREEDOM SYSTEMS 9

Mathematical models of two degree of freedom systems, Free and forced vibrations of two degree of freedom systems, Normal modes of vibration, Applications.

MODULE III DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS 9

Mathematical models of Multi-degree of freedom systems, Orthogonality of normal modes, Free and forced vibrations of multi degree of freedom systems, Mode superposition technique, Applications.

MODULE IV DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS 9

Mathematical models of continuous systems, Free and forced vibration of continuous systems, Rayleigh - Ritz method - Formulation using Conservation of Energy - Formulation using Virtual Work, Applications.

MODULE V DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 9

Damping in MDOF systems, Nonlinear MDOF systems, Step-by-step numerical integration algorithms, Substructure technique. Variable - Probability density function - Moment generating function- Distributions: Binomial, Poisson, Normal and Exponential.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Develop and implement new analytical or computational techniques for SDOF vibration analysis.

CO2: Evaluate the limitations of the 2DOF model and its applicability to real-world engineering problems.

CO3: Evaluate the accuracy and limitations of the MDOF model and mode superposition results compared to analytical solutions.

CO4: Formulate the governing differential equation for free vibration of a specific beam or plate using Euler-Bernoulli theory or Kirchhoff plate theory.

CO5: Evaluate the accuracy and limitations of using PDFs and MGFs to characterize complex dynamic systems

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Dynamics of Structures" by Ray Clough and Joe Penzien, McGraw Hill Book Company, 2015.
2. "Dynamics of Structures - Theory and Applications to Earthquake Engineering" by ¯Anil K Chopra, Prentice Hall, New Delhi, 2019.

COURSE CODE	CLIMATE CHANGE AND ADAPTATION	L	T	P	C
		3	0	0	3

MODULE I EARTH'S CLIMATE SYSTEM **9**

Introduction - weather and climate - Climate in the spotlight-The Earth's Climate Machine – Climate Classification – Global wind systems – Trade Wind Systems – Trade Winds and the Hadley Cell – Cloud formation and Monsoon Rains – Storms, Hurricanes and Tornado – The Hydrological Cycle – Global Ocean Circulation – El Nino – LA Nino effect – Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming.

MODULE II OBSERVED CHANGES AND ITS CAUSES **9**

Observation of Climate Change – Changes in pattern of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – Climate Change modelling.

MODULE III IMPACTS OF CLIMATE CHANGE **9**

Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for different regions – Uncertainties in the Projected Impacts of Climate Change – Risk of irreversible changes.

MODULE IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES **9**

Adaptation Strategy/options in various sectors – Water – Agriculture – Infrastructure and Settlement including coastal zones. Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and practices – Energy supply – Transport – Buildings – Industry – Agriculture – Forestry – Carbon sequestration – Carbon Capture and Storage (CCS) – Waste (MSW & Biowaste, Biomedical, Industrial waste – International and Regional co-operation.

MODULE V CLEAN TECHNOLOGY AND ENERGY **9**

Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco-friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Explain the earth's climate system and the concept of global warming.

CO2: Identify the causes for climate change on the earth's surface.

CO3: Comprehend the impact of climate change on society.

CO4: Apply the various climate change adaptation and mitigation measures.

CO5: Evaluate the role of clean technology in climate change adaptation.

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Climate Change Impacts on Agriculture: Mitigation and Adaptation‖ by Manish Sinha, Springer, 2021.
2. ¯The Climate Crisis: What Scientists Need You to Know‖ by Rahmstorf, S, Columbia University Press, New York, NY, 2018.

REFERENCES:

1. "Understanding Climate Change" by David Archer, Cambridge University Press, 2016.
2. ¯Climate Change and Climate Variability on Hydrological Regimes‖ by Jan C. van Dam, Impacts of IHE, The Netherlands, October, 2009.
3. ¯Climate Change – An Indian Perspective‖ by Dash Sushil Kumar, Cambridge University Press India Pvt. Ltd, 2007.
4. Al core ¸inconvenient truth‖ – a Global Warming, video form, Documentary, May 2006.
5. ¯Climate Change and Sustainable Development: Prospects for Developing Countries‖ by Anil Maranda, Routledge, 2002.

ONLINE RESOURCES:

1. https://climate.nasa.gov/
2. https://www.climate.gov/

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2						3						1		
2		1					3						1		
3						3	3						2		
4			2				3						2		
5	2						3						2		
Avg.	2	1	2			3	3						2		

1 – Low, 2 – Medium, 3 – High

COURSE CODE	MARINE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

MODULE I MARINE AND COASTAL ENVIRONMENT **9**

Seas and oceans, continental area, coastal zone, properties of sea water, principles of marine geology, coastal features – beaches, estuaries, lagoons, salt marshes, mangroves and sand dunes– the oceans and climate, coastal zone regulation in India- national and international treaties.

MODULE II OCEAN HYDRODYNAMICS **9**

Wave theory, waves in shallow waters – refraction, diffraction and shoaling, approximations for deep and shallow water conditions – tidal classification - general circulation of ocean waters - ocean currents - coastal sediment transport - onshore offshore sediment transport – beach formation and coastal processes - Tsunamis, storm surge, El Nino effect.

MODULE III MARINE POLLUTION **9**

Sources of marine pollution – point and non-point sources, pollution caused by effluent discharge, oil exploration, dredging, offshore mining, port and harbour activities, power plants, agriculture runoff, plastic waste, marine debris and marine litter - effects of marine pollution on marine water quality and coastal ecosystems.

MODULE IV MARINE POLLUTION MONITORING **9**

Basic measurements - sounding boat, echo sounders – current meters - tide gauge - use of GPS – measurement of coastal water characteristics – sea bed sampling – modelling of pollutant transport and dispersion - oil spill models - ocean monitoring satellites – applications of remote sensing and GIS in monitoring marine pollution – online marine pollution monitoring.

MODULE V MARINE POLLUTION CONTROL MEASURES **9**

Marine discharges and effluent standards, pollution control strategies – marine outfall design-selection of optimal marine outfall locations - Total Maximum Daily Load (TMDL) applications – protocols in marine pollution control– Integrated Coastal Zone Management (ICZM) and sustainable development.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Identify the different components of marine environment.

CO2: Summarize the physical concepts lying behind the tides, waves, and oceanic currents and natural processes of various activities happening over the marine environment.

CO3: Identify and measure the marine pollution levels and effects.

CO4: Focus the knowledge of remote sensing and GIS for monitoring marine environment water quality.

CO5: Develop marine pollution control measures.

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Oceans and Marine Ecology‖, 7th Edition by Gary Williams & David Kay, 2020.

2. ¯Marine Pollution: New Research‖ by Tobias N. Hofer, Nova Publishers, 2018.

REFERENCES:

1. ¯Oceanography and Marine Biology‖ by Robert J. Stewart, John Wiley & Sons, 2023.
2. ¯Marine Pollution and Climate Change‖ by Daniel Victor, 2023.
3. ¯Handbook of Marine Pollution Prevention‖ by Michael E. Connor, 2018.
4. ¯The International Law of Marine Pollution‖ by Alan E. Boyle, Oxford University Press, 2020.
5. ¯Marine Pollution‖ by Uwe Horstmann & Peter Wells, Springer, 2017.

ONLINE RESOURCES:

1. https://www.ioc.unesco.org/en/
2. ttps://marinedebris.noaa.gov/

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2						2						1		
2	2						3						1		
3	2						3						2		
4					3		3						1		
5			3				3						2		
Avg.	2		3		3		3						1		

1 – Low, 2 – Medium, 3 – High

COURSE CODE	INSTRUMENTAL METHOD OF ANALYSIS	L	T	P	C
		3	0	0	3

MODULE I QUANTITATIVE CHEMISTRY **9**

Necessity and scope - Quantitative methods: gravimetric, volumetric, and instrumental - Low level and high-level instruments - Precision, accuracy, and rounding-off data - Types of errors - Detection limits - Quality assurance and quality control - Colorimetry: Beer's and Lambertz laws.

MODULE II OPTICAL METHODS **9**

Definition and types - Absorption, emission, and dispersion and scattering methods - Ultraviolet, infrared, atomic emission, atomic absorption, and inductively coupled plasma (ICP) spectroscopes - Fluorimetry, turbidimetry, and nephelometry.

MODULE III CHROMATOGRAPHIC METHODS **9**

Definition and types - Gas chromatography (GC): packed and capillary columns, EC, FI, FP, TC, NPD, and AFI detectors - High performance liquid chromatography (HPLC) - Ion chromatography - Capillary electrophoresis.

MODULE IV ELECTRICAL METHODS **9**

Definition and types - Potentiometric and polarographic analyses - Glass electrode, membrane electrode, and membrane probe- Merits, demerits, and precautions in use of electrodes - Practical applications.

MODULE V SPECIAL INSTRUMENTS **9**

Necessity and applications - Mass spectroscopy (MS) - X-ray analysis - Scanning electron microscope (SEM) analysis - Nuclear magnetic resonance (NMR) spectroscopy - Radioactive measurements.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Outline the various quantitative-based instruments in environmental monitoring.

CO2: Infer different methods for analysis of samples using instrumentation.

CO3: Analyze the samples using optical, electrical and chromatography methods.

CO4: Comprehend the proper utilization of Advance instruments.

CO5: Employ the advanced analytical techniques in environmental quality monitoring.

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Instrumental Methods of Chemical Analysis", 6th Edition by B.K. SHARMA, Goel Publishing House, 2020.
2. ¯Quantitative chemical analysis‖, 10th ed. by Harris, D. C. New York, NY: W.H. Freeman and Company, 2020.

REFERENCES:

1. ¯Fundamentals of analytical chemistry‖ 10th ed. by Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R. Belmont, CA: Brooks/Cole Cengage Learning, 2021.
2. ¯Handbook of instrumental methods for the analysis of food‖ by Mills, I. M., & White, J. D. Cambridge University Press, 2018.
3. ¯Quantitative Chemical Analysis‖ 10th ed. by Harris, D.C., Macmillan Learning, 2019.
4. ¯Analytical chemistry: A modern approach‖ by Christian, G. D., John Wiley & Sons, 2018.
5. ¯Instrumental methods of analysis‖ by Willard, H. H., Merritt, L. L., Dean, J. A., & Settle, F. A., CBS Publishers & Distributors, 2018.

ONLINE RESOURCES:

1. https://www.nist.gov/topics/analytical-chemistry
2. https://www.asms.org/

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2				3								2		
2		2			3								2		
3	2				3								2		
4	3				3								2		
5			1		3								2		
Avg.	2	2	1		3								2		

1 – Low, 2 – Medium, 3 – High

COIMBATORE INSTITUTE OF TECHNOLOGY, COIMBATORE – 641 014
(Autonomous Institution affiliated to ANNA UNIVERSITY, CHENNAI)
DEPARTMENT OF CIVIL ENGINEERING
REGULATIONS 2023 - CHOICEBASEDCREDITSYSTEM

B.E. CIVIL ENGINEERING

CURRICULA AND SYLLABI

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23FYH111	Technical English	HSC	2	2	0	4	4
2	23FYM111	Matrices and Calculus	BSC	3	1	0	4	4
3	23FYP111	Physics for Civil Engineers	BSC	3	0	0	3	3
4	23FYC111	Engineering Chemistry for Civil Engineers	BSC	3	0	0	3	3
5	23CE111	Construction Materials	PCC	3	0	0	3	3
PRACTICALS								
1	23CE121	Engineering Graphics- I	ESC	0	0	4	4	2
2	23CE122	Engineering Practices Laboratory	ESC	0	0	2	2	1
3	23CE123	C Programming Laboratory	ESC	0	0	4	4	2
ONE CREDIT COURSES								
1	23FYH121	Heritage of Tamil	OC	1	0	0	1	1
MANDATORY COURSES								
1	23MC101	Induction Programme	MC	15 DAYS			-	-
2	23MC102	Soft Skills - I	MC	1	0	0	-	-
			TOTAL	**17**	**3**	**10**	**30**	**23**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23FYH211	Professional English	HSC	3	0	0	3	3
2	23FYM211	Fourier Series and Transforms	BSC	3	1	0	4	4
3	23CE211	Engineering Mechanics	ESC	3	0	0	3	3
4	23CE212	Engineering Geology	ESC	3	0	0	3	3
5	23CE213	Construction Technology	PCC	3	0	0	3	3
PRACTICALS								
1	23FYH221	English Communication Competency Laboratory	HSC	0	0	4	4	2
2	23CE221	Engineering Graphics- II	ESC	0	0	4	4	2
3	23FPC221	Basic Sciences Laboratory	ESC	0	0	4	4	2
ONE CREDIT COURSES								
1	23FYC221	Environmental Science and Engineering	OC	1	0	0	1	1
2	23FYH222	Tamil's & Technology	OC	1	0	0	1	1
CO-CURRICULAR ACTIVITES								
1	23CC	23CC221- NSS	OC	15 HOURS			1	1
2		23CC222- YRC						
3		23CC223- RSP						
4		23CC224- Sports						
			TOTAL	**18**	**1**	**12**	**31**	**25**

SEMESTER – III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23M311	Differential Equations and Random Variables	BSC	3	1	0	4	4
2	23CE311	Mechanics of Solids I	ESC	3	0	0	3	3
3	23CE312	Concrete Technology	PCC	3	0	0	3	3
4	23CE313	Mechanics of Fluids	PCC	3	0	0	3	3
5	23CE314	Surveying	PCC	3	0	0	3	3
PRACTICALS								
1	23CE321	Strength of Materials Laboratory	ESC	0	0	4	4	2
2	23CE322	Survey Laboratory	PCC	0	0	4	4	2
3	23CE323	Building Planning and Drawing	ESC	0	0	4	4	2
MANDATORY COURSES								
1	23MC301	Soft Skills – II – Design Thinking	MC	15 HOURS			1	1
2	23MC302	Human Value and Professional Ethics	MC	15 HOURS			1	1
TOTAL				**17**	**1**	**12**	**30**	**24**

SEMESTER 7

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23CE411	Mechanics of Solids II	ESC	3	0	0	3	3
2	23CE412	Highway and Railway Engineering	PCC	3	0	0	3	3
3	23CE413	Applied Hydraulics and Hydraulic Machinery	PCC	3	0	0	3	3
4	23CE414	Water Supply Engineering	PCC	3	0	0	3	3
5	23CE415	Construction Management	HSC	3	0	0	3	3
PRACTICALS								
1	23CE421	Environmental Engineering Laboratory I	ESC	0	0	2	2	1
2	23CE422	Hydraulics Laboratory	PCC	0	0	4	4	2
3	23CE423	Concrete Laboratory	PCC	0	0	4	4	2
MANDATORY COURSES								
1	23MC401	Value Added Course - I	MC	15 HOURS			-	-
2	23MC402	Community Service and Engineering	MC	15 HOURS			-	-
			TOTAL	**17**	**0**	**10**	**27**	**20**

SEMESTER 8

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23CE511	Structural Analysis - I	PCC	3	0	0	3	3
2	23CE512	Design of Reinforced Concrete Structural Elements	PCC	3	0	0	3	3
3	23CE513	Mechanics of Soils	PCC	3	0	0	3	3
4		ELECTIVE –I / OPEN ELECTIVE-I	PEC/OEC	3	0	0	3	3
5		ELECTIVE –II	PEC	3	0	0	3	3
PRACTICALS								
1	23CE521	Highway Engineering Laboratory	PCC	0	0	4	4	2
2	23CE522	Quantity Surveying Laboratory	PCC	0	0	4	4	2
3	23CE523	Geo-Informatics Laboratory	PCC	0	0	4	4	2
	PROJ	INPLANT TRAINING*	PROJECT				1	1
MANDATORY COURSES								
1	23MC501	Value Added Course – II	MC	**15 HOURS**			-	-
2	23MC502	Seminar and Technical Writing	MC	15 HOURS			-	-
			TOTAL	**18**	**0**	**12**	**30**	**22**

**** 2 weeks of Inplant Training need to be completed during 4th semester vacation***

SEMESTER – VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23CE611	Structural Analysis - II	PCC	3	0	0	3	3
2	23CE612	Design of Steel Structures	PCC	3	0	0	3	3
3	23CE613	Foundation Engineering	PCC	3	0	0	3	3
4		ELECTIVE -III / OPEN ELECTIVE - II	PEC/OEC	3	0	0	3	3
5		ELECTIVE – IV	PEC	3	0	0	3	3
PRACTICALS								
1	23CE621	Soil Mechanics Laboratory	PCC	0	0	4	4	2
2	23CE622	Project Planning Laboratory	PROJECT	0	0	4	4	2
3	23CE623	Building Information Modelling Laboratory	PCC	0	0	2	2	1
	PROJ	MINI PROJECT	PROJECT	0	0	4	4	2
MANDATORY COURSES								
1	23MC601	Hackathon	**MC**	**15 HOURS**			**1**	**1**
			TOTAL	**16**	**0**	**14**	**30**	**23**

LIST OF VALUE-ADDED COURSES:

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	C
1.		Building Construction Process- an Overview	OC	1	0	0	1	-
2.		Applications of IoT in Civil Engineering	OC	1	0	0	1	-
3.		Certification and Career Roadmap in Civil Engineering	OC	1	0	0	1	-
4.		Environmental Monitoring	OC	1	0	0	1	-
5.		Python for Civil Engineers	OC	1	0	0	1	-
6.		3D Printing of Civil Engineering Structures	OC	1	0	0	1	-
7.		Alternative Building Materials from Waste	OC	1	0	0	1	-
8.		Sustainability in Construction	OC	1	0	0	1	-
9.		Detailing of Steel Structures Using TEKLA	OC	1	0	0	1	-
10.		Pre – Engineered Building Detailing	OC	1	0	0	1	-
11.		Basic Plumbing	OC	1	0	0	1	-
12.		Green Building Rating	OC	1	0	0	1	-
13.		Drone Surveying	OC	1	0	0	1	-
14.		Archaeology of India	OC	1	0	0	1	-
15.		Retrofitting and Rehabilitation of Heritage Structures	OC	1	0	0	1	-

COURSE CODE	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

MODULE I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9

Role of ground improvement in foundation engineering - Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils - Selection of suitable ground improvement techniques based on soil conditions.

MODULE II DEWATERING 9

Dewatering Techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two-dimensional flow for fully and partially penetrated slots in homogeneous deposits - Design for simple cases.

MODULE III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 9

In-situ densification of cohesion less soils - Dynamic compaction – Vibro - flotation, Sand compaction piles and deep compaction; Consolidation of cohesive soils - Preloading with sand drains and fabric drains, Stabilization of soft clay ground using stone columns and lime piles- Installation techniques – Simple design - Relative merits of above methods and their limitations.

MODULE IV EARTH REINFORCEMENT 9

Concept of reinforcement - Types of reinforcement material - Reinforced earth wall - Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

MODULE V GROUTING TECHNIQUES 9

Types of grouts - Grouting equipments and machinery - Injection methods - Grout monitoring – Stabilization with cement, lime and chemicals - Stabilization of expansive soil.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Analyze geotechnical challenges in alluvial, lateritic, and black cotton soils and recommend appropriate ground improvement techniques based on soil properties and project requirements.

CO2: Develop dewatering systems using wellpoints, vacuum, and electro-osmotic methods for efficient control of groundwater in construction projects, considering seepage analysis and practical limitations.

CO3: Select and design in situ densification consolidation techniques for cohesionless and cohesive soils, evaluating their relative merits and limitations.

CO4: Design and evaluate reinforced earth walls using various materials and mechanisms, considering applications in soil reinforcement and the functional roles of geotextiles in filtration, drainage, separation, road works, and containment.

CO5: Illustrate grouting procedures for soil stabilization with cement, lime, and chemicals, considering the treatment of expansive soils.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Soil Mechanics and Foundations (8th Edition)‖ by B. C. Punmia, Laxmi Publications, 2019.
2. ―Dewatering in Building Construction (2nd Edition)‖ by Jacob Sandstedt, CRC Press, 2018.

REFERENCES:

1. ―Principles of Foundation Engineering (7th Edition)‖ by D. P. Coduto, Prentice Hall, 2019.
2. ―Grouting in Geotechnical Engineering (4th Edition)‖ by Paul I. Mayhew, ICE Publishing, 2019.
3. ―Modern Ground Improvement Techniques (2nd Edition)‖ by Yoshitaka Ooi, CRC Press, 2019
4. ―Ground Improvement Techniques (4th Edition)‖ by M. J. Tomlinson, CRC Press, 2018.
5. ―Ground Improvement by Deep Mixing‖ by Yasushi Matsuda, Fumihiko Ohya, and Hideaki Igarashi, by John Wiley & Sons, 2018.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105108075

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2											3	1	
2	3	2	1										3	2	
3	3	2	2										3	2	
4	3	2											3	2	
5	3	2	3		2								3	2	
Avg.	**3**	**2**	**2**		**2**								**3**	**2**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	DESIGN OF DEEP FOUNDATION	L	T	P	C
		3	0	0	3

MODULE I PILE CLASSIFICATIONS **9**

Function - classification of piles - Factors governing choice of pile foundation - Load transfer principles - piling equipment and methods - changes in soil condition during installation of piles - requirement of code of practice - responsibility of engineer and contractor.

MODULE II AXIALLY LOADED PILES AND PILE GROUPS **9**

Allowable load evaluation of piles and pile groups - Static method - cohesive - cohesion less soil – time effects - Dynamic method-pile driving formulae - Wave equation application – modelling – theoretical analysis - Interpretation of field test results and pile load test results - Settlement of Piles and Pile groups.

MODULE III LATERAL AND UPLIFT LOAD EVALUATION **9**

Piles subjected to Lateral loads - Broms method, elastic -p-y curve analyses - Batter piles - response to moment - pile subjected to uplift loads - load -deformation behavior - Lateral and uplift load test data interpretation. Foundation on week compressible-collapsible soil – case studies.

MODULE IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS **9**

Pile foundation - structural design - pile cap analysis, pile - raft system basic interactive analysis - pile and pile groups subjected to vibrations - fundamental solutions.

MODULE V CAISSONS **9**

Caissons types - Stability of caissons - principles of analysis and design, seismic influences.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Evaluate and select suitable pile foundation types and installation methods based on site-specific conditions, load requirements, and code specifications.

CO2: Estimate and assess the axial load capacity of single piles and pile groups using both static and dynamic methods, interpreting field and test data to make informed design decisions.

CO3: Analyze and design piles subjected to lateral and uplift loads using appropriate methods by considering soil-pile interaction and interpreting test data for safe and reliable foundation design.

CO4: Apply structural design principles to analyze and design pile caps, pile-raft systems, and pile groups subjected to static and dynamic load.

CO5: Illustrate and design different types of caissons for stability under various loading conditions, considering seismic influences and relevant design codes.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Design of Shallow and Deep Foundations‖ by Frank, R., Cuira, F., & Burlon, S. CRC Press, Taylors & Francis Group, 1st Edition, Taylor & Francis Ltd, 2021.

2. ¯Ground Improvement Techniques and Geosynthetics‖ by Manfred R. Hausmann, 4th Edition‖, 2019.

REFERENCES:

1. ¯Advanced Foundation Engineering‖ by Murthy V.N.S., 2023.
2. ¯Deep Foundations in Coarse-Grained Soils‖ by John P. Turner and Harry G. Poulos, 2021.
3. ¯Analysis and Design of Advanced Foundation Systems‖ by Charles W. Wissa, David B. Peck, and Hsai-Yang Fang, 2020.
4. ¯Numerical Modeling in Geomechanics with Applications in Foundation Engineering‖ by Paolo Utili and Michele Flora, 2019.
5. ¯Pile Foundations in Engineering Practice‖ by Shamsher Prakash and Gopal Ranjan, 2019.

ONLINE RESOURCES:

1. www.nptel.ac.in courses

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2											3	2	
2	3	3			1								3	2	
3	3	3											3	2	
4	3	2	3										3	3	
5	3	2	2										3	2	
Avg.	**3**	**2**	**3**		**1**								**3**	**2**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	GEO ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I PERSPECTIVE IN GEOENVIRONMENTAL ENGINEERING 9

Scope in Geo-Environmental Engineering - role of soil in geo environmental applications-phase behaviour of soil – importance of hydrogeology- sources and type of soil contamination – case studies in soil failure.

MODULE II CONTAMINANT TRANSPORT 9

Transport of contaminant in subsurface flow – advection, diffusion, dispersion – chemical process - biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, volatization, biodegradation - characterization of contaminated sites - soil and rock data - hydrological and chemical data - analysis and evaluation – risk assessment – case studies.

MODULE III REMEDIATION OF CONTAMINATED SITES 9

In-situ contaminant - vertical and horizontal barrier - surface cover - ground water pumping system on subsurface drain – soil remediation - soil vapour extraction, soil waste stabilization, solidification of soils, electro-kinetic remediation, soil heating, bio remediation, Phyto- remediation - ground water remediation - pump and treat, In-situ flushing, permeable reacting barrier, In-situ air sparing - case studies.

MODULE IV LANDFILLS AND SURFACE IMPOUNDMENTS 9

Source and characteristics of waste - site selection for landfills - components of landfills – liner system - soil, Geo-membrane, Geo-synthetic clay, Geo-composite liner system – leachate collection - final cover design - monitoring the geo liners in landfill.

MODULE V STABILISATION OF WASTE 9

Hazardous waste control and storage system - stabilization/ solidification of wastes - micro and macro encapsulation - absorption, adsorption, precipitation- detoxification – mechanism stabilization - organic and inorganic stabilization - utilization of solid waste for soil improvement Case studies.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Evaluate the role of soil and hydrogeology in environmental challenges, analyse case studies of soil failure, and identify potential sources and types of soil contamination.

CO2: Analyze the transport of contaminants in the subsurface and various chemical and biological processes, to characterize contaminated sites and conduct risk assessments.

CO3: Select appropriate remediation techniques for contaminated soil and groundwater, considering the environmental impact, and analyze case studies of remediation projects.

CO4: Enumerate landfill components by considering site selection, waste characteristics, and regulatory requirements, and evaluate monitoring methods for geo-liners.

CO5: Illustrate stabilization techniques for hazardous and non-hazardous waste, utilizing micro/macro encapsulation, other processes, and evaluate the utilization of stabilized waste for soil improvement.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Geo environmental Engineering‖ by Richard H. Giroud and David R. Bowders, 4th Edition, 2023.
2. ―Recent Advances in Geo-Environmental Engineering, Geomechanics and Geotechnics, and Geohazards‖ by Springer International Publishing, Kallel, Amjad, etal.2019.

REFERENCES:

1. ―Environmental Geotechnics: Innovative Solutions and Management Practices‖ by Subba Rao R. Pothini and N. Krishna Pillai, 2023.
2. ―Geotechnical Aspects of Mine Site Closure‖ by John D. Barnhisel, 2022.
3. ―Landfill Geotechnics: Design, Operation, and Closure‖ by Richard D. Rowe, 2019.
4. ―Sustainable Remediation of Contaminated Sites‖ by Edward K. Nyer, 2018.
5. ―Geoenvironmental Engineering Handbook‖ by Robert D. Holtz, William D. Kovacs, and Thomas C. Sheahan, 4th Edition, 2018.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105103025

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2					1						3		
2	3	2		1									3		
3	3	2	2										3	1	
4	3	2				1	2						3	1	
5	3	2	1			1	2						3	1	
Avg.	**3**	**2**	**2**	**1**		**1**	**2**						**3**	**1**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	SLOPE STABILITY AND LANDSLIDES	L	T	P	C
		3	0	0	3

MODULE I STABILITY OF SLOPES **9**

Introduction – Importance – General characteristics – Types of failures – Causes of failures – Purpose of stability computation – Investigation of failures – Procedure – Case studies.

MODULE II STABILITY ANALYSIS **9**

Stability analysis – Method of slices – Friction circle method – Soils with cohesion – Soils with cohesion and angle of internal friction. Critical states for design for embankments – Stability computations – Evaluation of pore water pressure.

MODULE III IRREGULAR SLOPES **9**

Non-uniform soils – Janbu's analysis – Taylor's analysis – Bishop's analysis – Total stress and effective stress approaches – Composite surfaces of sliding – Block sliding.

MODULE IV LAND SLIDES **9**

General Characteristics – Sources–Stability of Hill side slopes – Open cuts – Engineering problems involving the stability of slopes – Cuts in sand – Cuts in loess – Homogeneous and soft clay slopes – Sudden spreading of clay slopes – Clay flows – Clays containing pockets and sand masses – Slides in stiff clay slopes on shale – Slopes on weathered rock; talus slopes, slopes on over consolidated clays – Slides along coastal areas and tropically weathered residual soils – Long term stability of clay slopes.

MODULE V FIELD OBSERVATIONS AND SLOPE STABILIZATION **9**

Field instrumentation – Observation studies during construction – Post construction, piezometers – Settlement plates – Inclinometer – Case histories. Compaction of new embankments – Compaction of natural masses of soil and existing fills – Compaction of deep deposits of sand – Vibroflotation – Compaction of compressible soils – Drainage as a means of stabilization – Use of Geotextiles – Soil nailing.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Gain knowledge about the purpose of computing slope stability.

CO2: Ability to analyse stability of slopes in cohesive and cohesionless soils.

CO3: Familiar on the analysis of irregular slopes with different approaches.

CO4: Reasoning about causes of landslides in different soil conditions.

CO5: Understand the use of instrumentation in the slope stability and execute suitable ground improvement techniques in the field.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ¯Landslides: theory, practice and modelling‖ by Pradhan, Sarada Prasad, Vikram Vishal, and Trilok Nath Singh, eds. Springer International Publishing, 2019.

2. ¯Soil strength and slope stability‖ by Duncan, J. Michael, Stephen G. Wright, and Thomas L. Brandon, John Wiley & Sons, 2014.

REFERENCES:

1. ¯Slope analysis‖ by Chowdhury, D.F., Prentice Hall, 1988.
2. ¯Foundation Engineering Handbook‖ by Winterkorn, H.F. and Fang, H.Y., Van Nostrand Reinhold, 1994.
3. ¯The Stability of Slopes‖ by Bramhead, E.N., Blacky Academic and Professionals Publications, Glasgow 1986.
4. ¯Slope Stability‖ by Anderson, M.G., and Richards, K.S., John Wiley, 1987.
5. ¯Landslides and their contro‖ by Zaruba, Quido, and Vojtěch Mencl. Elsevier, 2014.
6. ¯Slope analysis‖ by Chowdury, R. Elsevier, 2012.

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2											3		
2	3	3			1								3	2	
3	3	3											3		
4	3	2											3		
5	3	2		1									3	1	
Avg.	**3**	**2**		**1**	**1**								**3**	**2**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	EARTH RETAINING STRUCTURES	L	T	P	C
		3	0	0	3

MODULE I EARTH PRESSURE THEORIES **9**

State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

MODULE II STABILITY OF RETAINING STRUCTURES **9**

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

MODULE III SHEET PILE WALLS **9**

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

MODULE IV SUPPORTED EXCAVATIONS **9**

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts - Slurry Supported Trenches-Basic principles – Slurry characteristics – Specifications – Diaphragm walls – stability Analysis.

MODULE V STABILITY OF SLOPES **9**

Stability of infinite and finite slopes, Limit Equilibrium method, Wedge analysis, Method of Slices, Bishop's method, Janbu's method etc. Special aspects of slope analysis, stability charts. Role of geosynthetics in stabilization of slopes.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Gain knowledge about the purpose of computing slope stability.

CO2: Ability to analyse stability of slopes in cohesive and cohesionless soils.

CO3: Familiar on the analysis of irregular slopes with different approaches.

CO4: Reasoning about causes of landslides in different soil conditions.

CO5: Understand the use of instrumentation in the slope stability and execute suitable ground improvement techniques in the field.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Earth Retaining Structures, 7th Edition‖, Christopher J. Elias and Christopher R. I. Clayton, 2023.
2. ―The engineering of foundations, slopes and retaining structures Salgado‖, Rodrigo. CRC Press, 2022.

REFERENCES:

1. ―Gravity Retaining Walls‖ by David C. Onyemeluk, 2023.
2. ―Ground Improvement Techniques and Geosynthetics‖ by Manfred R. Hausmann, 4th Edition, 2019.
3. ―Design and Construction of MSE Walls and Reinforced Slopes‖ by David C. Bathurst and Ilan Juran, 2nd Edition, 2019.
4. ―The Earthworks Handbook‖ by James Wright, 4th Edition 2018.
5. ―Geosynthetic Engineering for Slopes‖ by Amarjit Singh, 2nd Edition, 2018.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105106052

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2											3		
2	3	2			1								3	2	
3	3	3	2										3	3	
4	3	2											3	1	
5	3	2		1									3	1	
Avg.	**3**	**2**	**2**	**1**	**1**								**3**	**2**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	FOUNDATIONS IN EXPANSIVE SOILS	L	T	P	C
		3	0	0	3

MODULE I GENERAL PRINCIPLES **9**

Origin of expansive soils – Physical properties of expansive soils –Mineralogical composition – Identification of expansive soils – Field conditions that favour swelling – Consequences of swelling.

MODULE II SWELLING CHARACTERISTICS **9**

Swelling characteristics – Laboratory tests – Prediction of swelling characteristics – Evaluation of heave.

MODULE III TECHNIQUES FOR CONTROLLING SWELLING **9**

Horizontal moisture barriers – Vertical moisture barriers – Surface and subsurface drainage – Pre wetting – Soil replacement – Sand cushion techniques – CNS layer technique.

MODULE IV FOUNDATIONS ON EXPANSIVE SOILS **9**

Belled piers – Bearing capacity and skin friction –Advantages and disadvantages – Design of belled piers – Under reamed piles – Design and construction.

MODULE V MODIFICATION OF SWELLING CHARACTERISSTIC **9**

Lime stabilization – Mechanisms – Limitations – Lime injection – Lime columns – Mixing – Chemical stabilization – Construction.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Analyze the behavior of expansive soils, predicting potential swelling and its consequences on structures.

CO2: Evaluate the swelling potential of expansive soils through laboratory testing and predict heave using appropriate methods.

CO3: Select appropriate techniques to control swelling potential based on site conditions and project requirements.

CO4: Design belled piers and under-reamed piles for expansive soils, considering their advantages, limitations, and specific design considerations.

CO5: Evaluate and select chemical stabilization techniques for expansive soils, considering their mechanisms, limitations, and construction methods.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ¯Expansive Soils: Problems and Solutions‖ by M. Basarat Ali and V. Sivakumar, 2018.
2. ¯Soils and Geotechnology in Construction‖ by Lutenegger, Alan J‘ CRC Press, 2019.

REFERENCES:

1. ¯Geotechnical Engineering in Expansive Soils‖ by D. Nelson and Der-Chung Donald Liu, 2019.

2. ¯Expansive Soils: Problems and Practice in Foundation Engineering‖ by Murthy V.N.S., 2021.
3. ¯Foundation Engineering in Expansive Soils‖ by B.B. Kale and S.N. Murthy, 2020.
4. ¯Expansive Soils: From Problem Child to Reliable Partner‖ by Prashant Nath and Manoj R. Dixit, 2018.
5. ¯Analysis and Design of Substructures: Limit State Design Saran‖ by Swami, Oxford and IBH Publishing, 2018.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105103214

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2											3		
2	3	2			1								3		
3	3	2	2										3	1	
4	3	2	3										3	2	
5	3	2	2										3	1	
Avg.	**3**	**2**	**2**		**1**								**3**	**1**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	ADVANCED FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I PLANNING OF SOIL EXPLORATION 9

Exploration methods for different projects - methods of borings-penetration tests-pressure meter test, field vane shear test-field permeability test-rock boring, preservation, shipment and storage of samples.

MODULE II SHALLOW FOUNDATIONS 9

Requirements for satisfactory performance of foundations, methods of estimating bearing capacity, settlements of footings and rafts, proportioning of foundations using field test data, IS codes.

MODULE III PILE FOUNDATIONS 9

Methods of estimating load transfer of piles, settlements of pile foundations, pile group capacity and settlement, negative skin friction of piles, laterally loaded piles, pile load tests, analytical estimation of load- settlement behavior of piles, proportioning of pile foundations, lateral and uplift capacity of piles.

MODULE IV WELL FOUNDATION 9

Belled piers – Bearing capacity and skin friction –Advantages and disadvantages – Design of belled piers – Under reamed piles – Design and construction.

MODULE V FOUNDATIONS ON PROBLEMATIC SOILS AND COFFERDAMS 9

Foundations for collapsible and expansive soil Cofferdams-various types, analysis and design Foundations under uplifting loads.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Apply an appropriate soil exploration program for different project types, selecting suitable methods for data acquisition, interpretation, and sample handling.

CO2: Analyze shallow foundations by considering bearing capacity, settlements, and code requirements, utilizing field test data for practical application.

CO3: Design pile foundations for axial and lateral loads, and load-settlement characteristics, implementing analytical methods.

CO4: Evaluate well foundations by considering Terzaghi's method, lateral stability, uplift, and design individual components, recognizing measures for rectification.

CO5: Select and design foundations for collapsible and expansive soils cofferdams, and evaluate foundations under uplifting loads, considering design strategies.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ¯Advanced Foundation Engineering‖ by V. N. S. Murthy, 2023.
2. ¯Advanced Geotechnical Engineering: Soil, Rock, and Earthquake Engineering‖ by Donald P. Coduto, 2021.

REFERENCES:

1. ―Deep Foundations in Coarse-Grained Soils‖ by John P. Turner and Harry G. Poulos, 2021.
2. ―Analysis and Design of Advanced Foundation Systems‖ by Charles W. Wissa, David B. Peck, and Hsai-Yang Fang, 2020.
3. ―Deep Foundations for Offshore Wind Turbines‖ by Brian L. Klosek and James R. Snedker, 2020.
4. ―Micropile Design and Construction‖ by David P. Day, 2019.
5. ―Ground Improvement Techniques and Geosynthetics‖, by Manfred R. Hausmann, 4th Edition, 2019.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105207

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2											3		
2	3	3			1								3	2	
3	3	3	2										3	2	
4	3	3	2										3	2	
5	3	3	3										3	2	
Avg.	**3**	**3**	**2**		**1**								**3**	**2**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	REINFORCED SOIL STRUCTURES	L	T	P	C
		3	0	0	3

MODULE I PRINCIPLES AND MECHANISMS OF SOIL REINFORCEMENT 9

Historical Background – Principles - Concepts and Mechanisms of reinforced earth – Soil – Geosynthetics interaction mechanism – interface resistance – Factors influencing interaction – Strain compatibility.

MODULE II REINFORCING MATERIALS AND THEIR PROPERTIES 9

Materials used in reinforced soil structures, fill materials, reinforcing materials metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojutes, Geofoam, Natural fibers - facing elements – Influence of environmental factors on the performance of Geosynthetic materials – Physical – Mechanical – Hydraulic and Endurance properties testing.

MODULE III DESIGN FOR SOIL REINFORCEMENT AND SEPARATION 9

Reinforcing the soil - Geotextiles and Geogrids -Retaining wall – embankment - unpaved roads – paved roads – railway tracks – Shallow foundations – seismic aspects.

MODULE IV DESIGN FOR FILTRATION, DRAINAGE AND CONTAINMENT 9

Geotextile filter – Filtration Mechanism – Factors affecting filter behaviour – Filtration design – Drains – Drainage in embankments – erosion control silt fences – Containment ponds – Reservoirs and Canals – Hydraulic tunnels – River bed and bank protection.

MODULE V DESIGN OF REINFORCED SLOPES 9

Type and orientation of Geosynthetics – Function of reinforcement against slope failure – Stability analysis – Design aspects – Embankments – Basal reinforcement – seismic aspects – General construction aspects.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Analyze the interaction between soil and geosynthetics in reinforced soil structures, identifying factors influencing their performance and ensuring strain compatibility.

CO2: Select and evaluate appropriate geosynthetic materials for specific applications in reinforced soil structures, considering their properties, parameters and testing methods.

CO3: Design reinforced soil structures for various applications using geotextiles and geogrids, considering seismic aspects and construction guidelines.

CO4: Assess the geotextile filters, drainage systems, and containment structures, considering filtration mechanisms, hydraulic properties, and erosion control measures.

CO5: Develop and design reinforced slopes, selecting appropriate geosynthetics, evaluating their reinforcement function, and incorporating seismic considerations.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Reinforced Soil and Mechanically Stabilized Earth‖ by Christopher J. Elias, Christopher R. I. Clayton, and Peter B. Flygare, 7th Edition, 2019.

2. ¯Geosynthetic reinforced soil (GRS) walls‖ by Wu, Jonathan T H., John Wiley & Sons, 2019.

REFERENCES:

1. "Reinforced Soil Structures" by C.J.F.P. Jones & P.J. Zweifel, by CRC Press, 2019.
2. ¯Ground Improvement Techniques and Geosynthetics‖ by Manfred R. Hausmann, 2019.
3. ¯Design and Construction of MSE Walls and Reinforced Slopes‖ by David C. Bathurst and Ilan Juran, 2nd Edition, 2019.
4. "Ground Improvement Techniques" by M.J. Tomlinson, by CRC Press, 2018.
5. "Geosynthetics and their Applications" by Berndt, J.P., Adam, D., & Bell, J.R., by Wiley-Blackwell, 2018.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/105/106/105106052/

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2											3		
2	3	2											3		
3	3	2	2										3	1	
4	3	2	2										3	1	
5	3	3	3										3	2	
Avg.	**3**	**2**	**2**										**3**	**1**	

1 – Low, 2 – Medium, 3 – High

COURSE CODE	AIR AND WATER QUALITY MODELLING	L	T	P	C
		3	0	0	3

MODULE I MODELING CONCEPT **9**

Overview of different types of models-identification of dependent and independent variables-Deterministic and stochastic approach- Steps in model development-numerical and simulations models-calibration and validation of models- Limitations Transport phenomena- Mass balance analysis-Model development and decision making.

MODULE II AIR QUALITY MODELS **9**

Air quality parameters - air Quality Index -Types, modelling technique, modelling for nonreactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models-diffusion models – Gaussian plume derivation- modifications of Gaussian plume equation- long term average-multiple cell model receptor oriented and source-oriented air pollution models- model performance, accuracy and utilization -air quality mapping.

MODULE III INDOOR AIR QUALITY MODELS **9**

Indoor Air Pollutants - Volatile Organic Compounds, Inorganic Gaseous Pollutants Respirable Particulates, Bio-aerosols, Radon and its decay products-Infectious disease transmission- A/C units in indoor- Odours and sick building syndrome-Indoor Air quality Models.

MODULE IV WATER QUALITY MODELLING **9**

Water quality parameters- water quality index- Historical development of water quality models - rivers and streams water quality modelling; Lakes and impoundments - water quality response to inputs; water quality modelling process - model sensitivity - assessing model performance.

MODULE V SOFTWARE MODELLING **9**

The principles and application of computer models for surface water quality, and air quality.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Outline the significance and need for modelling.

CO2: Summarize the suggestions regarding the modelling to be adopted for different scenarios and also discuss the long-term uses of those models.

CO3: Assess indoor air quality risks associated with different pollutants.

CO4: Employ various modelling concepts to monitor the quality of polluted water and air in future.

CO5: Interpret and comprehend the adoptability of models for the scenario under study.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Air Quality Modelling: The Science and Application‖ by John Seinfeld and Spyros Pandis, John Wiley & Sons, 2023.
2. ―Environmental Modelling: Integrating Ecology, Economics, and Management‖ by Andrew James, 2022.

REFERENCES:

1. ¯Atmospheric Dispersion Modelling‖ by Steven Hanna, John Wiley & Sons, 2023.
2. ¯Air Quality Modelling‖ by John Seinfeld and Spyros Pandis, Wiley-Interscience, 2022.
3. ¯Indoor Air Quality Handbook‖ by John Spengler, Michael Samet, and John McCarthy, (CRC Press), 2021.
4. ¯Water Quality Modelling: Advanced Methods‖ by L. Bengtsson et al, Academic Press, 2020.
5. ¯Water Quality Engineering‖ by Larry Mays, John Wiley & Sons, 2020.

ONLINE RESOURCES:

1. https://www.awma.org/
2. https://www.nalms.org/2023nmc/

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2						2						2		
2			2				3						2		
3	2						3						2		
4					3		3						2		
5		2			3								2		
Avg.	2	2	2		3		3						2		

1 – Low, 2 – Medium, 3 – High

COURSE CODE	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I IRRIGATION METHODOLOGY AND CROP WATER REQUIREMENT 9

Importance of irrigation - scope of irrigation engineering- types of irrigation system: surface and subsurface irrigation methods, Sprinkler and Drip Irrigation - Soil-water plant relationship: Soil properties affecting water movement- Soil moisture characteristics and measurement - Infiltration and percolation.

MODULE II CROP WATER REQUIREMENT 9

Crops - Seasons - Definitions related to agriculture and irrigation - Rotation of crops - Crop water requirements - Base period - Duty - Delta – Evapotranspiration- Effective rainfall- - Consumptive use Irrigation Efficiencies - Assessment of irrigation water – irrigation scheduling. Water logging-causes and effects - Factors leading to waterlogging- Drainage Systems- Surface drainage techniques, subsurface drainage methods, Vertical drainage systems.

MODULE III HYDROLOGY AND HYDROGRAPH ANALYSIS 9

Hydrology – Surface hydrology - Precipitation - Types, forms, Measurement of rainfall, evaporation and infiltration – Estimation of runoff- Factors affecting runoff – Computation of volume of runoff and peak flow- Hydrograph concepts assumptions and limitations of unit hydrograph.

MODULE IV GROUND WATER FOR IRRIGATION 9

Occurrence of ground water- aquifer - aquiclude - confined, unconfined and perched aquifer-hydraulics of wells, types of wells and their construction- Types of well screen - Design of well screens – Well development - Ground water yield - specific capacity of a well - measurement of yield of an open well by pumping test and recuperation test.

MODULE V CANAL IRRIGATION 9

Classification of Irrigation Canals - Canal regulations - cross drainage works - canal alignments-Canal lining — Kennedy‘s and Lacey‘s Regime Theory-Design of unlined canal.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Apply fundamental principles of irrigation engineering to design and manage efficient and sustainable irrigation systems.

CO2: Demonstrate proficiency in evaluating crop water requirements and implementing appropriate irrigation scheduling techniques.

CO3: Analyze hydrological processes and groundwater dynamics to assess water availability and design effective irrigation strategies.

CO4: Design and optimize irrigation canals, considering factors such as classification, capacity, losses, and lining, to ensure efficient water conveyance.

CO5: Apply knowledge and skills to real-world scenarios, addressing water management challenges and proposing innovative solutions for sustainable irrigation practices.

TOTAL: 45 PERIODS

TEXT BOOK:

1. "Irrigation Engineering and Hydraulic Structures" by Garg S.K, Khanna Publishers, New Delhi, 38th Revised Edition 2023.
2. ¯Engineering Hydrology‖ by Subramanya, K., Tata McGraw-Hill, 2013.

REFERENCES:

1. "Irrigation - Theory & Practice" by Micheal A.M., Vikas publishing house, New Delhi, 2006.
2. "Irrigation Engineering & Hydraulic Structures" by Sharma R.K., Oxford and IBH Publishing Company, New Delhi, 2002.
3. ¯Irrigation Water Management‖ by Dilip Kumar Majumdar, Prentice-Hall of India, New Delhi, 2008.
4. "Irrigation and Water Power Engineering" by Punmia B. C. and Pande B. B. Lal, Laxmi Publications, New Delhi, 2009.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/126105010

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3		3				3						2		
2	2		2				3								
3	3			2			3						2		
4	3		3										2		
5			3				3			2					
Avg.	3		3	2			3			2			2		

1 – Low, 2 – Medium, 3 – High

OURSE CODE	REMOTE SENSING AND GIS	L	T	P	C
		3	0	0	3

MODULE I PRINCIPLES AND CONCEPTS **9**

Definition - Historical Importance of remote sensing - Principles - and methods of remote sensing - Electromagnetic spectrum Electromagnetic Radiation and radiation sources - Interference - Atmospheric effects on remote sensing - Energy interaction with energy surface features.

MODULE II AERIAL PHOTOGRAPHY **9**

Definition - Types of air photographs - Geometry of air photo - Parallax - pair of photos - Height determination - Flight planning - Stereoscopy - Monovision - Binocular vision - Aerial photo interpretation - Basic elements - Techniques of photo interpretation - Application of aerial photo interpretation - photographs versus maps.

MODULE III IMAGERY **9**

Landsat imagery - Digital image processing - Comparison with aerial photographs - Imaging devices - Aerial camera - Panoramic camera – Satellites – Geo Stationery – Sun Synchronous Satellites – Platforms and Sensors – types - Characteristics.

MODULE IV GIS **9**

GIS – Structure of GIS – various components of GIS – vector and raster data – analysis of data – Introduction to various GIS softwares – Introduction to GPS – Principles – list of software.

MODULE V APPLICATIONS OF GIS AND REMOTE SENSING **9**

Application of Remote Sensing and GIS in water resources engineering, land use studies, soil investigations, geology, transportation networks, agriculture, forestry, coastal engineering and military services.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Analyze the fundamental principles of remote sensing, including electromagnetic interactions, atmospheric effects, and energy interactions with surface features.

CO2: Interpret aerial photographs using stereoscopic principles and image analysis techniques to extract spatial information and solve real-world problems.

CO3: Compare and contrast various satellite imageries based on their acquisition characteristics, resolutions, and applications.

CO4: Analyze and evaluate the components, data types, and functionalities of GIS to apply them effectively in spatial data analysis and problem-solving.

CO5: Select and integrate geospatial technologies to address real-world problems in various domains.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Fundamentals of remote sensing‖ by Bhatia S.C, New Delhi Atlantic Publishers, 2018.

2. ¯Remote Sensing and Image Interpretation‖ by Lillesand, Thomas.M and Ralph W.Kiefer, John Wiley Sons, 2021.

REFERENCES:

1. ‖Applications of Geographic Information Systems in Civil Engineering‖ by Niraj Kumar Thakur, Springer, 2018.
2. ‖Manual of Remote Sensing: Principles and Applications‖ by Steven M. De Jong, John Wiley & Sons, 2023.
3. ‖GIS and Remote Sensing in Hydrology, Water Resources and Environment‖, by Biswajeet Pradhan, Springer, 2018.
4. ‖Handbook of Satellite Remote Sensing‖ by Quac Pham & Jochen A. Schiller, CRC Press, 2019.
5. ‖Mastering ArcGIS Pro‖ by Rodney Dangerfield, , ESRI Press, 2023.

ONLINE RESOURCES:

1. https://earthobservatory.nasa.gov/
2. https://www.opengeospatial.org/

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2			2									2		
2	2				2					2					
3	2			1											
4	3				3								2		
5			3		3								2		
Avg.	2		3	2	3					2			2		

1 – Low, 2 – Medium, 3 – High

COURSE CODE	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

MODULE I ELECTRO OPTICAL AND MICRO WAVE TOTAL STATION 9

Computation of group Refractive Index for light, near infrared and microwaves - First velocity correction and Second velocity correction - Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Care and maintenance of Total Station instruments – Applications of COGO functions -Traversing and Trilateration – Topographic mapping - Recent trends.

MODULE II GPS SATELLITE SYSTEM AND DATA PROCESSING 9

Global Navigation System, Regional Navigation System and SBAS - Basic concepts of GNSS, Glonass, IRNSS - Historical perspective and development - applications GPS - Segments - Space, Control and User segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability – GPS receivers- GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – Data processing – software modules -solutions of cycle slips, ambiguities, RINEX format.

MODULE III LASER SCANNING 9

Airborne Topographic Laser Scanner – Ranging Principle – Pulse Laser and Continuous Wave Laser – First Return and Last Return – Ellipsoidal and Geoidal Height - Airborne Laser Scanner (ALS) – Components of ALS - GPS, IMU, LASER Scanner, Imaging Device - Terrestrial Laser Scanners (TLS) – Working Principle – Static, Dynamic and Vehicle Mounted TLS - Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography.

MODULE IV GEODESY AND PPLICATIONS 9

Definitions – Histrory, Classifications, Applications, Problem and purpose of Geodesy -. Reference Surfaces and their relationship. Engineering, Lunar, Planetary and interferometric Synthetic aperture radar Geodesy – Local and International Spheroid - Geometry of ellipsoid - fundamental mathematical relationship of Geodetic, Geocentric and Reduced latitudes and their relationship- Ellipsoidal Co-ordinates in terms of Reduced, Geodetic and Geocentric latitude.

MODULE V PHOTOGRAMMETRIC SURVEY, HYDROGRAPHIC SURVEY AND OTHER MODERN SURVEY 9

Photogrammetry – Terrestrial and Aerial Photogrammetry – Horizontal position of a point from photographic measurement – elevation of a point – Determination of focal length of camera – determination of scale – Ground co-ordinates - Relief displacement – Photo interpretation. Drone survey – principle, mapping and modeling, application and uses, Ground Penetrating Radar - Data Processing, Modeling and Analysis in Environmental Applications – principle and uses.

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Evaluate and choose the appropriate total station technology and apply COGO functions for traversing, trilateration, and topographic mapping.

CO2: Analyze and process GNSS data effectively, interpreting GPS observables and achieve accurate positioning and coordinate determination in diverse surveying scenarios.

CO3: Distinguish laser scanning data using both airborne and terrestrial systems for diverse surveying applications, accounting for environmental factors and data quality considerations.

CO4: Apply fundamental geodetic concepts and coordinate systems to interpret geospatial data accurately, considering the relationships between local, regional, and global reference surfaces.

CO5: Integrate various modern surveying techniques for data acquisition, processing, and analysis to solve diverse surveying problems, considering data quality, project requirements, and cost-effectiveness.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ¯Advanced Surveying Total Station, GPS, GIS, and Remote Sensing‖ by Gopi Satheesh and R Sathikumar, Pearson India, 2023.
2. ¯Laser Scanner Technology: Applications in Geoscience‖ by Javier Vegas, José Luis González-Aguilar, and Juan Carlos Alonso, Springer, 2020.

REFERENCES:

1. ¯GPS Theory, Algorithms and Applications‖ by Guocheng Xu, Springer - Verlag, 2023.
2. ¯Geodesy: The concepts‖ by Petr Vanicek and Edward J. Krakiwsky, Elsevier, 2021.
3. ¯Airborne and Terrestrial Laser Scanning‖ by George Vosselman and Hans-Gerd Maas, Whittles Publishing, 2023.
4. ¯Photogrammetry - Geometry from Images and Laser Scans‖ by Karl Kraus, De Gruyter, 2023.
5. "Laser Scanner Technology" by J. Apolinar Munoz Rodriguez, 2012.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105103176
2. https://nptel.ac.in/courses/105104100

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2				3								2		
2	2				3										
3	2				3										
4	3														
5			2		3								2		
Avg.	2		2		3								2		

1 – Low, 2 – Medium, 3 – High

COURSE CODE	TRANSPORTATION SYSTEMS PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I TRANSPORTATION AND SOCIETY 9

Role of Transport in Society and Economy - Functions and Problems in Transportation Planning - Economic, Geographical, Political, Technological, Social and Cultural Factors in Planning of Transportation System. Transport Technology: System Classification and their Variation; Conventional Systems and Unconventional Systems - Air, Water and Ground Modes

MODULE II MODES OF TRANSPORT AND THEIR CHARACTERISTICS 9

Propulsion Forces - Factors in Operation - Levels of Service and Performance Criteria - Quality of Service: Capacity and Levels of Service of different Transportation Systems; mobility and accessibility – Flexibility - Speed, Acceleration, Deceleration - Comfort and Environmental Effects - Time Spent and Cost – Integration of modes.

MODULE III A BRIEF HISTORICAL DEVELOPMENT OF TRANSPORTATION SYSTEMS 9

Growth of Transport - Road Development Plans - Imbalances in Transport System - National Transport Policy Recommendations - Optimum Inter Model Mix-Study - Vision 2021, NHDP, PMGSY, Rural Roads Vision 2025 - IRC, CRRI etc. - Inland waterways in India

MODULE IV PLANNING OF PASSENGER AND GOODS TERMINAL FACILITIES 9

Planning of passenger and goods terminal facilities of Air, Water, Railway and Highway Transportation Systems – requirements and typical layouts - passenger facilities - parking configuration - terminal requirements – goods facilities and containerization

MODULE V OPERATIONAL CONTROLS 9

Operational Controls of Air, Water, Railway and Highway Transportation Systems: Functions of Control & Communications - Signals and Traffic Control Devices - Navigational Aids of the different Transportation Systems. Air Traffic Control; Navigational Control. Automatic Signaling Systems of Railway and Highway Movements.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Evaluate the economic, social, and environmental impacts of various transportation systems, advocating for sustainable and equitable solutions.

CO2: Compare and contrast various transportation modes based on performance, service quality, and environmental impact, by selecting appropriate options for specific needs

CO3: Evaluate the historical evolution of transportation systems in India by analyzing current policies and initiatives for achieving an optimal multimodal mix

CO4: Design and evaluate passenger and goods terminal facilities for different transportation modes, considering user needs, operational efficiency, and sustainability principles.

CO5: Analyze and explain operational control systems for air, water, rail, and highway transportation systems, their effectiveness in ensuring safety, efficiency, and traffic management.

TOTAL: 45 PERIODS

COURSE CODE	TRANSPORTATION ECONOMICS AND FINANCE	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTORY CONCEPTS IN TRANSPORTATION DECISION MAKING 9

Overall transportation project development, budgeting, financial planning, the process of transportation project development, models associated with transportation impact evaluation.

MODULE II TRANSPORTATION COSTS 9

Classification of transportation costs, transportation agency costs, transportation user costs, general structure and behavior of cost functions and road pricing. Estimating Transportation Demand and Supply - supply equilibration, dynamics of transportation demand and supply, elasticity of travel demand and supply, classification of elasticity.

MODULE III VEHICLE OPERATING COSTS 9

Fuel costs - Maintenance and spares, Depreciation - Crew costs - Value of travel time savings - Accident costs. Economics of traffic congestion - Pricing policy.

MODULE IV ECONOMIC ANALYSIS OF PROJECTS 9

Methods of evaluation - Cost-benefit ratio, first year rate of return, net present value, and internal-rate of return methods; Indirect costs and benefits of transport projects.

MODULE V FINANCING OF ROAD PROJECTS 9

Methods – Private Public Partnership (PPP) - Toll collection - Economic viability of Design-Build-Operate-Transfer Schemes – Risk Analysis – Value for Money analysis - Case Studies.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Analyze and apply economic principles to the entire transportation project development process, including financial planning, impact evaluation, and relevant models.

CO2: Interpret different transportation costs and apply cost functions and road pricing concepts to inform decision-making

CO3: Evaluate the key components of vehicle operating costs and their implications for policy decisions.

CO4: Enumerate the economic viability of transportation projects using various methods and considering both direct and indirect costs and benefits.

CO5: Assess transportation projects using economic analysis tools and public-private partnerships thereby ensuring value for money.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Kenneth A. Small, ¯Transportation Economics‖ ,2023.
2. Susan Perkins and William H. Schneider, ¯Transportation Planning Handbook‖, 2021.

REFERENCES:

1. W.G. Waters, ¯Handbook of Transport Modelling‖, 2023.
2. David A. Henshe, ¯Transportation Impact Assessment‖, 2022.
3. Richard B. Dial, ¯Handbook of Road Pricing: Theory, Practice, and Case Studies‖ 2020.

4. Umar Zafar, ¯Sustainable Transportation Engineering: An Introduction‖, 2020.
5. Edward S. Beimborn, ¯Handbook of Transport Economics‖, 2018.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105105107
2. https://archive.nptel.ac.in/courses/105/106/105106058/

CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2		2		2								2		
2	3												2		
3	3												2		
4	3					2							2		
5	3		2												
AVg.	3		2		2	2							2		

1-low, 2-medium,3-high

COURSE CODE	ROAD SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I ROAD SAFETY AND ITS FACTORS **9**

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

MODULE II STATISTICAL INTERPRETATION AND ANALYSIS OF CRASH DATA **9**

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

MODULE III ROAD SAFETY AUDITS **9**

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

MODULE IV CRASH RECONSTRUCTION **9**

Describe the basic information that can be obtained from the roadway surface, understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies

MODULE V MITIGATION MEASURES **9**

Mitigation Measures: Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Evaluate the multi-dimensional factors contributing to road accidents and propose evidence-based safety improvement strategies within the framework.

CO2: Apply statistical methods to analyze crash data, identify black spots, and draw informed conclusions for targeted safety interventions

CO3: Contrast road safety audits using recognized methodologies, identify potential hazards, and recommend effective countermeasures

CO4: Illustrate the scientific principles and engineering analysis to reconstruct crash scenarios, determine contributing factors, and support legal proceedings

CO5: Propose evidence-based mitigation measures to address various road safety challenges, considering engineering interventions, policy frameworks, and stakeholder engagement

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Traffic Engineering and Transport Planning‖ by Kadiyali.L.R. Khanna Publishers, Delhi, 2020.
2. ―Transportation Engineering‖ by Khisty C.J. and Kent B Lall, Prentice Hall, 2018.

REFERENCES:

1. ―Road Safety Inspections and Audits‖ by Rune Elvik, 2022.
2. ―Human Factors in Road Safety‖ by Jens Rasmussen, Kinga M. Wisniewski, and Rune Elvik, 2020.
3. ―Statistical Methods for Road Safety Analysis‖ by W.C. Mannering and Kenneth L. Caves, 2019.
4. ―Handbook of Transportation Safety‖ by Robert J. Haver, 2019.
5. ―Road Safety: An Introduction‖ by David Jamieson, 2020.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_ce35/preview

CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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3	3												2		
4	3			2											
5	3		3			3							2		
AVg.	3		3			3							2		

1-low, 2-medium,3-high

COURSE CODE	PROFESSIONAL PRACTICE FOR CIVIL ENGINEERS	L	T	P	C
		3	0	0	3

MODULE I BUILDING BY LAWS RULES AND REGULATION AND PLAN APPROVAL PROCESS **9**

Building by laws - importance - acts and rules of public interest - state and central – approval bodies-Metros – Corporation – Municipalities - Town Panchayats. Preparation and Submission of Drawings and Documents for Building Approval and Layout. Land use Classification in urban & Mofussil Areas-Related Regulatory and approvals.

MODULE II MUNICIPAL SERVICES (WATER SUPPLY SEWAGE AND ELECTRICAL CONNECTIONS **9**

Local approvals and clearances for residential, industrial and commercial Buildings - General specifications for water supply and sewers - Water Supply – Process for waste water connections to public Mains. Domestic water supply connection from public mains, types and sizes of pipes, special installation in multi-storeyed buildings. Connections to Public sewers.

General Specifications - Electrical supply for residential, industrial and commercial Buildings - List of procedures – Standards - Local approvals and clearances for residential, industrial and commercial Buildings-Temporary – Permanent Services-Consumer Guidance TNEB.

MODULE III ESTABLISHMENT FOR PROFESSIONAL PRACTICE **9**

Establishment of firm - Consultancy, Construction - Registration of firms with GST, CST, Companies –IT - Licensing from local bodies – Metros - Municipalities, town panchayats - Obtaining Chartered Engineership, approved valuership, registered valuership with income tax, Bank Empanelment-Membership of other professional bodies- BAI, ACCE(I) Etc., - Registration of contractors with Government Departments, Public undertakings & Private organizations.

MODULE IV DOCUMENTATION FOR PROJECT COMMENCEMENT AND CLOSURE AND TAX ASSESSMENT **9**

Documentation for formal approval of work commencement - Procedures. Documentation for procurement and mobilization of resources – Record of works – Changes - Deviation - Preparation of running account bill & Final bill. Submission of project closure report. Handing over documents –

Procedure for contract closure.

MODULE V SAFETY EDUCATION AND TRAINING **9**

Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training, safety laws.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Apply the legal and regulatory framework for building construction, ensuring compliance with local bylaws, obtaining approvals, and preparing necessary documents.

CO2: Analyze the required municipal services for residential, industrial, and commercial buildings, understanding specifications, procedures, and approvals for water supply,

sewage, and electrical connections.

CO3: Demonstrate civil engineering practice, obtaining necessary registrations, licenses, and memberships, and complying with legal and ethical requirements.

CO4: Organize project documentation throughout its lifecycle, ensuring proper commencement procedures, resource mobilization, bill preparation, closure reports, and tax compliance.

CO5: Identify and implement safety training programs for themselves and others in the construction industry, understanding legal requirements, awareness strategies, and best practices.

TOTAL: 45 PERIODS

TEXT BOOK:

1. ¯Estimating and Costing in Civil Engineering‖ by Dutta B.N., UBS Publishers & Distributors Pvt. Ltd., 2010.
2. ¯A Text Book of Estimating and Costing (Civil)‖ by Kohli D.D. and Kohli R.C., Chand &; Company Ltd., 2004.

REFERENCES:

1. ¯Construction Contracts: Law and Management‖ by Michael I. Bushell, 2022.
2. ¯Sustainable Infrastructure‖ by Scott A, 2021.
3. ¯Green Building Handbook: Comprehensive guide to green building principles, technologies, and practices, applicable to civil engineering projects‖ by Paul S. Cipes, 2021
4. ¯Professional Practice for Civil Engineers‖ by John P. Clougherty, 2021
5. ¯Civil Engineering Ethics‖ by James R. Chudley, 2020
6. ‖ Ethics in Engineering‖ by W.M.Martin and; R.Schinzinger., McGraw-Hill, 2005
7. ¯Safety Management in Industry‖ by Krishnan N.V., Jaico Publishing House, Bombay,1997
8. Hand Book of Consolidated Data - 8/2000, Vol.1, TNPWD.
9. Tamil Nadu Transparencies in Tenders Act, 1998, Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003.
10. Handbook of Occupational Health and Safety, NSC Chicago, 1982.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/noc/courses/105/

COURSE CODE	BUILDING INFORMATION MODELLING	L	T	P	C
		3	0	0	3

MODULE I BIM WITH BUILDING SYSTEMS **9**

Review of Buildings and Systems- Building components and systems Integrating BIM in Construction Contracts- Contract Systems, Work Organization and Process Details.

MODULE II BIM MODELING WITH AUTODESK REVIT **9**

BIM for modelling (Autodesk Revit) Model Support in Coordination, Creating Levels and Grids, Walls Modelling, Object Modification, Doors and Windows, Floors and Roofs, Curtain, Stairs and Ramps, Dimensions and Constraints, Annotation and Documentation.

MODULE III OPTIMIZING BUILDING DESIGN AND PERFORMANCE **9**

Importing and modifying families of objects and elements, Clash Detection, Model Support in Coordination. BIM for Energy Analysis, Use of BIM for the Tasks of Energy Demand Calculation and Building Simulation. BIM for Construction Safety and Health.

MODULE IV INTEGRATING BIM FOR SAFER, MORE EFFICIENT CONSTRUCTION **9**

Integrating BIM in the Safety Planning Process, Safety and BIM-Based Quantity Take-Off. BIM in Industrial Prefabrication for Construction.

MODULE V BIM FOR PREFABRICATION & 3D PRINTING **9**

BIM in Industrial Prefabrication for Construction- Production Models for Digital Production Methods. BIM for 3D Printing in Construction.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Integrate BIM within construction contracts, considering different systems, contract types, and project workflows.

CO2: Create and modify building models in Autodesk Revit, applying best practices for efficient coordination and documentation

CO3: Analyze BIM for energy analysis, clash detection, and construction safety planning, optimizing building design and performance

CO4: Evaluate BIM into construction workflows for improved safety, efficiency, and quantity take-off.

CO5: Apply BIM for prefabrication production models and explore its potential for 3D printing in construction

TOTAL: 45 PERIODS

TEXT BOOK:

1. ―Building Information Modeling: BIM in Current Practice‖ by Michael Gagnon, Flavius C. Bologea, Azhar Irani, 2019
2. ―BIM for Facility Management‖ by Thomas O'Connor, Daniel Talbott, 2019.

REFERENCES:

1. ¯BIM for Structural Engineers: Leveraging Building Information Modeling for Efficient Structural Design and Analysis‖ by Behzad Razavi, 2019.
2. ¯BIM for MEP Contractors: A Practical Guide to Integrating Mechanical, Electrical & Plumbing Systems into Building Information Models‖ by John Messner, 2018.
3. ¯BIM for Architects: Integrating Design, Construction and Facility Management‖ by Eddy Krygiel, John Frazer, 2018.
4. ¯Digital Twins: Bridging the Physical and the Virtual World‖ by Christoph Reinhart, Markus Bechmann, Daniel Menges, 2020.
5. ¯BIM Handbook: Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors‖ by Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, 2018.

ONLINE RESOURCES:

1. https://www.coursera.org/learn/bim-fundamentals

CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2		2			1							2	3	
2	3				3					2					
3	3		3				2								
4	2										2				
5	3		3												
AVg.	3		3		3	1	2			2	2		2	3	

1-low, 2-medium,3-high

	ALTERNATIVE BUILDING MATERIALS FROM WASTE	L	T	P	C
		1	0	0	1

MODULE I ENVIRONMENTAL ISSUES **3**

Environmental issues – Global warming – Eco friendly materials – Materials related to energy and carbon di oxide emission

MODULE II BLOCKS AND BRICKS **3**

Waste based blocks and bricks – Advantages – Disadvantages – Applications

MODULE III CEMENTS **3**

Pozzolana – Types – Agro and industrial based waste – Characterization – Process adopted to improve properties – Applications in cement / mortar / concrete

MODULE IV AGGREGATES **3**

Artificial aggregates – Waste as replacement for aggregates – Characterization – Applications in Cement / mortar / concrete Recycled coarse aggregate – Recycled fine aggregate

MODULE V MISCELLANEOUS ELEMENTS **3**

Wastes used for non-structural elements - Partitions – Walls – Roofing system – windows

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Evaluate the environmental footprint of conventional building materials across their lifecycle.

CO2: Develop recommendations for appropriate applications of waste-based materials in building projects, considering both technical performance and environmental benefits.

CO3: Describe their design solution effectively, communicating its potential contribution to sustainable construction practices.

TOTAL: 15 PERIODS

REFERENCES:

1. ¯Waste-Based Building Materials: Opportunities and Challenges‖ by Bhatty, J. I. (2023), McGrawHill Education.
2. ¯Sustainable Construction Materials: A Handbook‖ by Blenkinsop, S., Cook, M., & Roberts, T. (2020), Springer Nature.
3. ¯The Routledge Handbook of Sustainable Buildings‖, by Sayigh, A. (Ed.). (2022), Routledge.

	SUSTAINABILITY IN CONSTRUCTION	L	T	P	C
		1	0	0	1

MODULE I FUNDAMENTALS OF SUSTAINABLE BUILDING 3

The context and principles of sustainable design - A view of the current state of sustainable building in national and internationally - Physical, psychological and financial benefits of Sustainable construction.

MODULE II SUSTAINABLE ARCHITECTURE AND DESIGN 3

Role of architecture in sustainable construction - An introduction to sustainable site planning and ecological design - Importance of transportation planning, siting and relationship to sustainability - Benefits of adopting a natural systems-based approach - Biomimicry as a design tool based on ecosystem analogy.

MODULE III ENERGY EFFICIENT DESIGN 3

Importance of building energy systems - impacts of energy with human experience and the global environment -Low Energy Building Strategies - Fundamental building energy systems: HVAC, lighting and water conservation.

MODULE IV SUSTAINABLE MATERIALS SELECTION 3

Factors in material selection-Material considerations when designing a green construction – Eco friendly building materials: Environmental impact study of building materials about composition, production and recycling, physical properties - Life cycle assessment.

MODULE V SUSTAINABLE BUILDING TECHNOLOGIES 3

Wastes used for non-structural elements - Partitions – Walls – Roofing system – windows

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Analyze and evaluate the principles and benefits of sustainable construction practices

CO2: Apply sustainable design principles and strategies to building projects

CO3: Evaluate the challenges and opportunities associated with promoting sustainable construction in the industry.

TOTAL: 15 PERIODS

REFERENCES:

1. ¯Sustainable Construction: Materials, Methods, and Practice‖ by Blenkinsop, S, Routledge, 2023.
2. ¯Green Building: A Guide for Architects, Designers, and Engineers‖ by Wilson, A, Taylor & Francis, 2022.
3. ¯The Building Green Handbook: Sustainable Design and Construction‖, by Athena Institute, Schiffer Publishing, 2023.

	DETAILING OF STEEL STRUCTURES USING TEKLA	L	T	P	C
		1	0	0	1

LIST OF EXPERIMENTS

1. Create a simple model consisting of columns, beams, and braces.
2. Model a basic steel frame with different types of connections
3. Modeling a Simple Beam-Column Connection
4. Detailing of welded connection for tension
5. Detailing of welded connection for compression
6. Detailing of welded connection for bending
7. Detailing of purlin connection 8. Modeling a Plate with Stiffeners

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Use Tekla to create accurate and efficient 3D models of steel structures with various elements and connections.

CO2: Detail the steel connections according to industry standards and design requirement by Tekla features.

CO3: Create construction drawings and reports from Tekla models for fabrication and production.

TOTAL: 15 PERIODS

REFERENCES:

1. ¯Steel Detailing: Principles and Applications‖ by Peter Beest, John Wiley & Sons, 2014.
2. ¯Detailing for Steel Construction‖ by Glenn J. Rourke and Ronald T. Packard, WCB McGraw-Hill, 2020
3. ¯Steel Designers' Manual‖, by Steel Construction Institute (SCI).

CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2				3								2		
2	2		2										2		
3					3								1	3	
AVg.	2		2		3								2	3	

1-low, 2-medium,3-high

	BASIC PLUMBING	L	T	P	C
		1	0	0	1

MODULE I INTRODUCTION TO PLUMBING SYSTEMS **3**

Basic Plumbing Terminology - overview of different types of plumbing systems (residential, commercial, industrial) - components of a plumbing system – fixtures - pipes – valves – traps - vents - plumbing codes and standards - Introduction to hydraulic principles applied to plumbing systems

MODULE II WATER SUPPLY SYSTEMS **3**

Water Sources and Treatment - pipe Materials and Selection - water Distribution Systems- Valves, Pumps, and Water Meters - Sizing and Design Considerations

MODULE III DRAINAGE AND WASTEWATER SYSTEMS **3**

Types of drainage systems - drainage Pipe Materials and Installation - drainage Fixture UnitsTraps - Interceptors - Backflow Prevention – Storm water Drainage

MODULE IV PLUMBING FIXTURES AND MATERIALS **3**

Types of Plumbing Fixtures - fixture Installation and Rough-in - Water Closets – Sinks - Tubs, Showers- Bidets - Faucets and Valves -Types of plumbing materials - Energy-Efficient Plumbing Appliances

MODULE V MAINTENANCE **3**

Common plumbing problems and their solutions - Leak detection and repair - Fixture maintenance and repair - Vent Pipe Materials and Installation - Winterization and freeze protection- Safety considerations in plumbing systems

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Explain the function and operation of various plumbing components, including fixtures, pipes, valves, and traps

CO2: Apply hydraulic principles to design and size plumbing systems

CO3: Identify and interpret relevant plumbing codes and standards.

TOTAL: 15 PERIODS

REFERENCES:

1. Building Services Handbook by Fred Hall, 11th Edition (2020), Routledge.
2. Domestic Plumbing: Design and Installation by Ray Wailes, 4th Edition (2017), Routledge.
3. International Plumbing Code 2021 by International Code Council (ICC).
4. Uniform Plumbing Code by International Association of Plumbing and Mechanical Officials (IAPMO).
5. Plumbing Principles and Practice by Kenneth R. Wakeman, 7th Edition (2021), Fairmont Press.

	GREEN BUILDING RATING	L	T	P	C
		1	0	0	1

MODULE I INTRODUCTION TO GREEN BUILDING CONCEPTS 3

Overview of Sustainability in Civil Engineering - importance of Green Building Rating Systems - Environmental Impact of Conventional Construction - Principles of Sustainable Design - Introduction to Green Building Rating Systems

MODULE II LEED (LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN) 3

History and Evolution of LEED - LEED Rating System Categories (New Construction, Existing Buildings, etc.) - LEED Credits and Categories (Sustainable Sites, Water Efficiency, Energy, Materials, Indoor Environmental Quality) - Certification Levels and Requirements - Case Studies of LEED Certified Buildings

MODULE III BREEAM (BUILDING RESEARCH ESTABLISHMENT ENVIRONMENTAL ASSESSMENT METHOD) 3

Overview of BREEAM - BREEAM Rating Categories (Management, Health and Wellbeing, - Energy, Transport, Water, Materials, Waste, Land Use and Ecology) - BREEAM Assessment Process- BREEAM Certification Levels and Criteria - International Applications and Case Studies

MODULE IV SUSTAINABLE CONSTRUCTION MATERIALS AND TECHNIQUES 3

Selection of Environmentally Friendly Materials- Low-Impact Construction Techniques- Energy Efficient Building Envelope Design - Life Cycle Assessment (LCA) in Construction - Integration of Renewable Energy Sources

MODULE V IMPLEMENTATION AND FUTURE TRENDS 3

Integrating Green Building Practices in Civil Engineering Projects - Challenges and Opportunities in Sustainable Construction - Cost-Benefit Analysis of Green Building Strategies - Green Building Trends and Innovations - Emerging Technologies in Sustainable Construction

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Explain of the principles underlying sustainable construction and the environmental, eco and social considerations involved.

CO2: Develop proficiency in major green building rating systems, such as LEED and BREEAM, by comprehending their criteria and scoring mechanisms.

CO3: Design practices and green building strategies in civil engineering projects, focusing on site development, energy efficiency, and material selection to enhance environmental performance.

TOTAL: 15 PERIODS

TEXT BOOKS:

1. Green Building Rating Systems: Implementation and Application (2022) by Edward K. Heaney, John Wiley & Sons
2. Sustainable Design for Civil Engineers: Water, Energy, and Buildings (2020) by Charles J. Kibert, John Wiley & Sons

REFERENCES:

1. ¯Green Building Handbook: Volume 1: Commercial, Industrial, and Institutional Buildings‖ by Ross Montgomery, Routledge.2012
2. ¯BREEAM In-Use International: Technical Manual‖, BREEAM In-Use Assessment Process, IHS Markit, 2020.
3. ¯LEED Certification Process and Requirements‖ by US Green Building Council, USGBC Press, 2019

CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1		1	2	3								
2	2	2	2		2										
3	2	2	3		2		3						3	3	3
AVg.	2	2	2		2	2	3						3	3	3

1-low, 2-medium,3-high

	DRONE SURVEYING	L	T	P	C
		1	0	0	1

MODULE I INTRODUCTION ON DRONES **3**

Introduction to Drones, History of Drone/UAS/UAVs, payload, battery life, Specs for good results, Regulations of DGCA and Drone license, Pre and Post Flight planning- Flight execution and photography, data collection- Image Format, GSD, Scale and Resolution.

MODULE II SURVEYING WITH DRONE **3**

Consideration for hardware selections, comparison on surveying drone and its accuracy, Techniques of controlling errors, Consideration of GCP in vertical and horizontal accuracies, Planning and estimation of drone surveying jobs, Autonomous flight vs. manual and hybrid flight profiles.

MODULE III IMAGE PROCESSING AND PHOTOGRAMMETRY **3**

Aerial Triangulation, post processing software's, Analysing Data, Contouring, DEM, DSM, Cut, Fill, and Volumetric Measurement Calculation and orthophoto generation.

MODULE IV MAPPING AND MODELING **3**

Introduction to mapping and modelling concepts, Understanding RTK, PPK and GCP's, Overview of popular data processing software platforms and functions.

MODULE V APPLICATIONS **3**

Application of drone for Surveying & Mapping-Construction, Irrigation and Agricultural, Engineering Land Survey and Transportation.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Understand the fundamentals of drone technology, including its history, terminology, p considerations, battery life, specifications for optimal results, and relevant regulations.

CO2: Apply drone surveying principles by selecting appropriate hardware, comparing surveying drone accuracy, implementing techniques to control errors.

CO3: Apply knowledge in image processing and photogrammetry techniques using drone-captured data, post-processing software, data analysis, contouring and orthophoto generation.

TOTAL: 15 PERIODS

TEXT BOOK:

1. Lillesand and Kiefer, ¯Remote Sensing and Image Interpretation‖, 5th Edition, published by John Wiley and Sons, 2008.
2. One Nation Under Drones: Legality, Morality, and Utility of Unmanned Combat Systems by John E. Jackson.
3. A.M. Chandra, S.K. Ghosh, ¯Remote Sensing and Geographical Information System‖, Narosa, Publishing house, 1st Edition, 2007.

REFERENCES:

1. David P Paine, ¯Aerial Photography and Image Interpretation‖, 2nd Edition, published by Wiley, Higher Education, 2006.
2. Drones and Support for the Use of Force by James Igoe Walsh.

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CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1		1			2					2		
2	2	2	2											3	3
3	3	2	3		2									3	3
AVg.	2	2	2		1			2					2	3	3

1-low, 2-medium,3-high

	ARCHAEOLOGY OF INDIA	L	T	P	C
		1	0	0	1

MODULE I INTRODUCTION TO INDIAN ARCHAEOLOGY 3

Introduction to the basic principles and methodologies of archaeology - role of archaeology in reconstructing India's past - Evolution of archaeological practices in India - Contributions of early archaeologists and their pioneering discoveries. - Archaeological sites across India - cultural and historical significance.

MODULE II CHRONOLOGICAL FRAMEWORK OF INDIAN ARCHAEOLOGY 3

Prehistoric cultures and human evolution in the Indian subcontinent - Paleolithic, Mesolithic, and Neolithic periods - Ancient Indian Civilizations - Indus Valley Civilization. - Classical and Medieval Periods - cultural and architectural developments.

MODULE III TECHNIQUES AND METHODS IN INDIAN ARCHAEOLOGY 3

Excavation Methods - detailed exploration of excavation techniques employed in Indian archaeology - Dating Techniques - Radiocarbon dating, thermoluminescence, and other relevant techniques - Preservation and Conservation - Importance of preserving archaeological sites and artifacts - Strategies and challenges in the conservation of India's archaeological heritage

MODULE IV ARCHAEOLOGICAL SITES AND MUSEUMS 3

Harappa, Mohenjo-daro, and other Indus Valley sites - Ajanta and Ellora Caves -Agra, Fatehpur Sikri, and other Mughal monuments - National Museum, Delhi, and other archaeological museums

MODULE V CONTEMPORARY ISSUES IN INDIAN ARCHAEOLOGY 3

Heritage Management and Policies - current policies and initiatives for heritage management in India - Challenges and opportunities in preserving archaeological sites - Role of archaeologists in public awareness and education - Community involvement and collaborative projects - Emerging trends and technologies in the field of Indian archaeology.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Understand the basic principles, methodologies, evolution of archaeology and the hi significance of archaeological sites across India.

CO2: Understand the chronological framework of Indian archaeology, including prehistoric cultures and human evolution.

CO3: Apply archaeological technique to excavation methods, dating techniques such as radiocarbon dating and thermoluminescence, and preservation and conservation strategies in Indian archaeology.

TOTAL: 15 PERIODS

TEXT BOOK:

1. Dr. A. K. Sharma "Indian Archaeology: Principles and Practices", Archaeological Publications, India, 2021

2. R.C. Majumdar, "History of Ancient India", Motilal Banarsidass Publishers, 2020.
3. K.M. Srivastava,"A Guide to Archaeological Sites in India", Cambridge University Press, 2019.
4. Nita Mathur and Vinita Tewari, "Heritage Management in India", Routledge, 2020

REFERENCES:

1. Vincent A. Smith, "Early India: A Concise History", Oxford University Press, 2004.
2. Clive Orton "Archaeological Methods and Techniques", Hodder Arnold, 2020.
3. Christopher Bronk Ramsey, "Dating Methods in Archaeology", Oxford University Press, 2008.
4. K.N. Arjunamurthy and K. Paddayya, "The Future of Archaeology in India", Cambridge University Press, 2014

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/124106009

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CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1			2		2					3		
2	2	1	1										2		
3	2	2	3		2										3
AVg.	2	2	2		2	2		2					3		3

1-low, 2-medium,3-high

	RETROFITTING AND REHABILITATION OF HERITAGE STRUCTURES	L	T	P	C
		1	0	0	1

MODULE I INTRODUCTION TO HERITAGE STRUCTURES AND CONSERVATION PRINCIPLES 3

Definition and significance of heritage structures - Types of heritage structures – religious – residential – commercial - Deterioration mechanisms and threats to heritage structures - Importance of conservation and rehabilitation - International and national guidelines for heritage conservation - Ethics and challenges in heritage conservation.

MODULE II ASSESSMENT AND DIAGNOSIS OF HERITAGE STRUCTURES 3

Visual inspection and documentation techniques - Non-destructive and destructive testing methods - Structural and material characterization - Identifying structural deficiencies and pathologies - Identification and analysis of traditional building materials - Understanding the impact of climatic conditions.

MODULE III RETROFITTING TECHNIQUES AND MATERIALS 3

Strengthening strategies for various structural elements (beams, columns, walls, foundations) - Minimally invasive and reversible intervention methods - Use of traditional and new materials in retrofitting - Repair and strengthening of masonry structures - Preservation and restoration of architectural elements - Balancing modern requirements with historical aesthetics.

MODULE IV REHABILITATION PLANNING AND DESIGN 3

Adaptive reuse of heritage structures for contemporary uses - Balancing modern functionality with heritage conservation - Formulating conservation plans for heritage structures - Integrating conservation with urban planning - Incorporating sustainability in rehabilitation projects - Energy-efficient solutions for heritage structures.

MODULE V PROJECT IMPLEMENTATION AND MANAGEMENT 3

Construction methodology and quality control for heritage projects - Monitoring and maintenance of retrofitted structures - Planning and executing retrofitting and rehabilitation projects - Budgeting, scheduling, and risk management in heritage conservation.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Understand the heritage structures, their significance, and deterioration mechanisms, impo of conservation and rehabilitation, challenges in heritage conservation.

CO2: Assess and diagnosing heritage structures and identify structural deficiencies, pathologies, and traditional building materials.

CO3: Apply retrofitting techniques and materials to heritage structures includes selecting appropriate strengthening strategies for various structural elements.

TOTAL: 15 PERIODS

TEXT BOOK:

1. Donald Insall, ¯The Conservation of Buildings and Historic Places‖ Wiley-Blackwell, 2020.

2. Carl Schwegler, ¯Structural Assessment of Historic Buildings‖, John Wiley & Sons, 2020.
3. Valerie J. Goldstein, ¯Adaptive Reuse of Historic Buildings‖, Wiley-Blackwell, 2013.

REFERENCES:

1. Eduardo Miranda and Sérgio Lopez, ¯Retrofitting Strategies for Existing Structures‘, Springer, 2014
2. James Douglas and Daniella Izzo, ¯Designing for Sustainable Heritage‖, Routledge, 2019.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ar08

CO-PO&PSOMAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1			2	1	2					3		
2	2	2												3	3
3	2	2	3		2									3	3
AVg.	2	2	1		2	2	1	2					3	3	3

1-low, 2-medium,3-high

VALUE ADDED COURSES

23ME	DESIGN OF ELECTRIC VEHICLE (FOUR WHEELER)	L	T	P	C
		1	0	0	1

MODULE I BASICS OF EV TECHNOLOGY **3**

Configuration of Electric Vehicles - Performance of Electric Vehicles.

MODULE II EV BATTERY DESIGN **3**

Energy storage requirements - Battery parameters - Types of Batteries - Modelling of Battery – Design aspects.

MODULE III DESIGN OF EV POWER TRAIN UNIT **3**

Components of power train unit – Design aspects - Architecture of Electric Drive Trains.

MODULE IV EV MODELING WITH VEHICLE DYNAMICS **3**

Dynamic Analysis of electric vehicle – A case study.

MODULE V INDUSTRIAL VISIT - EV UNIT **3**

TOTAL = 15 PERIODS

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: Interpret working of different configurations of electric vehicles and its components

CO2 : Design batteries for specific application

CO3: Design and develop power train systems for electric vehicles

CO4: Model and analyze vehicle dynamic system

CO5 : Demonstrate various EV technologies and systems

Text Books:

1. Electric and Hybrid Vehicles, Design Fundamentals, Third Edition, Iqbal Husain, CRC Press, 2021.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004
2. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons, 1998
3. Hybrid and electric vehicle solutions guide – released by Texas Instruments, 2011
4. https://nptel.ac.in/courses/108/102/108102121/#

CO PO MAPPING

CO	Programme Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1					2								
CO2	3	3	3		2		2					1			2
CO3	3	3	3		2		2			1			3		2
CO4	3	3			3		2						3		2
CO5	1						2		3		3	3			3
Avg.	2.6	2.5	3		2.3		2		3	1	3	2	3		2.2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

VALUE ADDED COURSES

23ME	HEATING VENTILATION AND AIR-CONDITIONING SYSTEM DESIGN	L	T	P	C
		1	0	0	1

INTRODUCTION TO HVAC **(5)**

Introduction to HVAC - Fundamental and scope of HVAC - Mode of heat transfer - Standards - Refrigeration cycle. Component of A/C - Refrigerants and types Classification of Air-Conditioning System. Chilled water system of air conditioning - Air water system of air conditioning - Direct refrigerant system of air conditioning.

AIR DISTRIBUTION AND DUCT DESIGN **(5)**

Air Distribution: Room air distribution - Types of supply air outlets - Mechanism of flow through outlets - Distribution patterns of outlets DUCT design.

LOAD CALCULATION **(5)**

Cooling and Heat Load Calculation - ASHRAE Standards - Calculation of sensible Heat Factor-ADP and Dehumidified CFM.

TOTAL = 15 PERIODS

Course Outcomes:

On successful completion of the course, the student will be able to

CO1: Demonstrate the basic components of Air Conditioning & Refrigeration machines, Basic Refrigeration cycle, Accessories & Refrigerants
CO2: Select different Air-Conditioning System for specific applications
CO3: Use Psychrometric Chart and understand various terminology
CO4: Calculate load for building, Ventilation requirement for IAQ, ESHF, ADP & Air Flow Rate (CFM)
CO5: Develop Hydronic System, Water Piping, Fittings used in the HVAC Piping System.

Reference:

1. Refrigeration and Air conditioning MANOHAR PRASAD, New Age publisher, 2018
2. Refrigeration and Air conditioning, R.C. ARORA, PHI publishers 2020, INDIA,

Reference Links:

1. ASHRAE Handbook Volumes 2020,Online
2. Ishrae Data Book 2017
3. Hvac Handbook 2020 by Rosaler, Robert
4. Heating and Cooling of Buildings: Design for Efficiency, Revised Second Edition 2018 (Mechanical Engineering Series)

Industrial visit:

1. VOLTAS Refrigeration, Chennai,
2. MR Referigerator, Coimbatore,

VALUE ADDED COURSES

23ME	GEOMETRIC DIMENSIONING AND TOLERANCING IN DESIGN	L	T	P	C
		1	0	0	1

MOULE I INTRODUCTION **5**

History, Introduction and understanding the need for GD & T - Fundamental rules of GD&T per ASME - Rule1 and Rule2 – Tolerance charting, Coordinate vs Geometric Tolerancing - Definitions of Terms and Symbols: Feature, FOS, FCF, MMC, LMC and RFS - DRF thro definition of datums and DOF restrained by primary, secondary and tertiary datums - Calculation of bonus tolerance per MMC / LMC

MODULE II FORM, ORIENTATION, LOCATION TOLERANCES AND APPLICATIONS **5**

Form tolerances and applications – Straightness, Flatness, Circularity, Cylindricity. Orientation tolerances and applications – Parallelism, Perpendicularity, Angularity - Location tolerances and applications – Position, Concentricity, Symmetry

MODULE III RUN OUT, PROFILE TOLERANCES AND APPLICATIONS **5**

Run out tolerances and applications - Circular run out, Total run out Profile tolerances and applications - Profile of a line, Profile of a surface Inspection Methodology for GD&T Parameters

TOTAL = 15 PERIODS

COURSE OUTCOMES:

On successful completion of the course, the student will be able to

CO1: Understand the concepts of GD&T features and correctly interpret GD&T symbols in Engineering Drawings
CO2: Learn about using Geometric tolerances at RFS, MMC and LMC conditions and Calculate Bonus tolerance
CO3: Interpretation of GD&T Parameters
CO4: Learn GD&T through Case Studies and Exercises
CO5: Gain an insight into inspection of GD&T features using conventional methods

Text Books:

1. David A. Madsen, Geometric Dimensioning and Tolerancing: Principles and Practices, 10th Edition, The Goodheart-Willcox Company, Inc., 2022.
2. Ashok Kumar, Simplified GD&T: Based on ASME-Y 14.5-2009, 2nd Edition, 2018.

Reference Books:

1. ASME Y14.5 – 1994 Dimensioning and Tolerancing
2. James D. Meadows, Geometric Dimensioning and Tolerancing: Workbook and Answerbook: 112 (Mechanical Engineering), CRC Press, 1997
3. CAD Desk, GEOMETRIC DIMENSIONING & TOLERANCE (GD&T) REFERENCE GUIDE BOOK, 2016
4. Alex Krulikowski, Fundamentals of Geometric Dimensioning and Tolerancing: Based on Asmey 14.5-2009, Delmar Cengage Learning, 3rd Edition, 2012.

Further Reading:

NPTEL

1. https://nptel.ac.in/courses/112103019
2. https://nptel.ac.in/courses/112105294

VALUE ADDED COURSES

23ME	ADVANCED SOLID STATE JOINING PROCESSES	L	T	P	C
		1	0	0	1

MODULE I DIFFUSION JOINING PROCESSES **5**

Principles and applications; Diffusion brazing, braze welding, diffusion welding; Diffusion bonding of metals to ceramics; Solid-state deposition welding processes; Pressure non-fusion welding processes: Cold welding, electromagnetic pulse welding, pressure gas welding.

MODULE II FRICTION WELDING (FW) PROCESSES **5**

Friction Welding (FW) process: Process parameters, applications, metallurgical, mechanical and tribological characterizations; Spin welding, rotary drive FW, inertia welding, friction taper stitch welding, radial FW; Friction seam welding, Study of friction welds and joint quality of FW.

FRICTION STIR WELDING (FSW) PROCESSES (5)

Friction Stir Welding (FSW) process: Fundamentals and Classifications, materials; Heat generation, metallurgical and mechanical characterizations, micro FSW and its applications; friction stir spot welding (FSSW) - process parameters, hybrid FSW, underwater FSW, ultrasonic assisted FSW, and electrically assisted FSW; Friction stir processing and friction surfacing.

TOTAL = 15 PERIODS

Course Outcomes:

On successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on fundamental principles and overview of different types of solid-state joining processes.

CO2: Adopt suitable solid state welding processes to obtain sound weld with minimal heat input.

CO3: Apply friction welding technology for the suitable industrial applications.

CO4: Develop friction stir welding procedures to obtain defect free joints as well as pollution free environment.

CO5: Demonstrate and understanding of different methods of friction stir technologies.

Text Books:

1. R.S.Paramar , & quot; Welding Processes and Technology & quot;, 3rd Edition, Khanna Publishers, New Delhi, 2010.
2. Daniela Lohwasser, Zhan Chen, & quot; Friction Stir Welding from Basics to Applications & quot;, Woodhead Publishing, 2010.

Reference Books:

1. Rajiv Sharan Mishra, ParthaSarathi De, Nilesh Kumar, " Friction Stir Welding and Processing: Science and Engineering & quot;, 1st Edition, Springer International Publishing, 2014.
2. Bekir Sami Yilbas, Ahmet Z. Sahin, " Friction Welding: Thermal and Metallurgical Characteristics", Springer Science, 2014.
3. P.Asadi, M.K. Besharati-Givi , "Advances in Friction-Stir Welding and Processing & quot;, Woodhead Publishing, 2014.
4. Nilesh Kumar, Rajiv S. Mishra, Wei Yuan, " Friction Stir Welding of Dissimilar Alloys and Materials", Elsevier, 2015.

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23M313	Complex Analysis and Transforms	BSC	3	1	0	4	4
2	23EE311	Electric Circuit Analysis	PCC	3	1	0	4	4
3	23EE312	Electromagnetic Fields	PCC	3	1	0	4	4
4	23EE313	DC Machines and Transformers	PCC	3	0	0	3	3
5	23EE314	Linear Integrated circuits	PCC	3	0	0	3	3
PRACTICALS								
6	23EE321	DC Machines and Transformers Laboratory	PCC	0	0	3	3	1.5
7	23EE322	Linear Integrated Circuits Laboratory	PCC	0	0	2	2	1
8	23EE323	OOPS and C++ Laboratory	PCC	0	0	3	3	1.5
ONE CREDIT COURSES								
9	23MC321	Human Values and Professional Ethics	OCC				15	1
10	23MC322	Design Thinking	OCC				15	1
MANDATORY COURSES								
11	23MC301	Induction Programme	MC				One week	-
			TOTAL	**15**	**3**	**8**	**26**	**24**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		AC Rotating Machines	PCC	3	0	0	3	3
2		Transmission and Distribution of Electrical Power	PCC	3	0	0	3	3
3		Signals and Networks	PCC	3	1	0	4	4
4		Control Systems	PCC	3	1	0	4	4
5		Digital System Design	PCC	3	0	0	3	3
PRACTICALS								
6		AC Rotating Machines Laboratory	PCC	0	0	3	3	1.5
7		Control & Instrumentation Laboratory	PCC	0	0	2	2	1
8		Digital System Design Laboratory	PCC	0	0	3	3	1.5
ONE CREDIT COURSES								
9		Value Added Course-I	OCC				15	1
MANDATORY COURSES								
10		Community Service and Engineering	MC				15	-
			TOTAL	**15**	**2**	**8**	**25**	**22**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Power System Analysis	PCC	3	0	0	3	3
2		Power Electronics	PCC	3	1	0	4	4
3		Embedded System Design	PCC	3	0	0	3	3
4		Elective –I	PEC	3	0	0	3	3
5		Elective –II	PEC	3	0	0	3	3
PRACTICALS								
6		Power System Simulation Laboratory	PCC	0	0	2	2	1
7		Power Electronics Laboratory	PCC	0	0	2	2	1
8		Embedded System Design Laboratory	PCC	0	0	2	2	1
9		In-Plant Training	EEC	-	-	-		1
ONE CREDIT COURSES								
10		Value Added Course-II	OCC				15	1
11		Seminar and Technical Writing	OCC				15	1
			TOTAL	**15**	**1**	**6**	**22**	**22**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Digital Protection of Power Systems	PCC	3	0	0	3	3
2		Electric Vehicles	PCC	3	0	0	3	3
3		Data Structures and Algorithms	PCC	3	0	0	3	3
4		Elective –III	PEC	3	0	0	3	3
5		Elective –IV	PEC	3	0	0	3	3
PRACTICALS								
6		Power and Energy Laboratory	PCC	0	0	2	2	1
7		Electric Vehicle Laboratory	PCC	0	0	2	2	1
8		IoT Laboratory	PCC	0	0	2	2	1
9		Mini Project	EEC	0	0	4	4	2
ONE CREDIT COURSES								
10		Hackathon	OCC				15	1
			TOTAL	**15**	**0**	**10**	**25**	**21**

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Generation of Electrical Energy	PCC	3	0	0	3	3
2		Solid State Drives and Control	PCC	3	0	0	3	3
3		Smart Grid	PCC	3	0	0	3	3
4		Elective -V	PEC	3	0	0	3	3
5		Elective -VI	PEC	3	0	0	3	3
PRACTICALS								
6		Electrical Drives Laboratory	PCC	0	0	3	3	1.5
7		Industrial Automation Laboratory	PCC	0	0	3	3	1.5
8		Reverse Engineering and Product Realization Laboratory	PCC	0	0	2	2	1
			TOTAL	**15**	**0**	**8**	**23**	**19**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1		Elective -VII	PEC	3	0	0	3	3
2		Elective -VIII	PEC	3	0	0	3	3
PRACTICALS								
3		PROJECT WORK AND VIVA-VOCE	EEC	0	0	12	12	6
			TOTAL	**6**	**0**	**12**	**18**	**12**

23EE323	OOPS AND C++ LABORATORY	L	T	P	C
		0	0	3	1.5

LIST OF EXPERIMENTS:

1. Functions and overloaded function
2. Concept of class
3. Friend function
4. Static, dynamic and array of objects
5. Constructors and destructors
6. Data hiding (public, private and protected)
7. Overloading unary operators
8. Overloading binary operators
9. Inheritance
10. File operations
11. Calculation of Power in simple DC network by OOP concepts
12. Analysis by Mesh analysis technique using OOP concept
13. Analysis by Nodal analysis technique using OOP concept
14. Calculation of Tariff using OOP concept
15. Calculation of efficiency and voltage regulation in transmission lines using OOP concept

TOTAL:45 PERIODS

COURSEOUTCOMES:

Upon completion of the course, the students will be able to

CO1: Distinguish object oriented Programming and traditional programming techniques.

CO2: Develop, compile and debug programs.

CO3: Infer the concept of constructor and destructor.

CO4: Illustrate key concepts such as encapsulation and polymorphism.

CO5: Illustrate key concepts such as inheritance and abstraction.

CO6: Write C++ program for practical electrical applications

CO-PO&PSO MAPPING

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		3	1	1	3					2	2	3
2	3	3	3	3	3	3		1	3	2	3	3
3	3	1	2	2	3	2				2	2	3
4	3	1	2	2	3	2				2	2	3
5	3	1	2	2	3	2				2	2	3
6		3	3	3	3	3		1	3	2	3	3
AVG	**3**	**2**	**2.2**	**2.2**	**3**	**2.4**		**1**	**3**	**2**	**2.3**	**3**

1-low,2-medium,3-high

	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Computation of Transmission Line Parameters (A,B,C,D Parameters)
2. Formation of Bus Admittance (YBUS) Matrices
3. Formation of Bus Impedance Matrices (ZBUS) and Solution of Networks
4. Power Flow Analysis using Gauss-Seidel Method
5. Power Flow Analysis using Newton Raphson Method
6. Simulation of Symmetric and unsymmetrical faults
7. Varley Loop test by using cable fault locator
8. Power Quality Analysis (Sag and THD) using simulation software.
9. Analysis of EMI.
10. Transient stability analysis of SMIB System
11. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
12. Compensation of Reactive power using FACTS devices using simulation software.

TOTAL:30 PERIODS

COURSEOUTCOMES:

At the end of the course, students will be able to

CO1: Determine the A,B,C,D parameters and understand the performance of the transmission lines.

CO2: Acquire knowledge on formation of Bus Admittance and Impedance Matrices and provide solutions of Networks.

CO3: Assess the power flow using GS and NR method

CO4: Identify, analyze and locate Symmetric and Unsymmetrical faults

CO5: Investigate and employ the suitable reactive power compensation techniques

CO6: Explore the electromagnetic transients and harmonics in power system using simulation softwares & Perform various load flow and performance analysis

CO-PO&PSO MAPPING

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	2	2							2
2	3	3	3	3	2							2
3	3	2	2	2	2		2		2	2		2
4	3	2	2	3	3							2
5	3	3	3	3	2	2	2	2	2	2	2	3
6	3	3	3	3	3	2	2	2	2	2	2	3
AVG	**3**	**2.6**	**2.6**	**2.6**	**2.3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**

1-low,2-medium,3-high

	ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

MODULE I EV FUNDAMENTALS **9**

An Overview of Conventional, Battery, Hybrid and Fuel Cell Electric Systems - Conventional IC Engine Vehicle - BEVs - HEVs - Series HEV - Parallel HEV - Series-Parallel HEV - FCEV - EV subsystems - Vehicle Dynamics: Vehicle Load Forces - Basic Power, Energy, and Speed Relationships – Aerodynamic Drag - Aerodynamic Drag and Fuel Consumption - Rolling Resistance – Gradeability.

MODULE II ENERGY STORAGE **9**

Introduction to Batteries - Energy Storage Requirements in Electric Vehicles: Batteries Types: Battery Operation - Battery Parameters and Comparisons -Battery Packs - Battery Sizing -Battery Management System- SOC Estimation - Safety in Battery Design, Battery Pack Safety-Electrolyte Spillage and Electric Shock-various energy storage technologies-Fuel Cells and its types- Super capacitors- Hybridization of different energy storage devices.

MODULE III POWER TRAIN **9**

Power Electronics in HEVs: Power electronics circuits used for control and distribution of electric power for HEV. Electric Machines and Drives in HEVs: Fundamental of Drives and Control of EV Using DC motor, Induction Motor- Permanent Magnet Motor- Switched Reluctance Motor- BLDC motor- Design and Sizing of Traction Motors-Supporting Subsystems-Performance analysis and Standards.

MODULE IV EV CHARGING TECHNOLOGIES **9**

Classification of different charging technology-On-board & off-board charging, The Fast Charging Process, Fast Charging Strategies, The Fast Charger Configuration, EV charging station- single line diagram -introduction to Grid-to-Vehicle- Vehicle to Grid (V2G) or Vehicle to Buildings (V2B) or Vehicle to Home (V2H) operations- bi-directional EV charging systems- energy management strategies used in hybrid and electric vehicle- Wireless power transfer (WPT) technique for EV charging(Block Diagram only)-Performance analysis and EV charging Standards.

MODULE V EV- PERFORMANCE AND SAFETY ISSUES **9**

Electric vehicle verses IC engine vehicle comparison: efficiency comparison – pollution comparison – capital and operating cost comparison – GHG emission – emission standards and comparison - United Nations Framework Convention on Climate Change (UNFCCC) – Kyoto protocol – UNFCCC Paris climate change summit (COP 21) - legislation and standardizations for electric vehicles – EV performance testing – safety requirements of electric vehicles.

COURSEOUTCOMES

At the end of the course, students will be able to

CO1: Identify the various electric vehicles technologies and their performance parameters.

CO2: Compare the different types of energy storage systems.

CO3: Design of power train components for electric vehicle application.

CO4: Illustrate the different charging technique and its standards.

CO5: Select a novel and alternate energy sources that could be used in EVs.

CO6: Review of various standards and safety requirements for EV.

TOTAL:45 PERIODS

TEXTBOOKS:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel

Cell Vehicles: Fundamentals, Theory and Design, 2 nd edition CRC Press, 2018.

2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 3 rd Edition, CRC Press, 2021.

REFERENCES:

1. Ali Emadi, Mehrdad Ehsani, ¯Vehicular Electric Power Systems‖ Marcel Dekker, Inc., New York, 2014.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, 2 nd edition, Wiley, 2012.
3. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd., 2011.
4. Hybrid and electric vehicle solutions guide – released by Texas Instruments, 2011 available in *www.ti.com/hev*.
5. Indian vehicle emission standards: *https://www.dieselnet.com/standards/in/2wheel.php*
6. Jain, A. K., Electric Vehicles - Part 1, NPTEL Course Material, Department of Electrical Engineering, IIT Delhi, https://nptel.ac.in/courses/108/102/108102121/
7. Kumar, P., Majhi, S., Introduction to Hybrid and Electric Vehicles, NPTEL Course Material, Department of Electronics and Communication Engineering, IIT Guwahati, https://nptel.ac.in/courses/108/103/108103009/

CO-PO&PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	2	2	2				3		3	3	
2	3	3	3	3	2						3		3	3	
3	3	3	3	3							2		3	3	
4	3	3	3	3	3	2	2	2	3	2	3	3	3	3	
5	3	3	3	3	3	3	2	2	2	3	3	2	3	3	
6	3	3	3	3	3	2	3	2	2	2	3	2	3	3	
AVg.	**3**	**3**	**3**	**2.8**	**2.6**	**2.3**	**2.3**	**2**	**2.3**	**2.3**	**2.8**	**2.3**	**3**	**3**	

1-low, 2-medium,3-high

	POWER AND ENERGY LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Determination of Break-Down Voltage (BDV) of transformer oil.
2. Load sharing of parallel connected alternators
3. Phase Sequence detection using Static Relay.
4. Over Current detection using Static Over Current Relay & Electromechanical relay
5. Over/Under Voltage detection using Static Relay.
6. Over/Under Frequency detection using Static Relay
7. Earth Fault detection using a static relay.
8. Differential Protection of transformer using a static relay
9. Analysis of Hybrid solar and Wind power systems
10. FPGA & IoT Based over current relay.
11. LG -LL and three phase fault analysis of three phase synchronous machine
12. Characteristics of Fuse
13. Characteristics of Buchholz relay

TOTAL:30 PERIODS

COURSEOUTCOMES:

At the end of the course, students will be able to

CO1: Design and Select suitable Plug Setting Multiplier and test the overcurrent protective relay.

CO2: Identify and locate the fault in power system.

CO3: Measure experimentally the negative sequence components in unbalanced systems.

CO4: Analyze the IDMT characteristics of over/under voltage relay

CO5: Examine relay settings for safe operating of power systems.

CO6: Analyze the characteristics of fuse and buchholz relay.

CO-PO&PSO MAPPING

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	2	2							
2	3	3	3	3	2							
3	3	2	2	2	2							
4	3	2	2	3	3							
5	3	3	3	3	2							
6	3	3	3	3	3							
AVG	**3**	**2.6**	**2.5**	**2.6**	**2.3**							

1-low,2-medium,3-high

	ELECTRIC VEHICLE LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Testing of Permanent Magnet Synchronous Motor
2. Analyse the electric vehicle battery charge and discharge characteristics
3. Designing a solar PV based EV charging
4. Generation of phase shift modulation for dual active bridge DC-DC converter using Embedded Controller
5. Regenerative Charging and Braking Systems
6. VVVF Drive Training Systems
7. Characterization of power, torque and efficiency for EV over drive cycle
8. Simulation of power train system and determines its efficiency and Power flow in EV powertrain during charging, V2G feeding, motoring and braking
9. Simulation of speed control of AC and DC motors
10. Develop a model that could estimate the SOC of a Li-ion battery
11. Power Quality and Harmonic analysis of an Inverter (Drive train and Charger)
12. Machine Learning Model for Electronic Steering
13. Synchronized PWM techniques for high-power and high-speed IM drives
14. Simulation of Power line disturbance due to penetration of Electric Vehicle
15. Testing of safety compliance for electrical products
16. Study of various sensor outputs and its characterization
17. Performance evaluation of 2/3/4 W
18. Design and simulate a motor controller for hybrid electric vehicle applications
19. Design and simulation of DC/DC and DC/AC converter for electric vehicle application
20. Demonstrate a wiring layout for electric vehicle
21. Thermal analysis of Li-ion battery
22. Simulation of boost converter and calculating gain and phase margin from the transfer function.
23. Design and simulation of PI/PID controller for Electric Vehicle
24. Design and simulate speed controller for induction motors in EV and analyses its dynamic and steady state performance
25. Simulation of a wireless power charging station for EV charging
26. Design and simulate a battery management system for electric vehicle application
27. Simulate a fuzzy logic controller based energy storage system for EV

TOTAL:30 PERIODS

COURSEOUTCOMES:

At the end of the course, students will be able to

CO1: Modeling and thermal analysis of Li-ion battery with an appropriate Battery Management System.

CO2: Speed Control of AC and DC motor drive.

CO3 Control of Converters using PWM techniques.

CO4: Design a power train system, calculate its efficiency and also check the wiring layout for electric vehicle.

CO5: Able to design a charging station, wired, wireless charger and bidirectional charging of an Electric Vehicle.

CO6: Able to apply Artificial Intelligence and Machine Learning techniques for Automotive Electronics, Power Quality, Energy and Data Analytics.

	IoT LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Interfacing sensors ESP8266, Arduino in Tinkercad software.
2. Networking Simulation using CISCO Network Packet Tracer
3. Temperature and moisture Data uploading in the cloud platform.
4. Uploading Data to different Cloud Platforms.
5. Fire protection using sensors and Arduino UNO.
6. Security Testing Programs.
7. Home Appliances Control
8. Data Analyzing Techniques.
9. Traffic light controller.
10. Creating intranet using Local Server / client.
11. Program to use hybrid cloud.
12. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.

TOTAL:30 PERIODS

COURSEOUTCOMES:

At the end of the course, students will be able to

CO1: Perceive the basic IoT Components, Various cloud platforms

CO2: Distinguish the usage of networking components and LAN, WAN networks.

CO3: Assess the data from sensors.

CO4: Application of IoT for home, commercial buildings.

CO5: Interpret Ethical Hacking methods

CO6: Build Suitable security codes in IoT.

CO-PO&PSO MAPPING

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	1	3				2				
2	1	1	3	3				2				
3	1	1	3	3				2				
4	1	1	3	3				2				
5	1	1	3	3				2				
6	1	1	3	3				2				
AVG	**1.3**	**1.3**	**2.7**	**3**				**2**				

1-low,2-medium,3-high

	INDUSTRIAL AUTOMATION LABORATORY	L	T	P	C
		0	0	3	1.5

LIST OF EXPERIMENTS

1. Access of Analog and Digital I/Os via Industrial IoT 2040 using Python
2. Access of Analog and Digital I/Os via Industrial IoT 2040 using C/C++ compiler
3. Interfacing of IoT 2040 Gateway with Android Application.
4. Hardware configuration of PCS7 - combinational logics
5. Design logic for traffic light controller using PCS7
6. Design a level process with PID controller for a real time plant
7. Study of Distributed Control System architecture and ES/OS Configuration of AS410 CPU in PCS7.
8. RF Communication and control of two end Nodes
9. Application server and End device Communication
10. Real time Data Monitoring and Device Control
11. Smart meter interfacing using LoRa
12. IoT based 1 phase PWM inverter
13. Control of mobile robot
14. ON/OFF Logic control using PLC
15. Control applications using timers in PLC.

TOTAL:45 PERIODS

COURSEOUTCOMES:

At the end of the course, students will be able to

CO1: Apply an industrial IoT to access the data via industrial IoT.
CO2: Develop a controller for a plant/actuator using PCS7.
CO3: Implement PID controller for real time plant
CO4: Develop control applications using industrial automation protocols
CO5: Develop applications using warless network
CO6: Implement a control application program to PLC.

CO-PO&PSO MAPPING

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2	2	1	3				2	3		2
2	3	2	2	1	3				2	3		2
3	3	2	2	1	3				2	3		2
4	3	2	2	1	3				2	3		2
5	2	2	2	1	3				2	3		2
6	2	2	2	1	3				2	3		2
AVG	**2.5**	**2**	**2**	**1**	**3**				**2**	**3**		**2**

1-low,2-medium,3-high

23EC121	ELECTRICAL ENGINEERING AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

- Verification of series and parallel circuits
- Verification of KVL using Mesh Analysis
- Verification of KCL using Nodal Analysis
- Measurement of resistance using wheat stone bridge
- Measurement of Inductance using Maxwells bridge
- Speed control of dc motor
- V-I characteristics of an incandescent lamp
- Domestic wiring Installation
- Measurement of Temperature/Displacement/Force
- Measurement of frequency using Lissajous Method
- Measurement of signal parameters using CRO

COURSE OUTCOMES:

At the end of the course, students will be able to demonstrate an ability to,

CO1: Apply KVL and KCL to analyse the electric circuits
CO2: Calculate the unknown impedance using bridge circuits
CO3: Apply electrical principles for wiring installation
CO4: Interpret knowledge on sensors, transducers, and CRO
CO5: Develop communication skills and capability to work in team

TOTAL : 30 PERIODS

REFERENCES:

1. Electrical Engineering and Instrumentation Laboratory Manual, Department of ECE, CIT.
2. ―Schaum's Outline of Electric Circuits‖ by Joseph Edminister, MahmoodNahvi, , 7th Edition ,McGraw-Hill Publishing, 2017.
3. ―A Course in Electrical & Electronic Measurements & Instrumentation‖ by A.K. Sawhney, Puneet Sawhney Dhanpat Rai & Co, New Delhi, 2015.

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	1		1									1	2
2	3	1	1		1	1								1	3
3									1	2					
AVg.	2.5	2	1		1	1			1	2				1	2.5

1-low, 2-medium, 3-high

23EC122	PROBLEM SOLVING SKILLS AND PRACTICES	L	T	P	C
		0	0	2	1

PROBLEM SOLVING:

1. Introduction to problem solving and algorithmic thinking
2. Thinking with numbers
3. Logical Reasoning - Data Arrangements & Relations
4. Solving problems based on Coding & decoding, Series, Analogy, Odd man out , Visual reasoning and finding the shortest path
5. Problems based on Number system, Percentages, Simple & Compound Interest
6. Problems based on Ages, Logical Connectives, Syllogisms, Data Interpretation & Data Sufficiency
7. Order statistics and Introduction to Pseudo coding / algorithm and flowchart development
8. Branching & Repetition problems and finding optimal solutions
9. Solving problems on Clocks Calendars, Direction Sense & Cubes
10. App Development

Total: 30 PERIODS

COURSE OUTCOMES

At the end of the course, students will be able to demonstrate an ability to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Solve quantitative aptitude and logical reasoning problems.
CO3: Develop flowchart and algorithm for solving scientific or technical problems.
CO4: Solve Branching & Repetition problems and find optimal solutions.
CO5: Develop communication skills and capability to work in team.

REFERENCES:

1. "Quantitative Aptitude for Competitive Examination" by R.S. Aggarwal, S. Chand & Co., New Delhi, 2017.
2. ¯Quantitative Aptitude for Competitive Examinations‖ by Dinesh Khattar, Pearson Publishing, 2020.

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2		1	1				2	2			1	1	3
2	3	2		1	1				2	2			1	1	3
3									3	2			1	1	
AVg.	2	2		1	1				2.33	2			1	1	2

1-low, 2-medium, 3-high

23EC222	DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

- Verification of Super Position Theorem
- Verification of Thevenin & Norton theorem
- Verification of maximum power transfer theorem
- Characteristics of PN Junction Diode
- Zener diode Characteristics & application
  - Characteristics of Zener diode using Multisim
- Wave Shaping Circuits
- Rectifier Circuits
  - Full wave rectifier using Multisim
- Common Emitter input-output Characteristics
- Characteristics of FET
- Characteristics of SCR
- Characteristics of LDR

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Use network theorems for analysing electronic circuits and validate the results

CO2: Examine the characteristics of semiconductor diodes and calculate its parameters under forward and reverse bias conditions

CO3: Construct wave shaping circuits and calculate the ripple factor in rectifier circuits.

CO4: Examine the characteristics of BJT, FET, SCR & LDR

CO5: Develop communication skills and capability to work in team.

TOTAL: 30 PERIODS

REFERENCES:

1. Laboratory Manual prepared by ECE Department, CIT.
2. ―Fundamentals of Electronic Devices and Circuits Lab Manual‖ by David A Bell, , 5th Edition ,Oxford University Press, Canada, 2009.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												1
2	3	2												1
3									1	2				1
Avg.	2	2							1	2				1

1 - low, 2 - medium, 3 - high

COURSE CODE	INTEL COLLABORATED COURSE: INTRODUCTION TO MACHINE LEARNING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO MACHINE LEARNING AND TOOLS

Classify the type of problem to be solved - Demonstrate supervised learning algorithms - Choose an algorithm- tune parameters- and validate a model - Explain key concepts like under- and over-fitting- regularization- and cross-validation. - Apply Intel Extension for Scikit-learn* patching to leverage underlying compute capabilities of hardware

MODULE II SUPERVISED LEARNING AND ALGORITHMS

Explain supervised learning as applied to regression and classification problems - Apply K-Nearest Neighbor (KNN) algorithm for classification - Apply patching to leverage underlying compute capabilities of hardware

MODULE III TRAIN TEST SPLITS VALIDATION LINEAR REGRESSION

Explain the difference between over-fitting and under-fitting - Describe Bias-variance tradeoffs - Find the optimal training and test data set splits - Apply cross-validation - Apply a linear regression model for supervised learning - Apply Intel® Extension for Scikit-learn* to leverage underlying compute capabilities of hardware

MODULE IV REGULARIZATION AND GRADIENT DESCENT

Explain cost functions- regularization- feature selection- and hyper-parameters - Summarize complex statistical optimization algorithms like gradient descent and its application to linear regression - Apply patching to leverage underlying compute capabilities of hardware

MODULE V LOGISTIC REGRESSION AND CLASSIFICATION ERROR METRICS

Describe Logistic regression and how it differs from linear regression - Identify metrics for classification errors and scenarios in which they can be used - Apply patching to leverage underlying compute capabilities of hardware

MODULE VI SVM AND KERNELS

Apply support vector machines (SVMs) for classification problems - Recognize SVM similarity to logistic regression - Compute the cost function of SVMs - Apply regularization in SVMs and some tips to obtain non-linear classifications with SVMs - Apply patching to leverage underlying compute capabilities of hardware

MODULE VII DECISION TREES

Recognize Decision trees and apply them for classification problems - Recognize how to identify the best split and the factors for splitting - Explain strengths and weaknesses of decision trees - Explain how regression trees help with classifying continuous values - Describe motivation for choosing Random Forest Classifier over Decision Trees - Apply patching to Random Forest Classifier

MODULE VIII BAGGING

Describe bootstrapping and aggregating (aka ¯bagging‖) to reduce variance - Reduce the correlation seen in bagging using Random Forest algorithm - Apply patching to leverage underlying compute capabilities of hardware

MODULE IX BOOSTING AND STACKING

Explain how the boosting algorithm helps reduce variance and bias. - Apply patching to leverage underlying compute capabilities of hardware

MODULE X INTRODUCTION TO UNSUPERVISED LEARNING AND CLUSTERING METHODS

Describe unsupervised learning algorithms their application - Apply clustering - Apply dimensionality reduction - Apply patching to leverage underlying compute capabilities of hardware

MODULE XI DIMENSIONALITY REDUCTION AND ADVANCED TOPICS

Explain and Apply Principal Component Analysis (PCA) - Explain Multidimensional Scaling (MDS) - Apply patching to leverage underlying compute capabilities of hardware

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: classify various types of machine learning problems and gain knowledge in applying appropriate supervised learning algorithms and tuning models

CO2: apply supervised learning techniques to both regression and classification problems, including the use of K-Nearest Neighbor (KNN) algorithms

CO3: apply linear regression, manage bias-variance tradeoffs, and use cross-validation to optimize regression models for accuracy and efficiency

CO4: utilize advanced classification methods such as SVMs and Decision Trees, understanding their applications and effectiveness in real-world situations

CO5: use ensemble learning techniques, like bagging and boosting, to enhance model performance and reduce prediction errors.

CO6: explore and implement unsupervised learning algorithms, applying clustering and dimensionality reduction methods to analyze and interpret complex datasets.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. "Machine Learning with oneAPI" by Shriram K. Vasudevan, Nitin Vamsi Dantu, Sini Raj Pulari, T.S. Murugesh, 1st Edition, CRC Press, 2023, ISBN 9781003393122.

REFERENCES:

1. Console.cloud.intel.com (Training and resources, Machine Learning with oneAPI)
2. Git code repos - https://github.com/IntelSoftware/Machine-Learning-using-oneAPI
3. Home page - https://www.intel.com/content/www/us/en/developer/tools/oneapi/training/machine-learning-using-oneapi.html

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	2	-	-	-	-	-	-	-	-	-	-	2
2	3	-	2	-	-	-	-	-	-	-	-	-	-	2
3	3	-	2	-	-	-	-	-	-	-	-	-	-	2
4	3	-	1	-	-	-	-	-	-	-	-	-	-	2
5	3	-	1	-	-	-	-	-	-	-	-	-	-	2
6	3	-	1	-	-	-	-	-	-	-	-	-	-	2
Avg.	3	-	1.5	-	-	-	-	-	-	-	-	-	-	2

1-low, 2-medium, 3-high

COIMBATORE INSTITUTE OF TECHNOLOGY, COIMBATORE – 641 014
(Autonomous Institution affiliated to ANNA UNIVERSITY, CHENNAI)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
REGULATIONS 2023 - CHOICE BASED CREDIT SYSTEM

B. E. Computer Science and Engineering

CURRICULA AND SYLLABI
SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23FYH111	Technical English	HSC	2	2	0	4	4
2	23FYM115	Matrices and Vector Calculus	BSC	3	1	0	4	4
3	23FYP115	Applied Physics	BSC	3	0	0	3	3
4	23FYC115	Applied Chemistry -I	BSC	3	0	0	3	3
5	23CS111	C Programming	ESC	3	0	0	3	3
PRACTICALS								
1	23FYH122	English Communication Skills Laboratory	BSC	0	0	2	2	1
2	23CS121	Engineering Graphics	BSC	0	0	2	2	1
3	23CS122	C Programming Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
1	23FYH121	Heritage of Tamils	HSC	15 Hours			15 Hours	1
2	23MC101	Induction Programme	MC	15 Days			15 Days	--
3	23MC102	Soft Skills	EEC	15 Hours			15 Hours	--
			TOTAL	**14**	**3**	**8**	**25**	**22**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23FYM215	Fourier Series and Differential Equations	BSC	3	1	0	4	4
2	23CS211	Electron Devices	BSC	3	0	0	3	3
3	23FYC211	Applied Chemistry -II	BSC	3	0	0	3	3
4	23CS212	Digital Design	ESC	3	0	0	3	3
5	23CS213	Object Oriented Programming	ESC	3	0	0	3	3
PRACTICALS								
1	23CS221	Digital Design Laboratory	ESC	0	0	2	2	1
2	23CS222	Object Oriented Programming Laboratory	ESC	0	0	2	2	1
3	23FPC221	Basic Sciences Laboratory	HSC	0	0	4	4	2
MANDATORY COURSES								
1	23CC221/ 23CC222/ 23CC223/ 23CC224	Co-Curricular Activities- NSS/YRC/RSP/Sports	MC	15 Hours			15 Hours	1
2	23FYC221	Environmental Science and Engineering	HSC	15 Hours			15 Hours	1
3	23FYH222	Tamils and Technology	HSC	15 Hours			15 Hours	1
TOTAL				**15**	**1**	**08**	**24**	**23**

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23M315	Linear Algebra and Complex Variables	BSC	3	1	0	4	4
2	23CS311	Data Structures and Algorithms	PCC	3	1	0	4	4
3	23CS312	Discrete Mathematics	BSC	3	0	0	3	3
4	23CS313	Operating Systems	PCC	3	0	0	3	3
5	23CS314	Java Programming	PCC	3	0	0	3	3
PRACTICALS								
1	23CS321	Data Structures and Algorithms Laboratory	PCC	0	0	3	3	1.5
2	23CS322	Operating Systems Laboratory	PCC	0	0	3	3	1.5
3	23CS323	Java Programming Laboratory	PCC	0	0	2	2	1
MANDATORY COURSES								
1	23MC301	Induction Programme	MC	1 Week			1 Week	-
2	23MC321	Human Values and Professional Ethics	MC	15 Hours			15 Hours	1
3	23MC322	Design Thinking	EEC	15 Hours			15 Hours	1
TOTAL				**15**	**2**	**8**	**25**	**23**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Design and Analysis of Algorithm	PCC	3	1	0	4	4
2	T2	Database Management Systems	PCC	3	0	0	3	3
3	T3	Statistical Data Analysis	BSC	3	0	0	3	3
4	T4	Computer Architecture	PCC	3	0	0	3	3
5	T5	Formal Languages and Automata Theory	PCC	3	0	0	3	3
PRACTICALS								
1	P1	Database Management Systems Laboratory	PCC	0	0	3	3	1.5
2	P2	Design and Analysis of Algorithm Laboratory	PCC	0	0	3	3	1.5
3	P3	Python Programming	BSC	0	0	4	4	2
MANDATORY COURSES								
1	MC1	Value Added Course - I	EEC	15 Hours			15 Hours	-
2	MC2	Community Service and Engineering	MC	15 Hours			15 Hours	-
TOTAL				**15**	**1**	**10**	**26**	**21**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Computer Networks	PCC	3	0	0	3	3
2	T2	Software Engineering	PCC	2	0	2	4	3
3	T3	Compiler Design	PCC	3	1	0	4	4
4	T4	Elective -I	PEC	3	0	0	3	3
5	T5	Elective -II	PEC	3	0	0	3	3
PRACTICALS								
1	P1	Computer Networks Laboratory	PCC	0	0	2	2	1
2	P2	Compiler Design Laboratory	PCC	0	0	3	3	1.5
3	P3	Web Technology Laboratory	PCC	0	0	3	3	1.5
		Inplant Training	EEC	2 weeks			2 weeks	1
MANDATORY COURSES								
1	MC1	Seminar And Technical Writing	EEC	15 Hours			15 Hours	1
2	MC2	Value Added Course - II	MC	15 Hours			15 Hours	-
TOTAL				**14**	**1**	**10**	**25**	**22**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	T1	Embedded Systems and Internet Of Things	PCC	3	0	0	3	3
2	T2	Machine Learning	PCC	3	0	0	3	3
3	T3	Data Mining and Data Warehousing	PCC	3	0	0	3	3
4	T4	Elective - III	PEC	3	0	0	3	3
5	T5	Elective - IV	PEC	3	0	0	3	3
PRACTICALS								
1	P1	Embedded Systems & Internet of Things Laboratory	PCC	0	0	3	3	1.5
2	P2	Machine Learning Laboratory	PCC	0	0	3	3	1.5
3	P3	Exploratory Data Analysis Laboratory	PCC	0	0	2	2	1
		Innovation and Practices	EEC	0	0	4	4	2
MANDATORY COURSES								
1	MC1	HACKATHON	EEC	15 Hours			15 Hours	1
TOTAL				**15**	**0**	**12**	**27**	**22**

LIST OF PROFESSIONAL ELECTIVE COURSES:

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CONTACT PERIODS	CREDITS
1.	PE1	UNIX INTERNALS	PE	3	0	0	3	3
2.	PE2	DIGITAL MARKETING	PE	3	0	0	3	3
3.	PE3	ENTERPRISE RESOURCE MANAGEMENT	PE	3	0	0	3	3
4.	PE4	DIGITAL FORENSICS	PE	3	0	0	3	3
5.	PE5	SOFTWARE PROJECT MANAGEMENT	PE	3	0	0	3	3
6.	PE6	SOFTWARE TESTING AND QUALITY ASSURANCE	PE	3	0	0	3	3
7.	PE7	RECOMMENDER SYSTEMS.	PE	3	0	0	3	3
8.	PE8	ENGINEERING ECONOMICS AND MANAGEMENT	PE	3	0	0	3	3
9.	PE9	CUSTOMER RELATIONSHIP AND MANAGEMENT	PE	3	0	0	3	3
10.	PE10	SOFT COMPUTING	PE	3	0	0	3	3
11.	PE11	MULTIMEDIA AND ANIMATION	PE	3	0	0	3	3
12.	PE12	MOBILE COMPUTING	PE	3	0	0	3	3
13.	PE13	OBJECT ORIENTED ANALYSIS AND DESIGN	PE	3	0	0	3	3
14.	PE14	AD HOC NETWORKS	PE	3	0	0	3	3
15.	PE15	WIRELESS SENSOR NETWORKS	PE	3	0	0	3	3
16.	PE16	KNOWLEDGE ENGINEERING	PE	3	0	0	3	3
17.	PE17	DATA SCIENCE	PE	3	0	0	3	3
18.	PE18	ROBOTIC PROCESS AUTOMATION	PE	3	0	0	3	3
19.	PE19	QUANTUM COMPUTING	PE	3	0	0	3	3
20.	PE20	CYBER SECURITY	PE	2	0	2	4	3
21.	PE21	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	PE	3	0	0	3	3

23CS314	JAVA PROGRAMMING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO JAVA 10

Java and Internet - Byte Code - Features of Java - Java Development Environment- Java Programming: Methods and Classes- Constructor - Garbage Collection - Overloading - Inheritance - Overriding -Packages and Interfaces - Java I/O systems -String Handling : String, String Buffer and StringBuilder.

MODULE II EXCEPTION HANDLING 8

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - User defined Exceptions.

MODULE III THREADS 9

Multithreaded Programming : Thread Model - The Main Thread - Creating a Thread - Creating MultipleThreads – Thread priorities - Synchronization - Inter thread communication..

MODULE IV SWING AND EVENT HANDLING 9

Introduction to Abstract Window Tool kit - Swing class : Key Swing features - JComponent – Swing Menu Basics – Model view Controller Architecture- Event Handling: The Delegation Event Model -Event class: Keyboard and Mouse events handling..

MODULE V COLLECTIONS FRAMEWORK AND DATABASE CONNECTIVITY 9

Collections overview- Collections Classes – Spliterator - Working with maps - Comparators – Arrays - Data Base Connectivity: basic structure of JDBC API.

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COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Design objects for specific applications in java.
CO2: Analyse the concepts of Exception Handling and its types.
CO3: Apply the concepts of multithreading
CO4: Demonstrate the concepts of event handling.
CO5: Use the concepts of collections framework
CO6: Illustrate database connectivity.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, " Java The Complete Reference ", Tata McGraw Hill Education, 12th Edition,2021

REFERENCES:

1. Cay S. Horstmann “Core Java, Volume I: Fundamentals”, Oracle Press, 12th Edition 2021
2. Cay S. Horstmann “Core Java, Vol. II-Advanced Features”, Oracle Press, 12th Edition,2022

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	1
2	3	2											1	1
3	3	2											1	1
4	3	2											1	1
5	3	2											1	1
6	3	2											1	2
Avg.	3	2											1	**1**

1-low, 2-medium, 3-high

23CS323	JAVA PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

List of Experiments:

1. Control statements in Java
2. Classes
3. Inheritance
4. Exception Handling
5. Packages & Interface
6. Multithreading
7. Swing
8. Case study Database Connectivity
9. Collections Framework

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Create effective java applications using fundamental object-oriented programming concepts.
CO2: Demonstrate advanced java concepts like Exception handling, Multithreading and Swing.
CO3: Design and develop java applications for real world problems.
CO4: Apply the concepts of Socket programming
CO5: Use the concepts of collections framework.
CO6: Illustrate database connectivity.
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TOTAL : 30 PERIODS

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2											1	1
2	3	2											1	1
3	3	2											1	1
4	3	2											1	1
5	3	2											1	1
6	3	2											1	2
Avg.	3	2											1	**1**

1-low, 2-medium, 3-high

SEMESTER IV

COURSE CODE	DESIGN AND ANALYSIS OF ALGORITHM	L	T	P	C
		3	1	0	4

MODULE I TIME COMPLEXITY ANALYSIS 7

Introduction – Rate of growth of functions-Asymptotic notations (Revisited)- Internal Sorts: Selection Sort, Bubble Sort, Insertion Sort -Heap Sort(Priority Queue)-Time Complexity Analysis of Sorting Algorithms

MODULE II DIVIDE AND CONQUER 9

Introduction -Merge Sort-Quick Sort- Maximum sub array sum- Closest Pair of Points -Complexity Analysis- Recurrence relations and methods to solve them: Recursion tree, substitution, Master Method

MODULE III BACKTRACKING AND BRANCH AND BOUND ALGORITHMS 9

Backtracking-Introduction - 8 Queens Problem-Hamiltonian Cycle – Branch and Bound-Introduction - Job Assignment Problem - Traveling Salesman Problem

MODULE IV DYNAMIC PROGRAMMING AND GREEDY ALGORITHMS 10

Dynamic Programming – 0/1 Knapsack Problem-Optimal Binary search trees- Greedy Approach- Huffman Coding- Fractional Knapsack problem-Activity Selection Problem.

MODULE V STRING ALGORITHMS, NETWORK FLOW, AND COMPLEXITY 10

String Matching Algorithms- Rabin-Karp algorithm - Network Flow- Definition-Maximum Flow-Ford Fulkerson algorithm - Introduction to P, NP, NP-complete – Definition

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Perform Time Complexity Analysis of Algorithms.
CO2: Apply Sorting Algorithms to Solve Real-World Problems
CO3: Understand the fundamental concepts of different algorithm design techniques
CO4: Design efficient algorithms for moderately difficult computational problems, using various algorithm design techniques taught in the course
CO5: Solve Real World Network Flow Problems
CO6: Apply string algorithms to solve real-world challenges in Pattern Matching.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 4th Edition, Prentice Hall of India, 2022.
2. Anany Levitin, "Introduction to the design and analysis of Algorithms", Pearson, Third edition, 2011

REFERENCES:

1. Horowitz E., Sahni S., and Rajasekaran Sanguthevar, "Fundamental of Computer Algorithms", Universities Press (Computer Science), Second Edition, 2008.
2. Steven S.Skiena, " The Algorithm Design Manual", 2nd Edition, Springer,2008

COURSE CODE	DESIGN AND ANALYSIS OF ALGORITHM LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

Sorting Algorithms

Implement the following sorting algorithms

1. Insertion sort,
2. Selection sort
3. Quick sort
4. Heap sort

Algorithm Design Techniques

1. Implement the N Queens problem using Backtracking.
2. Implement Merge sort using the divide and conquer method.
3. Solve Huffman coding using a greedy approach.
4. Implement String Matching algorithms (Rabin-Karp algorithm).
5. Implementation of optimal binary search tree.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: To solve sorting problems.
CO2: Design efficient algorithms for solving real world problems.
CO3: Apply algorithmic problem-solving techniques.
CO4: Perform algorithm analysis and optimization.
CO5: Apply algorithmic strategies for specific domains.
CO6: Apply string matching algorithms to solve practical problems in text processing.

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3		2						1	1	3	3
2	3	3	3		2						1	1	3	3
3	3	3	3		2						1	1	3	3
4	3	3	3		2						1	1	3	3
5	3	3	3		2						1	1	3	3
6	3	3	3		2						1	1	3	3
Avg.	3	3	3		2						1	1	3	3

1-low, 2-medium, 3-high

COURSE CODE	WEB TECHNOLOGY LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Experiment with Client side scripting using JavaScript
2. Create a Simple web application using Servlet
3. Create a Simple web application using PHP/ JSP
4. Develop an Application to demonstrate cookies and session management.
5. Demonstrate Database connectivity using Servlet and JSP/ PHP
6. Create a Form and validate it using AJAX
7. Display a XML document from server in the form of HTML table in client side.
8. Develop an application that make use of database.
9. Develop E- commerce application
10. Examine the developed web application using testing techniques

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Conceptualize and plan an internet-based business that applies appropriate business models and web technologies

CO2: To select and apply markup languages for processing, identifying, and presenting information in web pages

CO3: Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations

CO4: Incorporate best practices in navigation, usability and written content to design websites that give users easy access to the information

CO5: To create a static website using HTML and add dynamic functionality to it by using java Script

CO6: To gain expertise in web based strategic business alignment prioritizing security, navigation and dynamic script functionalities to facilitate a successful internet business

TOTAL : 45 PERIODS

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	1	1								1	
2	1	3	3	2	2								1	
3	1	1	3	1	1								1	
4	1	1	1	1	1								1	
5	1	1	1	1	2								1	
6	1	1	1	1	1								1	
Avg.	1	1	2	1	2								1	

1-low, 2-medium, 3-high

COURSE CODE	EXPLORATORY DATA ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXERIMENTS:

1. Descriptive Statistics in EDA
2. Handling and Recoding missing value/Null values
3. Data merging
4. OLAP Operations
5. Data representation
6. Time variant analysis
7. Pooled OLS Regression
8. Forecasting
9. Hypothesis testing
10. Case study on Data visualization using Tableau/PowerBi

COURSE OUTCOMES

At the end of the course, students will be able to

CO 1: Calculate and interpret descriptive statistics to summarize datasets effectively and various techniques for handling missing values.

CO 2: Merge datasets using SQL joins.

CO 3: Perform OLAP operations and construct OLAP queries.

CO 4: Select and create appropriate visualizations to represent data and analyze temporal data trends.

CO 5: Apply Pooled OLS regression to real-world datasets and incorporate forecasting models.

CO 6: Interpret the results of hypothesis tests and perform data visualization using Tableau or Power BI

Total :30 Periods

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3												3	
3	3												3	
4	3		3										3	
5	3		3	3									3	
6	3	3	2	3									3	
AVG.	**3**	**3**	**3**	**3**									**3**	

1 - low, 2 - medium, 3 - high

COURSE CODE	NETWORK SECURITY LABORATORY	L	T	P	C
		0	0	2	1

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Working with Wireshark -packet sniffing tool
2. Demonstrate on port scanning and vulnerability assessment using Metasploit and Nmap.
3. Monitoring security events and anomalous network activities using CISCO packet analyzer
4. Implementation of substitution and transposition techniques.
5. Implementation Symmetric and Asymmetric ciphering security mechanisms
6. Implementation of Diffie-Hellman Key Exchange algorithm
7. Compute Message Digest using SHA hashing algorithm
8. Compute Digital signature using NIST digital signature algorithm
9. Demonstrate on web application vulnerability assessment using N-stalker.
10. Demonstrate on intrusion detection system using Snort.
11. Demonstrate on malware detection using rootkit hunter.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 : Use different tools for secure data transmission.
CO2: Understand the various substitution and transposition techniques.
CO3: Apply symmetric ciphering algorithms for security attacks and threats.
CO4: Apply asymmetric ciphering algorithms for security attacks and threats.
CO5: Compute message digest using hashing algorithms.
CO6: Analyze the working of network-based intrusion detection systems.

TOTAL: 30 PERIODS

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2				3	1	1					1	3	1	2
2	3	1	2	1		1	1					1	3	2	3
3	3	2	2	2		2	1					1	3	2	3
4	3	2	2	2		2	1					1	3	2	3
5	2	2	3	1		1	1					1	3	2	2
6	2	2	3	1	3	2	1					1	3	2	2
AVG.	3	2	2	2	3	2	1					1	3	2	2

1 - low, 2 - medium, 3 – high

COURSE CODE	BIG DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	3	1.5

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. Implement various file management tasks in Hadoop:
   i. Adding files and directories
   ii. Retrieving files
   iii. Deleting files
3. MapReduce applications on Hadoop cluster.
4. Process Unstructured data into NoSQL data and perform operations such as NoSQL query with API.
5. Perform K-means clustering using map reduce.
6. Develop Pig Scripts and User defined functions (UDF)
7. Embedding PIG Latin in Python
8. Semi structured data processing using “Pig” (e.g: Log analysis)
9. Install “HIVE” and Perform query processing on “Hive” (E.g: create, alter, and drop databases, tables, views, functions, and indexes.)
10. Application development using SPARK.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand the implementation of Hadoop, PIG and HIVE.
CO2: Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks.
CO3: Experiment with MapReduce and NoSQL queries in Hadoop frameworks
CO4: Implement MapReduce programs in variety of applications
CO5: Apply different data processing tools like Pig, Hive.
CO6: Design and develop application using SPARK

TOTAL: 45 PERIODS

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				1								1	
2	3				1								1	
3	2	2	3										2	
4	2	2	3										3	
5	2	2	2										3	
6	2	3	3										3	
AVG.	**2**	**2**	**3**		**1**								**2**	

1 - low, 2 - medium, 3 - high

COURSE CODE	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO ONLINE MARKET **9**

Online Market space- Digital Marketing Strategy- Components – Opportunities for building Brand Website – Planning and Creation – Content Marketing.

MODULE II SEARCH ENGINE OPTIMISATION **9**

Search Engine optimisation – Keyword Strategy- SEO Strategy – SEO success factors -On-Page Techniques – Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

MODULE III E- MAIL MARKETING **9**

E- Mail Marketing – Types of E- Mail Marketing – Email Automation – Lead Generation – Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

MODULE IV SOCIAL MEDIA MARKETING **9**

Social Media Marketing – Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships – Creating Loyalty drivers – Influencer Marketing.

MODULE V DIGITAL TRANSFORMATION **9**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics – Changing your strategy based on analysis- Recent trends in Digital marketing.

COURSE OUTCOMES

At the end of the course, students will be able

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment..

CO2: To focus on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

CO3: To know the key elements of a digital marketing strategy.

CO4: To express how Mobile Marketing is utilized in achieving profiling and targeting

CO5: To study how the effectiveness of a digital marketing campaign can be measured

CO6: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938 ISBN:788126566938;ASIN: 8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
6. Pulizzi,J Beginner‟s Guide to Digital Marketing , Mcgraw Hill Education

COURSE CODE	ENTERPRISE RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION 9

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining - OLAP--SCM.

MODULE II ERP IMPLEMENTATION 10

ERP Implementation Lifecycle - Implementation Methodologies - ERP deployment methods - Package Selection - Process Definition - Vendors and Consultants - Contract with Vendors, Consultants and Employees - Training and education- Project Management and Monitoring.

MODULE III THE ERP BUSINESS MODULE 9

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management Quality Management - Sales and Distribution.

MODULE IV THE ERP MARKET & ERP - PRESENT AND FUTURE 9

ERP Marketplace and Marketplace Dynamics - ERP Vendors - SAP AG, Oracle Corporation, Microsoft Dynamics, EPICOR, QAD, RAMCO Systems - Enterprise Application Integration (EAI)- ERP and E-Business- Future Directions and Trends in ERP

MODULE V SAP 8

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench

COURSE OUTCOMES

At the end of the course, students will be able to

CO1:Describe the operational aspects of ERP system and its related technologies.

CO2 :Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring.

CO3 :Categorize the business modules of an ERP package in order to define the functionality of various departments in a company.

CO4:Analyze the ERP market place and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit.

CO5 : Predicting the Future Directions and Trends in E- Business

CO6 : Summarizing the Three Tier Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, Third Edition, 2014.
2. Dreamtech Press, "SAP R/3, Black Book", Dreamtech Software Team, 2006. (SAP)

COURSE CODE	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I PROJECT EVALUATION AND PLANNING 9

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

MODULE II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

MODULE III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

MODULE IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

MODULE V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand Project Management principles while developing software.

CO2: Gain extensive knowledge about the basic project management concepts, framework and the process models.

CO3: Obtain adequate knowledge about software process models and software effort estimation techniques.

CO4: Estimate the risks involved in various project activities.

CO5: Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

CO6: Learn staff selection process and the issues related to people management

TOTAL : 45 PERIODS

COURSE CODE	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO RECOMMENDER SYSTEMS 9

Goals- Basic models of Recommender systems – Domain specific challenges in recommender systems – Advanced Topics and Applications – Data Mining methods for recommender systems – Data pre-processing - Classification – Cluster analysis –Association rule mining.

MODULE II CONTENT BASED RECOMMENDER SYSTEMS 9

Introduction - Basic components of Content-based systems – Preprocessing and feature extraction – Feature representation and cleaning - Collecting user likes and dislikes – supervised feature selection and weighting – Learning user profiles and filtering – Trends and future research.

MODULE III COLLABORATIVE FILTERING 9

Introduction – key properties of rating matrices-Predicting ratings with neighbourhood based methods-Clustering and neighbourhood based methods-Dimensionality reduction and neighbourhood methods-A regression modelling view of neighbourhood methods-Grah models for neighbourhood-based methods- Model –based collaborative filtering –Introduction – Decision and regression trees – Rule based collaborative filtering – Naïve bayes collaborative filtering .

MODULE IV KNOWLEDGE BASED AND CONTEXT SENSITIVE RECOMMENDER SYSTEMS 9

Constraint based recommender systems – Case based recommender systems – Context sensitive recommender systems – The Multidimensional Approach – Contextual prefiltering : A Reduction based approach – Post Filtering methods –Contextual modelling.

MODULE V ATTACK RESISTANT AND EVALUATING RECOMMENDER SYSTEMS 9

Introduction – Types of attacks- Detecting attacks on recommender systems-strategies of robust recommender systems –Designing robust recommendation algorithms- Evaluating paradigms- General goals of evaluation design – Design issues in offline recommender evaluation – Accuracy metrics in offline evaluation – Limitation of evaluation measures

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand the fundamentals and challenges of recommender systems.
CO2: Develop a content-based recommender system.
CO3: Designing of the predictive system using various classification, clustering and regression models.
CO4: Build knowledge-based resilient recommender systems.
CO5: Ability to analyse the various security threats and attacks**.**
CO6: Evaluate the recommender systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011).

REFERENCES:

1. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 202

COURSE CODE	ENGINEERING ECONOMICS AND MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTIONTO ENGINEERING ECONOMICS 9

Basic Concepts of Engineering Economics: Definition and scope of engineering economics-Time value of money-Interest rates and compounding-Economic Analysis Techniques: Present worth analysis-Annual worth analysis-Future worth analysis

MODULE II COST ESTIMATION AND ANALYSIS 9

Cost Concepts and Classifications: Direct and indirect costs-Fixed and variable costs-Overhead costs-Cost Estimation Methods-Analogous estimation-Parametric estimation-Bottom-up estimation

MODULE III DECISION MAKING UNDER UNCERTAINTY 9

Risk and Uncertainty in Engineering Projects-Probability concepts-Decision trees-Sensitivity analysis-Risk Management Techniques-Monte Carlo simulation-Real options analysis-Insurance and hedging

MODULE IV ENGINEERING MANAGEMENT PRINCIPLES 9

Organization and Leadership-Organizational structures-Leadership styles-Motivation theories-Project Management-Project planning and scheduling-Resource allocation-Performance measurement

MODULE V SUSTAINABLE ENGINEERING AND CORPORATE SOCIAL RESPONSIBILITY 9

Sustainability Principles in Engineering-Triple bottom line-Life cycle assessment-Sustainable development goals-Corporate Social Responsibility-Ethical considerations in engineering-Social and environmental impact assessment-Stakeholder engagement

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Apply economic principles to analyze engineering projects and make informed decisions.
CO2 : Estimate project costs accurately and apply cost control techniques effectively.
CO3 : Evaluate and manage risks associated with engineering projects using appropriate techniques.
CO4 : Demonstrate proficiency in project management principles and tools.
CO5 :Recognize and address sustainability and corporate social responsibility issues in engineering practice.
CO6: Communicate effectively and work collaboratively in interdisciplinary teams**.**

TOTAL : 45 PERIODS

TEXT BOOKS:

1. **.**"Engineering Economy" by William G. Sullivan, Elin M. Wicks, and C. Patrick Koelling
2. "Cost Accounting: A Managerial Emphasis" by Charles T. Horngren, Srikant M. Datar, and Madhav V. Rajan
3. Project Management for Engineering, Business, and Technology" by John M. Nicholas and Herman Steyn

REFERENCES:

1. "Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle
2. "Fundamentals of Engineering Economics" by Chan S. Park
3. "Engineering Ethics: Concepts and Cases" by Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins
4. "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" edited by David Crowther and Nicholas Capaldi

COURSE CODE	SOFT COMPUTING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

MODULE II NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons - Back Propagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks.

MODULE III GENETIC ALGORITHMS 9

Introduction - Genetic Algorithm and Search Space - Basic Terminologies in Genetic Algorithm - Operators in Genetic Algorithm - Classification of Genetic Algorithm - Advantages and Limitations of Genetic Algorithm - Applications of Genetic Algorithm.

MODULE IV NEURO FUZZY MODELING 9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

MODULE V APPLICATIONS 9

Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction: CANFIS modeling for color recipe prediction.

COURSE OUTCOMES

At the end of the course, students will be able to

CO 1: Basic knowledge of fuzzy rules and operations.
CO 2: Develop inference systems using different Fuzzy Logic concepts.
CO 3: Understand the concept of neural networks to solve problems related to machine and deep learning algorithms.
CO 4: Apply the concept of genetic algorithm to obtain optimization in research problems.
CO 5: Knowledge and modelling of the neurological concepts with fuzzy logic.
CO 6: Solve real problems using a soft computing approach and evaluate various soft computing approaches for a given problem

TOTAL : 45 PERIODS

TEXT BOOK:

1. Jang J.S.R., Sun C.T and Mizutami,Neuro Fuzzy and Soft computing , Prentice hall New Jersey, 1998.
2. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.

REFERENCES:

1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.

COURSE CODE	MULTIMEDIA AND ANIMATION	L	T	P	C
		3	0	0	3

MODULE I GRAPHICS PRIMITIVES, 2D TRANSFORMATION AND VIEWING 9

Output primitives: points and lines - line drawing algorithms - circle and ellipse drawing algorithms - polygon generating and filling algorithms. 2D Transformations: Basic Transformations - matrix representation - translation - rotation - scaling - general pivot point rotation - general fixed point scaling - general scaling directions - reflection - shear. Viewing: window to view port coordinate transformation - point clipping - Cohen and Sutherland line clipping algorithm - Sutherland and Hodgeman polygon clipping algorithm.

MODULE II 3D CONCEPTS, TRANSFORMATION AND VIEWING 9

3D display methods- 3D object representation: polygon surfaces - curved lines and surfaces - Quadric surfaces - Introduction to Spline Representations - Bezier curves and surfaces. 3D Transformations: Translation - Rotation - Scaling - 3D Viewing: view plane - projections - clipping.

MODULE III MULTIMEDIA SYSTEM DESIGN 9

Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system - Defining objects - Multimedia Data Interface standards - Multimedia databases.

MODULE IV COMPRESSION AND DECOMPRESSION 9

Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale& Still Video Image Compression-Video Image Compression - Audio Compression

MODULE V MULTIMEDIA APPLICATIONS 9

Content Based Information Retrieval - Multimedia Communications- Multimedia Information Sharing and Retrieval – Applications. Social Media Sharing, Online Social Networking- Virtual Reality- Multimedia for Portable Devices- Collaborative Multimedia Applications.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 : To understand the foundational concepts of multimedia components and systems

CO2 : Demonstrate the working of graphics output primitive algorithms, clipping algorithms and apply two dimensional geometric transformations.

CO3 : Illustrate three dimensional object representation, transformations and concepts involved in spline representation.

CO4 : Describe the Multimedia concepts, its architecture and its real world applications.

CO5 : Ability to understand the importance of various multimedia applications.

CO6 : Analyze various compression techniques for the efficient transmission of Multimedia data.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M., "Computer Graphics", Prentice Hall of India, Second Edition, 2008.
2. Prabhat K Andleigh and Kiran Thakrar, "Multimedia Systems and Design", Prentice Hall of India, Reprint 2007. (Multimedia Systems Design, Compression and Decompression)
3. Ze Nian Li, Mark S Drew and Jiangchuan Liu, " Fundamentals of Multimedia", Second Edition, Springer,2014. (Multimedia Applications)

COURSE CODE	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I REASONING UNDER UNCERTAINTY 9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods- Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

MODULE II METHODOLOGY AND MODELING 9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

MODULE III ONTOLOGIES – DESIGN AND DEVELOPMENT 9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain-Understanding and Concept Elicitation – Modelling-based Ontology Specification.

MODULE IV REASONIING WITH ONTOLOGIES AND RULES 9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching -Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

MODULE V LEARNING AND RULE LEARNING 9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement Overview – Rule Generation and Analysis – Hypothesis Learning.

CO1: Understand the basics of Knowledge Engineering.
CO2: Apply methodologies and modelling for Agent Design and Development.
CO3: Design and develop ontologies.
CO4: Apply reasoning with ontologies and rules.
CO5: Understand the machine learning concepts and modelling.
CO6: Ability to solve problems through the knowledge of rule-based learning.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press,First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCES

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning,Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations,

Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1stEdition,2001.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3									2			2	
2		3	2										2	3
3		2	2		2									3
4		3			2					3				3
5	3	3								3				3
6	3	3								3				3
AVg.	3	3	2		2					3			2	3

1-low, 2-medium, 3-high

COURSE CODE	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 6

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

MODULE II AUTOMATION PROCESS ACTIVITIES 6

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

MODULE III APP INTEGRATION, RECORDING AND SCRAPING 6

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

MODULE IV EXCEPTION HANDLING AND CODE MANAGEMENT 6

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

MODULE V DEPLOYMENT AND MAINTENANCE 6

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand the basic concepts of Robotic Process Automation.
CO 2: Expose to the key RPA design and development strategies and methodologies.
CO 3: Learn the fundamental RPA logic and structure.
CO 4: Explore the Exception Handling, Debugging and Logging operations in RPA.
CO 5: Learn to deploy and Maintain the software bot.
CO 6: Solve the real-world problems using RPA process.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020

REFERENCES

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

COURSE CODE	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

MODULE I FUNDAMENTAL CONCEPTS **9**

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms –Experimental Quantum Information Processing – Quantum Information.

MODULE II QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS **9**

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application:Superdense Coding – Density Operator – The Shmidt Decomposition and Purifications –EPR and the Bell Inequality – Computational Models: Turing Machines – Circuits – Analysis of Computational Problems.

MODULE III QUANTUM COMPUTATION **9**

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation – Quantum Fourier Transform and Applications – Quantum Search Algorithms – Quantum Computers

9

MODULE IV QUANTUM INFORMATION

Quantum Noise and Quantum Operations: Classical Noise and Markov processes – Quantum Operations – Examples – Applications – Distance Measures for Quantum Information – Quantum Error Correction – Entropy

MODULE V QUANTUM INFORMATION THEORY **9**

Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand the basics of quantum computing.
CO2: Understand the background of Quantum Mechanics.
CO3: Analyse the computation models.
CO4: Model the circuits using quantum computation.
CO5: Understand the quantum operations such as noise and error-correction.
CO6: Appreciate the need of quantum computing.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.

REFERENCES

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

COURSE CODE	CYBER SECURITY	L	T	P	C
		2	0	2	3

MODULE I INTRODUCTION **6**

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cyber crime and Punishment.

MODULE II ATTACKS AND COUNTERMEASURES **6**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

MODULE III RECONNAISSANCE **5**

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

MODULE IV INTRUSION DETECTION **5**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

MODULE V INTRUSION PREVENTION **5**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Explain the basics of cyber security, cyber crime and cyber law
CO2: Classify various types of attacks.
CO3: Learn the tools to launch various attacks.
CO4: Apply various tools to perform information gathering
CO5: Apply intrusion techniques to detect intrusion
CO6: Apply intrusion prevention techniques to prevent intrusion

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011 (Unit 1)
3. https://owasp.org/www-project-top-ten/

REFERENCES

1. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, 4th edition, Jones & Bartlett Learning Publishers, 2021 (Unit 2).

2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2013 (Unit 3).
3. Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers, 2010 (Unit 3).
4. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Global Edition, Pearson Education, 2018 (Units 4 and 5).
5. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No Starch Press, 2014 (Lab)

PRACTICAL EXERCISES: **15 PERIODS**

1. Install Kali Linux on Virtual box
2. Explore Kali Linux and bash scripting
3. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
4. Understand the nmap command d and scan a target using nmap
5. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
6. Use Metasploit to exploit an unpatched vulnerability
7. Install Linus server on the virtual box and install ssh
8. Use Fail2banto scan log files and ban Ips that show the malicious signs
9. Launch brute-force attacks on the Linux server using Hydra.
10. Perform real-time network traffic analysis and data pocket logging using Snort

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	1			1	2				1	3	2
2	2	2	2	1			1	1				1	3	2
3	3	2	2	1	2		1	1				1	3	2
4	3	2	2	3	3		1					1	3	2
5	3	2	2	1	1		2					1	3	2
6	3	2	2	1	2		2					1	3	2
Avg.	3	2	2	1	2		2	1				1	3	2

1-low, 2-medium, 3-high

COURSE CODE	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO BLOCK CHAIN 9

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

MODULE II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

MODULE III BITCOIN CONSENSUS 9

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner,Mining Difficulty, Mining Pool- Permissioned model and use cases.

MODULE IV HYPERLEDGER FABRIC & ETHEREUM 9

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

MODULE V BLOCKCHAIN APPLICATIONS 9

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance- Case Study.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand emerging abstract models for Blockchain Technology
CO2: Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
CO3: Understand how the individual components of the Bitcoin protocol make the whole system works: transactions, script, blocks, and the peer-to-peer network
CO4: Understand the functions of Blockchain as a method of securing distributed ledgers, ensuring consensus on their contents through algorithms.
CO5: Apply hyper ledger Fabric and Ethereum platform to implement the Blockchain Application.
CO6: Exploit the use cases where blockchain concepts are deployed.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”,O‟Reilly, 2014.

REFERENCES

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O‟Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner‟s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

MAJOR VERTICAL-1
WEB TECHNOLOGY FRAMEWORKS

COURSE CODE	Front End Web Development	L	T	P	C
		2	0	2	3

MODULE I Introduction to HTML **6**

Introduction to HTML- Editors- Elements-Attributes-Headings and paragraphs -Bold, italic, emphasis and Strong-Structural and semantic markup- Lists - Links- Images-Tables-Forms- HTML5 forms- Extra Markups- Flash Videos and Audios.

MODULE II Introduction to CSS **6**

Introduction to CSS: Rules, Properties and Values- Colors: Css3 HSL colors- Text- Boxes- Lists- Tables -Forms-Layout- Images- HTML5 Layout- Flexbox- Process and Design.

MODULE III JavaScript **6**

Introduction to script- objects and properties-linking javascript with html and css -statements-comments-variables-datatypes-arrays-expressions-operators-functions-method-objects-built in objects: browser object model, document object model, global javascript objects- decisions and loops, DOM, events.

MODULE IV Jquery **6**

Introduction To Jquery -Similarities To Dom- Finding Elements- Looping- Chaining- Content- Attributes- Css Properties- Each- Event Methods - Filters - Forms - Box - Page-Plugins.

MODULE V JSON **6**

Introduction to JSON- JSON data types- Creating JSON – Parsing JSON- Data Interchange- Serving JSON-Posting JSON -JSON data persistence

PRACTICALS:

HTML

- Embed a YouTube video or a Google Map into an HTML page using appropriate HTML tags.
- Develop a simple login form with HTML and validate the username and password using JavaScript.

CSS

- Create a CSS file and link it to an HTML document to change the text color, font size, and background color of a paragraph.
- Apply CSS styles to create a responsive layout for a webpage that adapts to different screen sizes.

JavaScript

- Create a JavaScript program that prompts the user for their age and displays a message based on their age (e.g., "You are a child", "You are a teenager", "You are an adult").
- Create a JavaScript program to validate a form by checking if all required fields are filled in.

Jquery

- Create a jQuery program that fades in an image when it is clicked and fades it out when it is clicked again.
- Develop a jQuery program that dynamically loads content from an external file and displays it on a webpage.

Json

- Create a JSON file containing an array of objects representing different products, such as their name, price, and description. Write a program to read the JSON file and display the product information on a webpage.
- Create a JSON-based quiz application where questions and answers are stored in a JSON file, and the program retrieves and displays them to the user.

TOTAL : 15 PERIODS

COURSE CODE	DevOps	L	T	P	C
		2	0	2	3

MODULE I Introduction to DevOps **6**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

MODULE II COMPILE AND BUILD USING MAVEN AND GRADLE **6**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

MODULE III CONTINUOUS INTEGRATION USING JENKINS **6**

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job,Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

MODULE IV CONFIGURATION MANAGEMENT USING ANSIBLE **6**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

MODULE V BUILDING DEVOPS PIPELINES USING AZURE **6**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

PRACTICALS:

- Create Maven Build pipeline in Azure
- Run regression tests using Maven Build pipeline in Azure
- Install Jenkins in Cloud
- Create CI pipeline using Jenkins
- Create a CD pipeline in Jenkins and deploy in Cloud

TOTAL : 30 PERIODS

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by

CO3: Build and automate test cases using Maven and Gradle.

CO4: Ability to Perform Automated Continuous Deployment

CO5: Ability to do configuration management using Ansible

CO6: Understand to leverage Cloud-based DevOps tools using Azure DevOps

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014.

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni.
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”,First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. MariotTsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	1	3						1		3	2
2	3	2	1	1	3						1		3	1
3	3	2	1		3						1		3	1
4	3	1	1		3						1		3	1
5	3	1	1		3						1		3	1
6	3	2	1		3						1		3	1
AVG.	3	2	1	1	3						1		3	1

1-low, 2-medium, 3-high

COURSE CODE	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION **10**

Defining a Cloud - Cloud Computing Reference Model – Characteristics and Benefits -Challenges - Principles of Parallel and Distributed Computing: Eras of Cloud Computing-Parallel vs. Distributed Computing-Elements of Parallel Computing: Hardware Architectures for Parallel Processing - Approaches to Parallel Programming - Levels of Parallelism. Elements of Distributed Computing: Concepts and Definitions - Components of a Distributed System -Models for Inter-Process Communication.

MODULE II CLOUD COMPUTING ARCHITECTURE **9**

Introduction- Cloud Reference Model -Architecture -Infrastructure / Hardware as a Service-Platform as a Service -Software as Service-Types of Clouds: Public Clouds - Private Clouds -Hybrid Clouds - Community Clouds -Economics of the Cloud -Open Challenges

MODULE III VIRTUALIZATION **9**

Introduction-Characteristics of Virtualized Environments - Virtualization Techniques: Execution Virtualization - Other Types of Virtualization - Virtualization and Cloud Computing -Pros and Cons of Virtualization - Technology Examples: Xen: Paravirtualization- VMware: Full Virtualization - Microsoft Hyper-V

MODULE IV CLOUD TECHNOLOGIES **8**

Hadoop – MapReduce – Virtual Box –Google App Engine - EMC-NetApp- Microsoft – Amazon AWS - Salesforce.com

MODULE V CLOUD STORAGE AND SECURITY **9**

IBM Cloud Object Storage System overview: How IBM Cloud Object Storage System works – Software-defined storage – Typical workloads and use cases – Cloud Storage Providers – S3- Differences between S3 and IBM Cloud Object Storage APIs - Differences between S3 and the IBM Cloud Object Storage System APIs - S3 Object Lock

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Summarizing the features of Cloud Computing, Parallel and Distributed Computing

CO2: Inferring the Models to establish the Inter-Process Communication

CO3: Interpreting Cloud Reference Model, Architecture and Services

CO4: Paraphrasing the significance of virtualization techniques and types of virtualization.

CO5: Integrating the Cloud Technologies and Advancements to improve the cloud environment

CO6: Exemplifying various security features and storage for cloud services

TOTAL : 45 PERIODS

TEXT BOOKS:

3. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, ¯Mastering Cloud Computing, TataMcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Copyright © 2010 by The McGraw-Hill.
3. Vasfi Gucer, Chris de Almeida, Joe Dorio, Israel Feygelman, Max Huber, Michael Knieriemen, Lars Lauber, Jussi Lehtinen, Jaswinder Singh Saini, “IBM Cloud Object Storage System Product Guide” , 2023, IBM Redbooks.

REFERENCES:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ¯Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	1		1									2	
2	1	1		2									2	
3	1	1		2									2	
4	1	1		2									2	
5	1	1		1									2	
6	1	1		1									2	
AVG.	1	1		2									2	

1-low, 2-medium, 3-high

OPEN ELECTIVES:

COURSE CODE	INTRODUCTION TO CUSTOMER RELATIONSHIP MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION **9**

Most profitable Customer - CRM: Custom centered database, Managing campaigns, Evolution of marketing, Closed loop marketing, CRM architecture - Customer profitability - Customer acquisition - Cross selling - Customer retention - Customer segmentation.

MODULE II BUILDING THE BUSINESS CASE **10**

Introduction - Uncovering the needs for data mining - Defining the business value - The costs - Deploying Data mining for CRM: Introduction - Define the problem - Define the user - Define the data - Scope the project - Trial - Quality assurance - Education Launch - Continuation.

MODULE III COLLECTING CUSTOMER DATA **8**

Introduction - Three types of customer data - Collecting customer data - Connecting customer - Customer data and privacy - Privacy and data mining - Guidelines for privacy - Legal issues associated with data mining.

MODULE IV SCORING YOUR CUSTOMER **8**

Introduction - Process - Scoring architectures and configurations - Preparing the data - Integrating scoring with other applications- Optimizing the CRM process: Introduction - Improved customer profitability through optimization - Optimized CRM - Complete loop - Optimal CRM process - Optimization techniques.

MODULE V OVERVIEW OF DATA MINING AND CRM TOOL MARKETS **10**

Introduction - Data mining market place - Taxonomy of data mining tools - Tool assessment attributes and methodology - Tool evaluation -Data mining tool: WEKA -CRM tools - Next generation for CRM.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 : State the evolution of marketing and define CRM architecture explaining customer acquisition, retention and segmentation.

CO2 : Describe the business value, its costs and deploying data mining for CRM.

CO3 : Understand the need for Quality assurance in real-time business cases for business continuation

CO4 : Understand the type of collecting and connecting the customer data with proper guidelines for privacy.

CO5 : Demonstrate the scoring process and apply the various CRM optimization techniques to optimize the CRM process in order to improve customer profitability.

CO6 :Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.

TOTAL : 45 PERIODS

COURSE CODE	FUNDAMENTALS OF SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION **9**

The Software Engineering Discipline - Software Development Projects - Software Life Cycle Models: Use of Life Cycle Models - Classical Waterfall Model-Iterative Waterfall Model-Prototype model-Evolutionary Model-Spiral Model

MODULE II SOFTWARE REQUIREMENTS AND ANALYSIS **8**

Requirements Analysis and Specification - Requirements Gathering and Analysis- Value of good SRS - Requirement process- Requirement Specification - desirable characteristics, components and Structure of requirements document - Functional Specification with use cases - basics - developing Use Cases -DFDs - Data Dictionary - ER Diagrams.

MODULE III SOFTWARE DESIGN **10**

Design concepts - Cohesion and Coupling- The Open-Closed Principle - Function Oriented Software Design : Structured charts-Structured design methodology - Detailed Design: Logic / Algorithm design - State Modeling of Classes

MODULE IV CODING **7**

Programming principles and guidelines - Structured programming - Information hiding - Some programming practices - Coding standards - Code inspection - Planning- Self-review - Group review meeting.

MODULE V TESTING **11**

Testing Fundamentals -Black Box Testing: Equivalence Class Partitioning - Boundary Value Analysis - White box Testing: Control Flow based criteria - Data Flow based Testing - Levels of Testing: Unit Testing - Integration Testing - System Testing - Acceptance Testing.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1:Describe the various software life cycle models and choose an appropriate model for a given application.

CO2:Identify the functional requirements, prepare data flow and ER diagrams.

CO3: Understand and develop the Software Requirement Specifications through various use cases.

CO4:Employ suitable architectural styles, and software design methodologies for various applications,

CO5: Understand the concepts of coding standards and practices in developing practical applications

CO6:Discuss various testing techniques and their application in defect removal.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Pankaj Jalote, "Software Engineering A Precise Approach", Wiley India, Third edition 2012.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning Private Limited, Third Edition 2013. (Introduction only)

REFERENCES:

1. Roger.S.Pressman "Software Engineering A Practitioner's Approach", McGraw Hill International Edition, Seventh Edition, 2014.
2. Ian Sommerville, "Software Engineering", Dorling Kindersley (India) Private Ltd., Eighth Edition, 2008.

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1								1				3
2	3	1	2	2	2					1				3
3	2	1	3		2					2				3
4	2	1	2		2					2				3
5	3	1	1	2	2					2				3
6	2	1	1	2	2					2				3
AVG.	2	1	2	2	2					2				3

1-low, 2-medium, 3-high

COURSE CODE	INTERNET PROGRAMMING	L	T	P	C
		3	0	0	3

MODULE I BASIC WEB CONCEPTS **9**

Basic Web Concepts - Web based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication-Review of HTML: Markup Languages, Introduction to HTML- forms - frames - tables.

MODULE II CLIENT SIDE PROGRAMMING **9**

Client-side Programming (Review of JavaScript): Introduction, Writing Comments, Variables, Operators, Statements, Alert, Confirm, and Prompt Boxes, Functions, Event and Error Handling, Introduction to Built-in Classes, Form Validation, Cookies.

MODULE III DYNAMIC HTML **9**

Dynamic HTML: Introduction - cascading style sheets-object model and collections - event model - filters and transition - data binding - data control - ActiveX control - handling of multimedia data.

MODULE IV SERVER SIDE PROGRAMMING **9**

Servlets - Deployment of simple servlets - Web server (Java web server / Tomcat / Web logic) - HTTP GET and POST requests-Session tracking - Cookies - JDBC - Simple web applications - Multi-tier applications.

MODULE V WEB BASED APPLICATIONS AND ITS TECHNOLOGIES **9**

Rails: Overview of Rails-Ajax: Overview of Ajax Rails with Ajax- e-Business Models-e-Marketing-online payments-Security.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 :Gain knowledge in overview of www and web based applications.
CO2: Understand the importance of client side programming and design a basic application.
CO3 :Design and develop dynamic and Interactive web page using DHTML.
CO4 :Design and develop web applications using servlets.
CO5: Understand the usage of rails and Ajax calls in developing web applications
CO5 :Gain knowledge on E-business models and E-marketing.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Deital & Deital, "Internet and World Wide Web-How to Program", Pearson Education Fifth Edition, 2011.
2. Robert W.Sebesta, "Programming with World Wide Web", Pearson Education, Eighth Edition, 2015.

REFERENCES:

1. Scot Johnson, Keith Ballinger, Davis Howard Chapman, "Special Edition Using Active Server Pages", Prentice Hall of India, paperback 1999.
2. Ravi Kalakota and Andrew B Whinston, "Frontiers of e-commerce", Addison Wesley, paperback 1999.

OE04	INTRODUCTION TO DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

MODULE I BASIC CONCEPTS OF DATABASE SYSTEM 8

Purpose of DBMS - Applications - Views of data - Data Abstraction - Instances and Schemas - Data Models - Database Languages- Relational Databases - Database Architecture - Database users and administrators - History of Database systems.

MODULE II DATA MINING 9

Data Mining - On What Kind of Data-Data Mining Functionalities - Classification of Data Mining Systems - Data Mining Task Primitives - Integration of a Data Mining System with a Database or Data Warehouse System-Major Issues in Data Mining

MODULE III DATA WAREHOUSING 8

Data Warehouse - Introduction-Multidimensional Data Model-Data Warehouse Architecture -Data Warehouse Implementation from Data Warehousing to Data Mining.

MODULE IV DATA PREPROCESSING AND ASSOCIATION RULES 10

Data Preprocessing: Needs Preprocessing the Data - Data Cleaning- Data Integration and Transformation-Data Reduction- Discretization and Concept Hierarchy Generation. Association Rules: Basic concepts - Apriori Algorithm - Generation of association rules from frequent item sets - FP Tree Algorithm - Pattern evaluation methods

MODULE V CLUSTERING AND CLASSIFICATION 10

Cluster analysis - Partitioning Methods - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree induction.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 : Describe the basic concepts, architecture, data models of database management systems

CO2 : Understand the kind of data and appropriate mining techniques to be applied to a dataset.

CO3 : Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.

CO4 : Find frequent item sets and generate association rules for the given transactions.

CO5 : Analyze different types of data and apply classification algorithms

CO6: Analyse various partitioning methods and apply clustering techniques to various datasets

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Tata McGraw Hill, Sixth Edition, 2013. (Basic Concepts of Database System only)
2. Jiawei Han & Micheline kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.

REFERENCES:

1. Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Third Edition, 2012.
2. Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.
3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World ", Pearson Education, Seventh Indian Reprint New Delhi,2003.

COURSE CODE	INTRODUCTION TO EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION **10**

Characteristics of embedded computing applications- Challenges in embedded computing design - Performance in embedded computing. Embedded System Design Process - Computer Architecture Taxonomy - ARM Processor -Assembly Language Programming.

MODULE II CPU PERFORMANCE **8**

I/O Primitives - Busy -Wait I/O - Interrupts - Memory System Mechanisms: Cache, Memory Management Unit and Address Translation - Pipelining - CPU Power Consumption

MODULE III DEVELOPMENT AND DEBUGGING **9**

Development environments - Debugging Techniques - Debugging challenges - System Level Performance analysis - Program Level Performance analysis - Program Optimization.

MODULE IV SCHEDULING **10**

Scheduling states of a Process-Running Periodic Processes - Preemption - Priorities- Rate Monotonic Scheduling - Earliest Deadline First Scheduling - Priority Inversion - Data dependency

MODULE V NETWORKS **8**

Bus Standards: I2C, CAN Bus, Field Bus. CASE STUDY: Alarm Clock, Elevator Controller.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1 :Examine the characteristics and challenges in embedded system development

CO2 :Identify the parameters affecting CPU performance and develop optimized code

CO3 : Analyze memory system mechanisms such as cache management, memory management units, and address translation for improving CPU performance.

CO4 :Demonstrate the scheduling of a given set of real-time tasks using the appropriate scheduling algorithm

CO5 :Design embedded system for simple applications

CO6: Implement scheduling algorithms such as Rate Monotonic Scheduling and Earliest Deadline First to meet timing requirements

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman, Third Edition, 2012

REFERENCES:

1. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education, First Edition, 2009. (For Scheduling)
2. David. E. Simon, "An Embedded Software Primer", Pearson Education, First Edition, 2012
3. Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill, Third Edition, 2014.

23CH211	HEAT POWER ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I INTERNAL COMBUSTION (IC) ENGINE **12**

Classification - working of four stroke and two stroke engines - Petrol and Diesel engines - Ignition systems - working of simple carburetor - cooling and lubrication systems - Testing of IC Engines - various efficiencies - Heat balance test.

MODULE II AIR POWER CYCLES AND JET PROPULSION **9**

Otto cycles, Diesel cycle, Dual cycle, comparison. Mean Effective Pressure (MEP) - Brayton cycle - Simple problems, Turbo jet - thrust - thrust power - propulsion efficiency - Rocket propulsion.

MODULE III GAS AND STEAM TURBINES **10**

Open and closed cycle gas turbine system - practical gas turbines – Regeneration Intercooling and Reheating - Simple Problems, Principle of impulse and reaction turbines - compounding of turbines.

MODULE IV STEAM POWER CYCLE AND BOILERS **8**

Ranking cycle, Properties of steam - steam tables and charts, Study of boilers - fire tube, water tube boilers- Mounting - Accessories.

MODULE V REFRIGERATION AND AIR CONDITIONING **6**

Vapour compression refrigeration cycle on p-h diagram - COP - heat pump, Psychrometry - Air-Conditioning processes – application.

COURSE OUTCOME

After completion of the course, students are able to

CO1: Classify IC engines, discuss their working and analyze their performance.

CO2: Analyze - Air standard Otto, Diesel, Dual and Brayton Cycles; and performances of Jet and Rocket engines, using process diagrams.

CO3: Analyze Gas Turbine cycles, using process diagrams.

CO4: Explain steam generators, steam turbines, and analyze Rankine cycle using steam tables and Mollier diagram.

CO5: Evaluate performances of vapor compression refrigeration and heat pump systems, and compute property changes in simple calculations in air-conditioning processes, using psychrometric chart**.**

TOTAL:45 PERIODS

TEXT BOOKS

1. Rudramoorthy. R, Thermal Engineering, Fifteenth Edition, Tata McGraw Hill, New Delhi, 2012.

2. Kothandaraman C.P., Domkundwar S., Engineering Thermodynamics, Second Edition, Dhanpath Rai and Sons, New Delhi, 2003.

REFERENCES

23CH213	INTRODUCTION TO CHEMICAL ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I OVERVIEW OF CHEMICAL ENGINEERING **9**

Introduction to Unit Operations and Unit Processes, Basic Laws, Basic Mathematical principles: Units and Dimensions, Conversion Factors, Problems on Unit Conversion, Principles of Dimensional Homogeneity, Unit Conversion in Equation, Fundamentals of symbols used in process flowsheets.

MODULE II MATERIAL AND ENERGY BALANCE CALCULATIONS **12**

Basic Chemical Principles: gram atom, gram mole and gram equivalent, calculations on solid mixture and solution. Material Balance: Guidelines and Step-by-Step procedure. Material Balance for simple systems. Material Balance for system involving reaction. Energy Balance on simple systems.

MODULE III FLUID FLOW OPERATIONS **7**

Nature and Properties of Fluids, Types of Fluids, Newton's law of viscosity, Flow of a fluid past a solid surface. Equation of Continuity and Simple problems. Agitation and mixing.

MODULE IV HEAT TRANSFER OPERATIONS **9**

Review of conduction, resistance concept, extended surfaces, Introduction to Convection, natural and forced convection, correlations; Radiation; Heat exchangers- Fundamental principles and classification of heat exchangers, Evaporators**.**

MODULE V MASS TRANSFER OPERATIONS **8**

Diffusion – Basic laws with simple problems, Principles on Adsorption, Absorption, Distillation, Drying, Extraction, Membrane separation. Industrial Equipment for Drying, Adsorption and Extraction.

COURS OUTCOMES

After completion of the course, students are able to

CO1: Express the fundamentals of chemical engineering and to solve problems.

CO2: Develop basic fluid concepts, transfer and separation operations.

CO3: Apply basic transport laws to solve simple problems.

CO4: Apply material and Energy balance to precisely calculate material required for a process.

CO5: Apply steady state balances to develop process flow sheets.

TOTAL: 45 PERIODS

TEXT BOOKS

1. S K Ghosal**,** S K Sanyal and S Dutta, Introduction to Chemical Engineering, Tata McGraw-Hill publishing company Ltd, New Delhi, 1993.
2. W.L. McCabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 6th Edition, McGraw Hill, 2001.

REFERENCES

1. G.T. Austin, R.N. Shreve, Chemical Process Industries, 5th Ed., McGraw Hill, 1984.
2. R. M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd Ed., John Wiley, New York,2004.

3. L.B. Anderson and L.A. Wenzel, Introduction to Chemical Engineering, McGraw Hill, 1961

CO-PO & PSO MAPPING

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3										3	
2	3	3	3										3	
3	3	3	3										3	
4	3	3	3										3	
5	3	3	3										3	
Avg.	3	3	3										3	

1-low, 2-medium, 3-high

21MDS51- OPERATIONS RESEARCH

Contact Hours

PRE- REQUISITES

L	T	P	C
3	0	0	3

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- S*olve Linear Programming, Transportation and Assignment based problems*
- *Discuss the elementary Inventory models, Price break models and Safety stock problems*
- *Solve Job sequencing and replacement problems*
- *Categorize the Queuing models and also simulate the problems using Monte - Carlo Technique*
- *Analyze the network models using CPM and PERT*
- *Solve OR problems using classical optimization techniques*

Linear Programming Problem - canonical and standard forms - formulation - graphical solution – Simplex method-Big M method using artificial variables- **Transportation model** – Initial Basic Feasible Solution using North West Corner method, Matrix Minima method and Vogels approximation method – Optimal solution by Modified Distribution Method-Unbalanced Transportation problems and Degeneracy - **Assignment model**-Solution by using Hungarian metho **(9)**

Sequencing and Replacement: : Basic assumptions of sequencing – Johnson's procedure for Sequencing of: i) n jobs on 2 machines ii) n jobs in 3 machines and iii) n jobs on m machines

Replacement: Need for replacement of equipment - failure mechanism of items - Replacement policy - Replacement of items that deteriorates gradually - Replacement of items that fail suddenly. **(9)**

Inventory Models - Costs involved in inventory - Concepts of average inventory, economic order quantity - Deterministic model: Fixed ordering quantity models - EOQ model with uniform demand, finite / infinite replacement with / without shortages -EOQ with one price break. Inventory control - Buffer stock - Determination of optimum buffer stock - EOQ system of ordering - Multi item order model - ABC analysis. **(9)**

PERT and CPM Networks: Activities and events-Rules for forming a Network-**Critical Path Method**(CPM) for computing project completion time- network – Time estimation in CPM-Project Cost Analysis- critical path -Crashing-Least cost schedule algorithm- **PERT** - Network – Difference

between PERT and CPM-Time estimates in PERT- Critical Path estimation - Probability of meeting a scheduled date of completion of the project. **(9)**

Game theory: Decision making-Description of a game-Basic elements of game theory- the Two Person, zero-sum Games – Characteristics of a game- The maxmin and minmax principles- Steps in solving the game- Saddle point method- Principle of dominance in games- Solutions to 2 x 2 games without saddle point: (Mixed strategies)- Method of Oddments (for 2 × 2 games)- Solutions to 2 × n or m × 2 games-Graphical Method-Algebraic Method-Method of Linear Programming-Iterative Method for Approximate Solution-Bidding Problems-n- Person Zero sum games. Strategic games-Nash Equilibrium. **(9)**

TOTAL: 45

TEXT BOOK

1. *Hamdy, A Taha, "Operations Research - An introduction", Pearson Education India, 2004.*

REFERENCE BOOKS

1. *Rama Murthy P. Operations Research, New Age International, Second Edition, 2007, New Delhi*
2. *S. D. Sharma "Operations Research ", Kedar Nath Ram Nath & Co publishers, 10th edition, 1995.*
3. *Kanti Swarup, P.K. Gupta, Mani Mohan, "Operations Research", Sultan Chand & Sons, 2001.*
4. *Hillier & Lieberman, "Operations Research - An Introduction", Tata McGraw-Hill, 2004*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**M**	**H**	**L**	**M**					
CO2	**H**	**H**	**L**	**M**					
CO3	**H**	**H**	**M**	**M**					
CO4	**H**	**H**	**M**	**M**					
CO5	**H**	**H**	**M**	**M**					

21MDS52 - DEEP LEARNING

Contact Hours

PRE- REQUISITES

L	T	P	C
3	0	0	3

21MDS45

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the deep learning process using deep feed forward network, CNN and RNN models.*
- *Describe the regularization and Optimization techniques*
- *Apply appropriate deep network models along with optimization and regularization techniques for the given analysis application*
- *Describe and apply the image enhancement, segmentation and representation techniques.*

DEEP FEED-FORWARD NETWORKS: Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation and other Differentiation Algorithms **(7)**

REGULARIZATION Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems Dataset Augmentation, Dropout. **OPTIMIZATION FOR TRAINING DEEP MODELS** Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies.

(10)

IMAGE PROCESSING

IMAGE SAMPLING AND QUANTIZATION- Basic Concepts - Representing Digital Images - Spatial and Intensity Resolution - Image Interpolation

IMAGE ENHANCEMENT - Spatial Domain -Histogram Processing- Histogram Equalization - Histogram Matching - Local Histogram Processing - Using Histogram Statistics for Image Enhancement - The Mechanics of Spatial Filtering - Spatial Correlation and Convolution - Vector Representation of Linear Filtering - Generating Spatial Filter Masks -Smoothing Linear Filters - Order-Statistic (Nonlinear) Filters .

IMAGE SEGMENTATION - Fundamentals - Point, Line, and Edge Detection - Detection of Isolated Points - Line Detection - Edge Models - Basic Edge Detection - More Advanced Techniques for Edge Detection - Edge Linking and Boundary Detection. **(12)**

CONVOLUTIONAL NETWORKS The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The

Neuroscientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning. **(8)**

SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory. **(8)**

TOTAL: 45

TEXT BOOKS

1. *Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.*
2. *Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", Pearson Education, Third Edition, 2008.*

REFERENCE BOOKS

1. *Deng & Yu," Deep Learning: Methods and Applications", Now Publishers, 2013.*
2. *Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**H**	**H**	**H**	**L**			**L**	**L**
CO2	**H**	**H**	**H**	**M**	**L**	**L**		**L**	**L**
CO3	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**	**M**
CO4	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**	**M**

21MDS53 – BIG DATA COMPUTING

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS33, 21MDS44

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Analyze the analytical techniques on variety of Big data application scenarios.*
- *Apply hadoop clusters and map reduce techniques for parallel processing of big data.*
- *Understand SPARK, PIG and HIVE usage in Big Data Computing.*
- *Generate: Generate dynamic solutions for data analytics problems using map reduce framework.*
- *Given a problem, develop an efficient parallel algorithm to solve it.*
- *Design distributed system using appropriate communication protocols, synchronization mechanisms and NFS.*

INTRODUCTION TO PARALLEL COMPUTING

Parallel Programming Platforms - Implicit Parallelism - Limitations of Memory System Performance - Control Structure of Parallel Platforms - Communication Model of Parallel Platforms - Physical Organization of Parallel Platforms - Communication Costs in Parallel Machines - Impact of Process - Processor Mapping and Mapping Techniques. **(9)**

INTRODUCTION TO BIG DATA

Big data characteristics - Volume, Veracity, Velocity, Variety Value - Big data sources - Acquisition - Understanding the Big Data Project's Ecosystem - Creating the Foundation of a Long-Term Big Data Architecture -Early Big Data with NoSQL - NoSQL Landscape. **(8)**

THE HADOOP ECOSYSTEM

Big Data and the Hadoop Ecosystem- The Hadoop Ecosystem - Hadoop Core Components - Hadoop Distributions - Developing Enterprise Applications with Hadoop

STORING DATA IN HADOOP - HDFS -HBase -Combining HDFS and HBase for Effective Data Storage -Using Apache Avro - Managing Metadata with HCatalog - Choosing an Appropriate Hadoop Data Organization **(9)**

PROCESSING DATA WITH MAPREDUCE

Getting to Know First MapReduce Application - Designing MapReduce Implementations

CUSTOMIZING MAPREDUCE EXECUTION

Reading Data Way with Custom Record Readers -Organizing Output Data with Custom Output Formats - Writing Data Your Way with Custom Record Writers - Optimizing MapReduce Execution with a Combiner - Controlling Reducer Execution with Partitioners - Using Non-Java Code with Hadoop **(9)**

STREAMING ARCHITECTURE

Introduction to Apache Spark - Spark fundamentals – Writing Spark applications – The Spark API in depth –Sparkling queries with Spark SQL – Ingesting data with Spark streaming.

PIG: Installing and Running Pig - Comparison with Databases - Pig Latin -User-Defined Functions - Data Processing Operators – Pig in Practice

HIVE: Installing Hive - Running Hive -Comparison with Traditional Databases -HiveQL -Tables - Querying Data – User -Defined Functions **(10)**

TOTAL : 45

TEXT BOOKS

1. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, Introduction to Parallel Computing, Second Edition, Pearson Education, 2009.(Para 1)

2. Bahaaldine Azarmi. "Scalable Big Data Architecture -A Practitioner's Guide to Choosing Relevant Big Data Architecture" A Press, 2016

2. Kevin T. Smith, Alexey Yakubovich, Boris Lublinsky, "Professional Hadoop® Solutions", John Wiley & Sons Inc, 2013.

3. Tom White - Beijing, "Hadoop: The Definitive Guide", O'reilly, Third Edition, Jan 2012.

4. Peter Zecevic, Marko Bonaci, "Spark in Action", DreamTech Press, 2018.

REFERENCE BOOKS

1. Norman Matloff, "Parallel Computing for Data Science - With Examples in R, C++ and CUDA", Chapman and Hall/CRC, 2015.

2. Wan Fokkink, "Distributed Algorithms: An Intuitive Approach", MIT Press, 2013.

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H		H	M					M
CO2	H	H	M	M	M			L	
CO3	H	M	H	H			M		M
CO4	H	H	M	H			H		
CO5	M	H	H	M				L	

21MDS54 - ARTIFICIAL INTELLIGENCE

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Describe Intelligent Agents such as searching, knowledge-based agents and Searching Strategies*
- *Build Searching and Knowledge based systems by identifying suitable searching strategies and knowledge representation*
- *Develop Intelligent systems in the domains of Perception and Robotics*

ARTIFICIAL INTELLIGENCE

Introduction: Definition- Foundations- History-State of Art. Intelligent Agents: Agents and Environments-Concepts and Rationality-Nature of Environments-Structure of Agents (7)

SEARCHING AGENTS

Problem Solving Agents—Examples – Searching for Solutions – Uninformed Search Strategies – Informed Search Strategies – Heuristic Functions. Beyond Classical Search: Local search algorithms and optimization problems – Local search in continuous spaces – Searching with non-deterministic actions -searching with partial observations-on line search agents and unknown environments **(11)**

KNOWLEDGE BASED AGENTS

Logical Agents: Basics – The Wumpus world – Logic – Propositional Logic -Propositional Theorem Proving - Agents based on Propositional Logic. Constraint Satisfaction Problems: Definitions - Constraint Propagation: Inferences - Backtracking Search – Local Search **(10)**

KNOWLEDGE BASE REPRESENTATION

First Order Logic: Representation – Syntax and Semantics- Using First Order Logic – Knowledge Engineering in First Order Logic. Inference in First order Logic: Propositional versus First Order Inference – Unification and Lifting – Forward Chaining – Backward Chaining – Resolution. Knowledge Representation- Artificial Neural Networks **(10)**

APPLICATIONS OF AI

Perception: Basics – Image Formation - Image Processing Operations – Object Recognition by Appearance -Reconstruction 3D world – Object Recognition from structural information and Using

Vision. Robotics: Introduction – Robot Hardware – Robotic Perception – Planning To Move – Planning Uncertain Movements – Robotics Software Architectures – Application Domains **(7)**

TOTAL: 45

TEXT BOOK

1. *Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" ,Pearson Eductaion Series, Prentice Hall Publishers, Third Edition, 2014.*

REFERENCE BOOKS

1. Thomas Dean, James Allen , Yiannis Aloimonos, "Artificial Intelligence : Theory and Practice", Addison Wesley Pub.,Co

2. Nils J Nillsson, "Principles of Artificial Intelligence", Morgan Kauffmann Publishers , 2014

3. Patrick Hendry Winson, " Artificial Intelligence", Addition Wesley Publishers, Thrid Edition 1992

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**L**	**H**	**L**	**M**			**H**	**L**
CO2	**L**	**H**	**L**	**M**	**L**			**M**	**H**
CO3	**M**	**M**	**M**	**H**	**M**			**H**	**L**

21MDSE2 – NATURAL LANGUAGE PROCESSING

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS32, 21MDS54

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Describe the mathematical and linguistic foundations, underlying approaches to the areas in NLP.*
- *Apply Hidden Markov Model for Word Processing and Speech Recognition.*
- *Evaluate approaches to syntax, semantic and pragmatic processing in NLP.*
- *Design models using CFG, PCFG, Lexical and Computational concepts for syntax and semantic processing based applications.*
- *Design, implement and test algorithms for NLP problems.*

INTRODUCTION

Knowledge in Speech and Language processing - Ambiguity - Models and Algorithms - Language, Thought and Understanding - Brief History.

Words and Transducers : Finite-State Morphological Parsing - Building a Finite-State Lexicon - Finite-State Transducers - Sequential Transducers and Determinism - FSTs for Morphological Parsing -Transducers and Orthographic Rules – Combining FST Lexicon and Rules - Lexicon-Free FSTs -Word and Sentence Tokenization -Detecting and Correcting Spelling Errors - Minimum Edit Distance. (9)

WORDS PROCESSING

N-grams : Counting words - Training and test sets - Evaluating N-grams - smoothing. Parts-of-speech tagging : English word classes - Tagsets - POS tagging - Rule based POS tagging - HMM POS tagging - Transformation based tagging - Evaluation and error analysis. Hidden Markov Model : Markov chains - HMM - Forward algorithm - Viterbi algorithm - Training HMM. (9)

SYNTAX

Formal grammars of English: Context free grammars - Grammar rules - Treebanks - Normal forms - Finite state and CFG - Dependency grammar - spoken language syntax. Parsing with CFG: Parsing as search - Ambiguity - Dynamic programming parsing methods. Statistical Parsing: Probabilistic CFG - Probabilitic CKY parsing - Problems with PCFGs - Improving PCFGs. (9)

SPEECH

Phonetics: Articulatory phonetics - Phonological categories. Speech Synthesis: Text normalization - Phonetic analysis – Prosodic analysis. Automatic Speech Recognition: Architecture - HMM to

speech - Feature extraction - Lexicon and Language model - Search and Decoding - Embedding training - Evaluation. (9)

SEMANTICS, PRAGMATICS AND APPLICATIONS

Representing meaning – Semantic Analysis - Lexical semantics

Applications: Information Retrieval – Statistical Alignment and Machine Translation – Text Categorization. (9)

TOTAL : 45

TEXT BOOKS

1. *Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice-Hall, Upper Saddle River, NJ, 2000. (Para 1,2,3,4)*
2. *Manning, Christopher D. and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press., Cambridge, MA:, 1999. (Para 5)*

REFERENCE BOOKS

1. *James Allen,"Natural language Understanding", Pearson Education, Second Edition, 1994.*
2. *Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, O_Reilly Media, 2009.*
3. *Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.*

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	M					
CO2	L		M	M					
CO3	L		L	L					
CO4	L		L	M					
CO5	H	L	M	H					

21MDS55 - DEEP LEARNING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS48, 21MDS52

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

- *Apply and Implement the deep feed forward network, CNN and RNN models for analysing the complex real world systems.*
- *Apply and Implement the regularization and Optimization techniques for improving the deep forward network model.*
- *Execute the image representation, enhancement and segmentation techniques for the given analysis applications.*

CONCEPTS TO BE COVERED

1. Implementation of Viewing digital images, bits and bytes, sampling and quantization.
2. Apply scaling, translation and rotation, sums and differences with the grayscale and color images.
3. Implementation of Histograms , Linear and Non-Linear filters.
4. Construct edge detection algorithms using Operators.
5. Build a multi-layer neural networks, and analyze real data
6. Object detection using Convolution Neural Network
7. Perform Sentiment Analysis in network graph using RNN
8. Implementation of Long short term memory network

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	H	H	H	M	M	M	M
CO2	H	H	H	H	H	M	M	M	M
CO3	M	H	H	H	M	M	L	L	M

21MDS56 - BIG DATA COMPUTING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS53

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

- *Analyze the analytical techniques on variety of Big data application scenarios.*
- *Apply hadoop clusters and map reduce programs for parallel processing of big data.*
- *Practice structured/unstructured data analysis using PIG and HIVE programs.*
- *Experiment the NOSQL operations for processing of big data.*
- *Generate dynamic solutions for data analytics problems using map reduce framework.*
- *Given a parallel code, diagnose the errors and fix them.*
- *Develop client/server based distributed applications.*

CONCEPTS TO BE COVERED

1. Implementing Parallel programming concepts
2. Import /Export the data from datacenter (website or unstructured) to HDFS
3. Import /Export the data from SQL to HDFS
4. Parallelize Input/output process /compute process using MAPREDUCE
5. Storage /Process the data in NOSQL using MongoDB
6. Perform structured/unstructured data analysis using PIG
7. Perform structured data process/analysis using HIVE

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	L	L	L	L					
CO2	H	H	H	H				H	H
CO3	H	H	H	H				H	H
CO4	H	H	H	H				H	H
CO5	H	H	H	H				H	H
CO6	H	H	H	H					

21MDSEL2 - NATURAL LANGUAGE PROCESSING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDSE2

ASSESSMENT:PRACTICAL

COURSEOUTCOMES

- *Acquire knowledge in Fundamentals of Natural Language Processing.*
- *Apply various techniques to access and process text from the Web.*
  Gain experience in categorizing and tagging words.
- *Develop models for text classification using Supervised Learning Algorithms*
- *Apply and analyze sentence structure using context free grammar.*

CONCEPTS TO BE COVERED

1. Access Text Corpora and Lexical Resources
   (i) Conditional Frequency Distribution
   (ii) WordNet
2. Processing Raw Text
   (i) Accessing Text from the Web
   (ii) Regular Expression for Detecting Word Patterns
   (iii) Normalizing the Text
   (iv) Regular Expression for Tokenizing text
3. Categorizing and Tagging Words
   (i) Automatic Tagging
   (ii) N-Gram Tagging
   (iii) Transformation-Based tagging
4. Text Classification using Supervised Learning Algorithm
5. Extracting Information from Text
   (i) Chunking
   (ii) Named Entity Recognition
   (iii) Relation Extraction
6. Analyzing Sentence Structure using Context Free Grammars
7. Analyzing the Synonym of Sentences

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**M**	**L**	**L**						
CO2	**M**	**M**	**M**	**L**					
CO3	**M**		**L**		**L**				**L**
CO4	**H**	**M**	**M**	**H**					
CO5	**L**	**L**	**M**	**M**					

21MDS57 - COMMUNICATION SKILLS

Contact Hours

L	T	P	C
0	**0**	2	**1**

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT: PRACTICAL (100 Marks)

COURSE OUTCOMES

- *Conceive appropriate verbal responses from the learners to a given social situation, using the guidelines to effective speaking skills and body language.*
- *Generate trouble shooting solutions to develop team building and interpersonal skills with case studies that focus on body language and empathy.*
- *Develop appropriate responses for business phone calls and formulate effective resolutions to professional conflicts that arise out of cross cultural communication gaps in a given managerial context.*
- *Compose appropriate written responses to professional problems faced by a team at the workplace arising out of ineffective communication skills.*
- *Generate valid points for and against a HR topic and present them with appropriate group behavior. For any job requirement, plan and prepare for a 20 minute mock interview.*

INTRODUCTION

Introduction – Code and Content – Stimulus and Response: Source – The Encoding Process – The Channel – The Decoding Process – The Receiver – Speaking Skills – Effective Speaking Guidelines – Communicating Soft Skills: A Self-assessment – Closing Tips **(4)**

SOFT SKILLS

Introduction to Soft Skills – Lessons from the Three Case Studies – Change in Today's Workplace: Soft Skills as a Competitive Weapon – Antiquity of Soft Skills – Classification of Soft Skills: Time Management - Attitude – Responsibility – Ethics, Integrity, Values and Trust – Self-confidence and Courage – Consistency and Predictability – Teamwork and Interpersonal Skills - Communication and Networking – Empathy and Listening Skills – Problem Solving, Troubleshooting and Speed reading – Leadership – Body Language

(8)

TELEPHONING SKILLS & NEGOTATIONS

Preparing to make a telephone call – Receiving calls – Taking and leaving messages – Asking for and giving repetition – The secretarial barrier – Cross-cultural communication on the telephone – Fixing appointments – Changing arrangements – Ending a call – Cross-cultural communication on the telephone – Problem-solving on the telephone – Complaints – Negotiations: Types of negotiation – Preparation for a negotiation – Making an opening statement – Bargaining and making concessions

– Accepting and confirming – Summarizing and looking ahead – Types of negotiator – Dealing with conflict - Rejecting – Ending the negotiation **(8)**

WRITING SKILLS TO CREATE AN IMPRESSION:

Introduction- Fifteen Principle to Increase Clarity in Communication – Edit-Edit-Edit: The Reader's Perspective – Clarity of Thought – Clarity of Text. **(3)**

SPEAKING

Job Interviews: Introduction - Types of Interviews – Planning and Preparing for an Interview - Importance of body Language in Interview - Need for proper Articulation - Concluding an Interview - Telephonic or Video Interview - A Mock Interview - Group Discussion: Introduction - Ability to Work as a Team – Communication Skills - Active Listening - Non-verbal Communication - Leadership and Assertiveness - Reasoning – Ability to Influence - Innovation. Creativity, and Lateral Thinking - Flexibility - Key Steps to Succeed in a Group Discussion - The Responsibility of the First Speaker - Concluding the Discussion - Dos and Don'ts during a Group Discussion (**7)**

TOTAL : 30

REFERENCE BOOKS

1. Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.

2. Krishna Mohan, Meera Banerji. "Developing Communication Skills" Mac Million Publishers, 2012.

3. Sai Lakshmi. B, "Poly Skills- A Course in Communication and Life Skills" Cambridge University Press, 2012.

4. Simon Sweeney, "English for Business Communication", Cambridge University Press, 2013.

5. Meenakshi Raman, Sangeeta Sharma, "Technical Communication - Principles and Practice", 3rd edition, Oxford University Press, New Delhi, 2015.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1					**H**				**L**
CO2					**H**				**L**
CO3						**H**			
CO4					**H**				**L**
CO5						**H**			

21MDS61 – STOCHASTIC MODELS

Contact Hours

L	T	P	C
3	0	0	3

PRE-REQUISITES

21MDS13, 21MDS22, 21MDS31, 21MDS41

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Describe fundamentals of Stochastic Processes and their various classifications*
- *Analyze and understand Markov Chain and Markov Decision Models and their Applications*
- *Apply and Describe Queuing models and Simulation techniques for the real world problems.*

Basic Terminology: Properties of Random Variables and Distribution Functions-Joint Distribution Functions-Conditional distributions and conditional expectations-Infinite families of random variables-Characteristic Functions-Generating functions and Laplace Transforms-Examples of distribution functions: Multivariate Normal, Multinomial distributions-Limit Theorems-Convergence with probability one, convergence in probability, convergence in quadratic mean, convergence in distribution-Inequalities-Chebyshev and Schwarz. Basics of Stochastic Process: State Space S and Index Parameter T-Classical types of Stochastic Processes-Processes with Independent Increments, Martingales, Markov Processes, Stationary Processes, Renewal Processes and Point Processes. **(8)**

Classification of general Stochastic Processes: Markov Chains-Definitions-Examples-Spatially Homogeneous Markov Chains-One Step Transition Matrix of a Markov Chain and its estimation-Chapman-Kolomogorov Equation- Hypothesis Tests for Markov Chain: Anderson Goodman Test - Testing Time Homogeneity of Transition Matrices: Likelihood Ratio Test -Using Markov Chains in Predictive Analytics -Stationary Distribution- in a Markov Chain -Regular Matrix Classification of States of a Markov Chain –Accessible state-Communicating states-Recurrent and Transient states-First Passage Time and Mean Recurrence Time-Periodic State -Ergodic Markov Chain-Limiting Probability-Markov Chains with Absorbing States-Canonical Form of the Transition Matrix of an Absorbing State Markov Chain-Expected Duration to reach a State from other States-Calculation of Retention Probability and Customer Lifetime Value using Markov Chains **(10)**

Continuous time Markov Chains and Markov Decision Process

Continuous time Markov Chains: General Pure birth processes and Poisson Process-Birth and Death Processes-Compound Poisson Process-Applications

Markov Decision Process (MDP): Policy Iteration Algorithm - Linear Programming Formulation for Finding Optimal Policy- Value Iteration Algorithm **(10)**

Queuing system characteristics-Describing a queuing system by i) input pattern ii) service mechanism iii) queue discipline and iv) customer behaviour- Steady, transient and explosive states in queuing systems-Designation of queue and symbols used in queuing models- M/M/1 (∞/FIFO)

model-Steady State solutions-Finite Queue Length Model: (M / M / 1) : (N/FIFO) **(8)**

Simulation Modeling:-Monte Carlo Simulation-Types of Simulation-Elements of Discrete Event Simulation-Generic Definition of Events-Sampling from Probability Distributions-Generation of Random Numbers-Mechanics of Discrete Simulation-Manual Simulation of a Single Server Model-Spreadsheet based simulation of single server model-Methods of gathering statistical observations-Subinterval method, Replication method and Regenerative (cycle) method-Simulation Languages. **(9)**

TOTAL :45

TEXT BOOKS

1. *Samuel Karlin and Howard M. Taylor., A First Course in Stochastic Processes, 2nd Edition, 1975, Academic Press [Para 1, 2]*
2. *Dinesh Kumar U. Business Analytics, Wiley, First Edition, 2017 [Para 1,2,3]*
3. *Rama Murthy P. Operations Research, New Age International, Second Edition, 2007, New Delhi [Para 4]*
4. *Jerry Banks.John S. Carson ,Barry L Nelson, David M Nicol, Discrete-Event System Simulation, Second Edition. Prentice Hall, 1996. [Para 5]*

REFERENCE BOOKS

1. *J.Medhi, Stochastic Processes, New Age Science, 3rd Revised Edition, 2012.*
2. *Yates R.D. and Goodman D.J., Probability and Stochastic Processes, 2nd Edition, John Wiley and Sons, 2005.*
3. *Ibe,O.C.Fundamentals of Applied Probability and Random Processes, Elsevier, 1st Indian Reprint, 2007.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**M**	**M**	**M**	**H**	**L**			**L**	**L**
CO2	**H**	**H**	**H**	**H**	**H**	**L**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**M**	**L**	**L**	**M**	**M**

21MDS62-CLOUD COMPUTING

Contact Hours

PRE-REQUISITES

L	T	P	C
3	0	0	3

21MDS33, 21MDS34, 21MDS44

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the basics of cloud computing, various platforms and technologies.*
- *Apply the elements and technologies of Distributed Computing*
- *Recognize the levels and mechanisms of virtualization, its types and infrastructure*
- *Compare the various service models offered by different service providers and ability to configure and setup cloud and virtual environment solutions for real-time applications*
- *Ability to identify security challenges in cloud and manage risks*

INTRODUCTION

The vision of Cloud Computing – Defining a Cloud - Cloud Computing Reference Model – Characteristics and Benefits – Challenges – Historical developments: Distributed Systems – Virtualization- Web2.0 – Service-oriented computing – Utility-oriented computing – Building cloud computing environments: Application development – Infrastructure and System development – Computing platforms and technologies **(9)**

PRINCIPLES OF DISTRIBUTED COMPUTING

Elements of Distributed computing: Concepts and definition, Components of a distributed system, Architectural styles, Models for Interprocess communication – Technologies of Distributed computing: Remote Procedure call, Distributed object frameworks, Service-oriented computing **(9)**

VIRTUALIZATION

Introduction – Characteristics of virtualized environments – Taxonomy of virtualization techniques: Hardware-level virtualization, Programming Language-level virtualization, Application-level virtualization, Storage virtualization, Network virtualization, Desktop virtualization, Application server virtualization – Virtualization and Cloud Computing – Pros and Cons of virtualization – Technology: Xen, VMware, Hyper-**V** **(9)**

CLOUD ARCHITECTURE AND INDUSTRIAL PLATFORMS

Introduction – Cloud reference model: Architecture, Infrastructure-as-a-service, Platform-as-a-service, Software-as-a-service – Types of clouds: Public clouds, Private clouds, Hybrid clouds, Community clouds - Challenges – Cloud Platforms in Industry: Amazon Web Services – Google App Engine – Microsoft Azure. **(9)**

SECURITY IN THE CLOUD

Cloud Security Challenges – Software as a Service Security: Security Management and Governance – Risk Management – Policies, Standards and Guidelines - Security Monitoring – Third-Party Risk Management – Business Continuity Plan - Security Architecture Design – Data Privacy and Security – Application Security – Virtual Machine Security**.**

(9)

TOTAL : 45

TEXT BOOKS

1. *Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.*
2. *John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.*

REFERENCES BOOKS

1. *Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.*
2. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*
3. *Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.*
4. *Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner"s Guide", McGraw-Hill Osborne Media, 2009.*
5. *Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**L**	**L**	**L**	**L**				**L**	**L**
CO2	**L**	**M**	**H**	**H**			**H**	**H**	**H**
CO3	**L**	**M**	**H**	**H**			**H**	**H**	**H**
CO4	**L**	**M**	**H**	**H**			**H**	**H**	**H**
CO5	**L**		**M**	**M**			**H**	**H**	**H**

21MDS63 - DATA MINING

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS34, 21MDS41, 21MDS45

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Demonstrate the need for data preprocessing and suggest appropriate methods to produce proper data sources for mining.*
- *Learning how to gather and analyze large sets of data to gain useful business understanding.*
- *Describing and demonstrating basic data mining algorithms, methods, and tools.*
- *Identifying business applications of data mining*
- *Be exposed with different data mining trends and techniques*
- *Design and create data visualizations.*

INTRODUCTION

Definition and need of data mining, Kinds of data and patterns, Applications and issues. Types of data: Data objects and attribute types, Measuring data similarity and dissimilarity. Data Preprocessing: Overview, data cleaning, data integration, data transformation and data discretization. (13)

DATA WAREHOUSE AND OLAP TECHNOLOGY

Data warehouse-basic concepts, data warehouse modeling, data warehouse implementation. (8)

MINING FREQUENT PATTERNS AND ASSOCIATIONS

Basic concepts, Frequent itemset mining methods. Pattern mining in Multilevel, Multidimensional Space. (8)

ADVANCED CLASSIFICATION METHODS AND OUTLIER DETECTION

Bayesian Belief Networks, Classification by Back Propagation.

Outlier Detection: Outliers and Outlier analysis, Outlier detection methods. (8)

DATA MINING TRENDS AND VISULAIZATION

Mining sequence data, Mining other kinds of data, Statistical data mining, Visual and Audio data mining, Web mining.

Introduction to Data Visualization – The Seven Stages of Visualizing data – Getting started with processing. Case Study: D3. (8)

TOTAL : 45

TEXT BOOKS

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining - Concepts and Techniques", 3rd Edition, Elsevier Publications, 2012.

2. Ben Fry, "Visualizing data: Exploring and Explaining data with the processing environment", O'Reilly, 2007.

REFERENCE BOOK

Arun K Pujari, "Data Mining Techniques", Universities Press.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**M**	**H**							
CO2	**L**	**H**		**H**	**M**				
CO3	**L**		**M**	**H**				**M**	
CO4			**M**			**H**			
CO5							**M**	**M**	
CO6					**M**				**M**

21MDS64 – SOFTWARE ENGINEERING

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Choose and practice the software development process based on the factors such as problem complexity, time and cost to develop the software system.*
- *Create the requirements model by specifying the use cases and actors involved in the scenario or by specifying the classes along with their responsibility and collaboration involved in the given problem to describe the requirements of the software system.*
- *Design the architecture of the system in the various perspectives such as component model, pattern model and User experience based on the type of the proposed software system.*
- *Design the test plans to conduct Component Level and Integration Level testing on the developed system.*
- *Determine the size of the product by applying LOC or Function Point metrics.*

INTRODUCTION

Software and Software Engineering – The Nature of Software – The Software Process - Process Models: Prescriptive Process Models - Agility and Process – Agility Principles – Scrum (8)

MODELING AND DESIGN CONCEPTS

Understanding Requirements – Requirements Engineering – Requirements modelling – Scenario-based modelling – Class-based modelling

Design Concepts – Design Model - Architectural Design: Software Architecture – Agility and Architecture – Component-Level Design: Cohesion, Coupling – Specialized Component-level design - Pattern-Based Design - Design Patterns (12)

USER EXPERIENCE DESIGN

User Experience Design: User Experience Design Elements - The Golden Rules - User Interface Analysis and Design - User Experience Analysis - User Experience Design - User Interface Design - Design Evaluation - Usability and Accessibility (8)

SOFTWARE TESTING AND PROJECT MANAGEMENT

Software Testing – Component Level – White-box testing – Black-box testing - Integration testing

Project Management Concepts - Software Project Management Complexities – Responsibilities of a Software Project Manager - Metrics for Project Size Estimation: Lines of Code, Function Point Metric - Project Estimation Technique: Basic COCOMO Model . (10)

SOFTWARE ENGINEERING FOR DATA SCIENCE

Data Science for Software Engineers – Software Engineering for Data Analytics - Case study (7)

TOTAL : 45

TEXT BOOKS

1. *Roger S Pressman, "Software Engineering – A Practitioner's Approach", Ninth Edition, McGraw Hill Edition, 2020.*
2. *Rajib Mall, "Fundamentals of Software Engineering", Fourth Edition, Prentice Hall India, 2014.*
3. *Miryung Kim, "Software Engineering for Data Analytics" IEEE Software, 2020.*

REFERENCE BOOKS

1. *Ian Somerville, " Software Engineering", Tenth edition, Pearson Education, 2016.*
2. *Pankaj Jalote, "An integrated approach to software Engineering", 3rd edition, Narosa publishing house, Reprint 2013.*

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	M						
CO2		H	H	L					
CO3				H	M	L			
CO4	M	L	H				M	L	
CO5	H		M						L

21MDSE1 - BUSINESS INTELLIGENCE

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS34,21MDS64, 21MDS63

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Be exposed with the basic rudiments of business intelligence system*
- *Understanding the modeling aspects behind business Intelligence*
- *Understand the business intelligence lifecycle and the techniques used in it*
- *Be exposed with different data analysis tools and techniques*

BUSINESS INTELLIGENCE

Effective and timely decisions - Data, information and knowledge - Role of mathematical models - Business intelligence architectures: Cycle of a business intelligence analysis - Enabling factors in business intelligence projects - Development of a business intelligence system - Ethics and business intelligence. (9)

KNOWLEDGE DELIVERY

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

(9)

EFFICIENCY

Efficiency measures - The CCR model: Definition of target objectives- Peer groups - Identification of good operating practices; cross efficiency analysis - virtual inputs and outputs - Other models. Pattern matching - cluster analysis, outlier analysis.

(9)

BUSINESS INTELLIGENCE APPLICATIONS

Marketing models - Logistic and Production models - Case studies. (9)

FUTURE OF BUSINESS INTELLIGENCE

Future of business intelligence - Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics -Advanced Visualization - Rich Report, Future beyond Technology.

(9)

TOTAL: 45

TEXT BOOK

1. *Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th edition 2013*

REFERENCE BOOKS

1. *Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.*
2. *Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley publications, 2009*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**H**	**M**	**M**	**M**				**M**
CO2	**H**	**M**	**H**	**H**	**H**				
CO3	**M**	**H**	**M**	**M**	**H**			**M**	
CO4	**M**	**H**	**H**	**H**	**M**			**M**	
CO5									

21MDSE22 -ENTERPRISE COMPUTING

Contact Hours

L	T	P	C
3	0	0	3

PRE-REQUISITES

21MDS24

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the role of Component Technologies in developing reusable and easy accessible enterprise application*
- *Develop the client applications (browser / Java client) using J2EE platform by analyzing the requirements of the given system*
- *Design and develop the web tier components of an enterprise application using Servlet*
- *Construct the application components includes Process and Data components using Enterprise Java Bean Technologies*
- *Integrate the transaction management activities with the developed applications using the various components of enterprise*

USING J2EE PLATFORM

INTRODUCTION

Java EE 7 Platform highlights – Java EE application model – Distributed multitiered applications – Java EE Containers – Java EE application assembly and deployment – Development roles – Java EE 7 APIs – Java EE 7 APIs in the Java platform standard edition 7. Platform Basics : Resource creation – Packaging **(9)**

THE WEB TIER

Java Servlet Technology – Servlet Life Cycle – Sharing information – Creating and initializing a Servlet – Writing Service methods - Filtering requests and responses – Invoking other web resources – Accessing the web context – Maintaining client state – Asynchronous processing **(9)**

JAVA SERVER PAGES

Elements of JSP – JSP Syntax and Semantics – Expression, Scriptlets and Declarations – Request dispatching – Session and Thread Management.

JSP Tag extensions : Introduction to custom tags – Expression Language – The JSP standard tag library (JSTL) – JSP fragments **(9)**

ENTERPRISE BEANS

Session Bean – Message Driven Bean – Accessing enterprise Beans – Contents – Naming conventions – Life cycle – Getting started with Enterprise Beans – Running the enterprise

Bean examples – Using the embedded enterprise bean container – Using Asynchronous method invocation in session beans **(9)**

INTRODUCTION TO THE JAVA PERSISTENCE API

Entities – Entity Inheritance – Managing Entities – Querying Entities – The Java Persistence Query Language – Query Language Terminology – Creating Queries using the Java Persistence Query Language – Simplified Query Language Syntax – Example Queries – Full Query Language Syntax – Using the criteria API to create queries **(9)**

TOTAL: 45

TEXT BOOKS

1. *Eric Jendrock, Ricardo Cervera – Navarro, Ian Evans, "The Java EE 7 Tutorials" Volume I & II, Fifth Edition, Addison – Wesley Publications, 2014. Para(1,2, 4,5)*
2. *Phil Hanna, "The Complete Reference JSP 2.0", McGraw Hill Education, Second Edition, 2017.(Para - 3)*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		**M**	**M**		**M**	**L**		**M**	**H**
CO2		**H**	**M**	**L**	**M**				**M**
CO3		**H**	**M**	**L**	**M**				**M**
CO4		**H**	**M**	**L**	**M**				**M**
CO5		**H**	**M**	**M**	**M**				**M**

21MDS65 – CLOUD COMPUTING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS62

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

- *Demonstrate knowledge on creating, cloning, migrating virtual machines using virtualization tool.*
- *Construct a private cloud using the open source cloud technologies.*
- *For a given system configuration, can use cloud services to acquire instances.*
- *Develop an application, launch it on Google App Engine, and access it.*
- *Develop applications and deploy in cloud container.*

CONCEPTS TO BE COVERED-

I. VIRTUALIZATION

1. Create virtual machines of different configurations
2. Establish communication between host and virtual machine
3. Establish communication between virtual machine to virtual machine

Show the virtual machi**I. VIRTUALIZATION**

4. ne migration from one node to the other.

II. PRIVATE CLOUD

Use OpenStack/O**II. PRIVATE CLOUD**

1. pen Nebula or equivalent to set up the cloud and demonstrate
2. Run the virtual machine of different configuration
3. Attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine
4. Install any language in the virtual machine and execute a sample program
5. Show the virtual machine migration from one node to the other
6. Install storage controller and interact with it

III. PUBLIC CLOUD

1. Create virtual server in cloud and run a java application
2. Establish communication between two Cloud instances
3. Use an object storage service to store and retrieve data
4. Set up, operate, and scale a relational database in the cloud using Relational Database Service

5. Build, train, and deploy machine learning (ML) models for any use case with fully managed infrastructure in cloud
6. Deploy an application in the Google App Engine
7. Use cloud container to develop, ship and run applications

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**		**H**	**H**			**L**	**H**	**H**
CO2	**H**		**H**	**H**			**H**	**H**	**H**
CO3	**H**		**H**	**H**			**M**	**H**	**H**
CO4	**H**		**H**	**H**			**M**	**H**	**H**
CO5	**H**		**H**	**H**			**M**	**H**	**H**

21MDS66 - DATA MINING AND VISUALIZATION LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS63

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

- *Use tools to implement data preprocessing techniques.*
- *Apply data mining techniques on real time data to provide solutions for decision making.*
- *Construct data warehouse, using various data models.*

CONCEPTS TO BE COVERED

1. Perform data cleaning techniques for a given data test.

2. Perform Data Normalization using min-max, z-score and normalization by decimal scaling methods.

3. Extract Frequent Item Sets using candidate generation and without using candidate generation.

4. Extract patterns from multidimensional data.

5. Develop a model to apply Linear Regression for prediction.

6. Implement BBN using Training dataset.

7. Find the outliers using various Outlier Detection method.

8. Evaluation of measures for text retrieval.

9. Classification of Web documents.

10. Perform OLAP operations.

11. Build Datawarehouse using multi dimensional data models.

12. Exploring D3, Tableau

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	M	M	H						
CO2			M	M			H	M	
CO3				M		M	M		L

21MDS71 – PROJECT WORK AND VIVA VOCE – I

Contact Hours

L	T	P	C
0	**0**	36	18

ASSESSMENT: Project Work

COURSE OUTCOMES

At the end of Project Work I the students are able to

- *Acquire knowledge on the learned concepts and techniques*
- *Choose and apply the appropriate algorithm(s) for solving the given problem*
- *Determine and apply optimized algorithm(s) for solving the given problem*
- *Enhance the communication skills for interaction with others*
- *Inculcate the team spirit and enhancing the coordination for the completion of the projects*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**H**	**H**	**H**	**M**				
CO2	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**				**M**	**M**
CO4					**H**	**M**	**M**		
CO5					**H**	**M**	**H**		

21MDSEL1 - BUSINESS INTELLIGENCE LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDSE1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

• *Design appropriate data warehouse model for a given decision making problem.*

• *Generate the different views of analyzed data.*

• *Develop a dashboard to present the analyzed data in a format that help the decision makers to do the prediction.*

CONCEPTS TO BE COVERED

1. Create highly formatted templates, reports, and documents such as flash reports, checks, KPI and Score cards

2. Create BI dashboards and reports to turn insights into actions by providing the ability to invoke business processes

3 .Design the analysis template to enable the business analyst to create new analyses from scratch or modify existing analyses

4. Present the analyzed data using maps and spatial visualizations format

5. Generate a powerful, multi-step alert engine that can trigger workflows based on business events and notify stakeholders via their preferred medium and channel

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	M		H		M		
CO2	M	H	L	M					
CO3	H	M	H	H	M		M		
CO4									
CO5									

21MDSEL9 - ENTERPRISE COMPUTING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PREREQUISITES

21MDS24, 21MDSE22

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

- *Develop the client application using HTML or Java Server Page*
- *Construct web components to process the client request and generate response in online using Java Servlet*
- *Design and develop reusable business logic using Session EJB framework*
- *Generate persistent entities using Entity EJB frameworks*
- *Develop the enterprise applications for the given scenario by identifying the suitable components*

CONCEPTS TO BE COVERED

1. Understand and design the generic business process model of an enterprise
2. Design and implement the client side applications using JSP
3. Design and implement online business processing through Servlet components
4. Develop reusable business logics using Session EJB components
5. Develop persistent entity objects using Entity EJB components

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1		H	M		L			L	M
CO2		H	M		L				M
CO3		H	M		L				M
CO4		H	M		L				M
CO5		H	M		L		M		M

22MDC31 - APPLIED STATISTICS FOR BUSINESS DECISIONS

L	T	P	C
3	1	0	4

PRE-REQUISITES: 22MDC13, 22MDC21

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Understand the concepts of Control Charts for variables and attributes using data from economics

CO2:: Apply Statistical methods and Decision Analysis tools to analyze data from time series Business.

CO3: Analyze the concept of non-parametric tests to solve business decision problems

CO4: Assess basic concepts of classifications of design of experiments which plays very important r in the analysis of variances

CO5: Categorize ideas of Index Numbers used in Economics and Business

Index Numbers

Definition, characteristics and uses of Index Numbers-Types of Index Numbers-Price, quantity and value indices- Simple and weighted aggregate index numbers - Laspeyre, Paasche, Marshall - Edgeworth, Fisher's Ideal Index Numbers-Tests of adequacy of Index Numbers. **(9)**

Time Series and Forecasting

Definition- Time Series. Components- -Time series decomposition models: multiplicative and additive models -Forecasting error-measurement using Mean Absolute Deviation(MAD), Mean Absolute Percentage Error (MAPE), Mean Squared Error(MSE) and Root Mean Square Error (RMSE)- Smoothing Techniques: Naïve forecasting, moving averages and weighted moving averages-Exponential smoothing -Simple and double Exponential Smoothing- Trend analysis- linear, quadratic and exponential trend-Seasonal Effects-Decomposition methods: method of simple averages, ratio to trend method and ratio to moving average method **(11)**

Statistical Quality Control and Decision Analysis

Statistical Quality Control: Nature of Control Limits-Purpose of Control Charts-Control Charts for Variables-Control Charts for Attributes

Decision Analysis: Decision making under certainty: Decision Table - Decision making under risk: Expected Monetary Value, Expected value of perfect information - Decision making under uncertainty: Criteria of Laplace, Maximin, Maximax, Hurwicz, Minimax Regret **(10)**

Designs Of Experiments: Analysis of Variance (ANOVA) technique-Design of experiments - basic concepts - treatment - experimental unit -experimental error - basic principle - replication, randomization and local control- One way Analysis of Variance: Completely Randomized Design- Randomized blocks design - description - layout - analysis-Latin Square Design-description-layout-analysis. **(9)**

Non Parametric Statistics: Introduction to Non parametric tests -Sign test - Signed Rank test-Rank-

Sum test-Wilcoxon-Mann- Whitmey test (U test), Kruskal Wallis test-Runs test **(6)**

Theory : 45 hours
Tutorial: 15 hours
Total: 60 hours

TEXT BOOKS

1. Ken Black, "*Business Statistics for Contemporary Decision Making*", 6th Edition, John Wiley &Sons.Inc, 2010 [Para 1,2,3 and 4]
2. R.P.Hooda, "*Statistics for Business and Economics"*, 5th Edition, Vikas Publishing House Pvt. Ltd., Noida, 2013 [Para 1]
3. Richard I. Levin, David S. Rubin, "*Statistics for Management*", 7th Edition Pearson Education, 2011.[Para 2 and Para 3]
4. Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, *"Probability and Statistics for Engineers and Scientists*", 9th Edition, Prentice Hall, 2012 (Para 3, 4 and 5)

REFERENCE BOOKS

1. D M Levine, M L Berenson, T C Krehbiel and P.K.Viswanathan- "*Business Statistics: A First Course*", 7th Edition, Pearson Education, Delhi, India, 2017
2. Dinesh Kumar U. "*Business Analytics*", Wiley, Second Edition, 2021

22MDC32 - FINANCIAL ANALYSIS AND REPORTING

L	T	P	C
3	1	0	4

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Understand the financial statements to make decisions

CO2:: Demonstrate the accounting procedures and understand the purpose of financial reports.

CO3: Apply the various methods of financial statement analysis

CO4: Analyze the financial statements on various aspects of financial performance

CO5: Evaluate the financial statements and Identify the inferior quality of financial reporting to make sound decisions

Financial Accounting: Definition- Three Activities - Generally Accepted Accounting Principles - Accounting Equation: Balance sheet, Income Statement and Retained Earnings. Recording Process: Debit and Credit - Steps in Recording Process - Making Journal Entries, Posting the Journal Entries to Ledger Accounts, Posting the Ledger to Trial Balance, Preparation of Trial Balance. **(Problems in preparation of Journal, Ledger and Trial Balance)**

(Theory: 9 hours , Tutorial : 3 hours)

Understanding the Financial Statements: Balance Sheet Items: Assets, Liabilities and Owner's Equity, , Income Statement Items: Revenue from operations, other income and Expenses and Cash flow Statement Items: Cash from Operating Activities, Cash from Financing Activities and Cash from Investing Activities - Need and Linkages of Financial Statements:- Preparation of Common Size Balance sheet and Income Statement.**(Problems in preparation of Common size statements)**

(Theory: 9 hours , Tutorial : 3 hours)

Annual Report Analysis: Reading an annual report for a listed entity - Parts of Annual Reports - Financial Highlights - Directors' Report - Management Discussion and Analysis - Standalone and Consolidated Financial Statements- Notes to Financial Statements- Related Party Transactions.

(Theory: 9 hours , Tutorial : 3 hours)

Financial Ratios: Profitability Ratios, Return Ratios, Liquidity Ratios, Stability Ratios, Efficiency Ratios - Interpretation of Ratios.**Working Capital Analysis:** Working Capital Calculation - Impact of Working Capital on business - Negative and Positive Working Capital - Perspective of the banker and owner in analyzing working capital - Calculating Cash Conversion Cycle - Analysis of Receivables, Inventory, Cash and Payables.**(Problems in Ratio Analysis and Cash Conversion Cycle)**

(Theory: 9 hours , Tutorial : 3 hours)

Quality of Financial Reporting: Measuring Quality of Earnings - Identifying the potential red flag.

Costing: Concepts of Cost - Elements of Cost - Classification of cost - Preparation of Cost Sheet

(Theory: 9 hours , Tutorial : 3 hours)

Theory: 45 hours

Tutorial: 15 hours

Total: 60 hours

TEXT BOOKS:

1. Thomas .R. Robinson and et.al, "*International Financial Statement Analysis*", John Wiley & Sons, Inc, 4th edition,2020
2. Jain ,Narang and Simmi Agarwal,, "*Cost Accounting*", Pragati Publishers,, Pune, 2022

REFERENCE BOOKS:

1. Horngren, Sundem, Elliot, "*Introduction to Financial Accounting*", Pearson Education, Eleventh Edition,,New Delhi,, 2022.
2. Maheshwari.S.N, "*An Introduction of Accounting*", Vikas Publishing House Pvt Limited , Twelfth Edition,2018...
3. Narayanaswamy, "*Financial Accounting:A Managerial Perspective*", PHI Learning Pvt Ltd,Seventh Edition, 2022..

22MDC33 Digital Marketing

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Recognize the key issues and themes in the adoption and application of digital marketing to business

CO2 : Explore Tactical and Operational challenges faced by firms in implementing digital marketing strategies

CO3: Apply the tools and techniques involved in digital marketing for better customer service and relationship

CO4: Analyze the confluence of digital marketing in the real-world scenario

CO5: Evaluate the success rate of Digital Marketing and create a reporting system.

Digital Marketing: History of Digital Marketing – Traditional Marketing Vs Digital Marketing – 4 P's of Marketing – Perceptual positioning map – Customer Lifetime value – Segmentation – **Aligning with business:** Customer centricity- Business model – Global strategy – Brand – Vision – Culture – Research and insight – KPI's – Barriers - Trend of ChatGPT in Digital Marketing. **(9)**

Digital Marketing Planning: Process – Phased approach – Goals – Strategies and objectives – Action plans – Controls – People – Budgeting and forecasting. **Content Strategy:** Content marketing – Content types – Process of content creation – Distribution – Measuring the value of contents. **(9)**

Search Engine Optimization: History – Researching SEO Strategy – Technical SEO – Site Structure – Content – Mobile – Location – Penalties – Organization structure and SEO. Paid Search: Basics – Setting Campaign – Measurement and Optimization – Advanced paid search – Managing Paid search campaigns. **(9)**

Social Media: Customer Service – SEO angle – Types of social media – Content – Social Advertising – Measurement. **CRM and Retention:** Meaning – Contact strategy – Cross selling and Upselling – Predictive analytics – CRM systems – Social CRM – Loyalty. **(9)**

Analytics and Reporting: Data Landscape – Reliability of data-based decisions – Analytics tools and technology – Attribution modeling – Reporting. **Presenting Strategy:** Decision making – Budget – Key channel benefits – Website – Trends and cycles – 6's framework for structuring. **(9)**

Total: 45 Hours

Text Book:

1. Simon Kingsnorth, " *Digital Marketing Strategy: An Integrated Approach to Online Marketing*", Kogan Page Publishers, Third Edition,2022.

Reference Books:

1. Ryan Deiss and Russ Henneberry, *Digital Marketing"*, Wiley Publishers, Second Edition, 2020
1. Damian Ryan, "*Understanding Digital Marketing - Marketing Strategies for Engaging the Digital Generation*", 3rd Edition, Kogan Page Ltd., Fifth Edition. 2021.
3. Seema Gupta, "*Digital Marketing*", McGraw Hill, Third Edition, 2022.
4. Dave Evans and Jake Mckee, "Social Media Marketing – The Next Generation of Business Engagement", Wiley India pvt. Ltd, New Delhi,Second Edition, 2012.

22MDC34 Database Management Systems

L	T	P	C
3	0	0	3

PRE-REQUISITES : Consent of the Instructor
ASSESSMENT : THEORY

COURSE OUTCOME

CO1: Understand the concepts of Database, Conceptual Model, Relational Model,SQL Queries and Transaction Management

CO2: Analyze real world scenarios and represent conceptual and logical design incorporating normalization rules and write optimized queries

CO3: Apply Relational Algebra and SQL to extract information for given real life scenarios

CO4: Provide database solutions in terms of higher normal forms considering the issues in concurrent transactions

INTRODUCTION

Databases and Database users, Database System Concepts and Architecture – Data models, Schemas and instances, Three schema architecture and Data independence, Database languages and Interfaces, Centralized and Client/Server architectures for DBMSs. **(5)**

DATA MODELLING USING ER MODEL

Main phases of database design, Entity types, Entity sets, Attributes and Keys, Relationship types, Relationship sets, Roles and Structural constraints, Weak Entity types, ER diagrams Naming conventions and design issues, Relationships types of degree higher than two, Case studies on ER diagrams. EER model – Subclass, Superclass and inheritance, Specialization and Generalization, Aggregation and Association. **(10)**

RELATIONAL DATA MODEL

Concepts, Constraints and Relational database schemas, Update operations, Transactions and Dealing with constraint violations, EER to Relational mapping. **Normalization :** Informal design guidelines for relational schemas, Functional Dependencies, Normal forms based on Primary keys, General definition of second and third normal forms, Boyce-Codd normal form, Inference rules for functional dependencies. **(10)**

SQL

Basic SQL, Data definition and Data types, Constraints in SQL, Basic retrieval queries, Insert , delete and update statements in SQL, Schema change statements in SQL, DCL and TCL commands. Advanced SQL - Complex retrieval queries, Nested queries, Correlated nested queries, Exists and Unique functions, Explicit sets and Renaming, Joins, Aggregate functions, Group by and Having clauses, Assertions and Triggers, Views.

Relational Algebra : Unary relational operations, Relational algebra operations from set theory, Binary relational operations, examples of queries in relational algebra. (**10)**

QUERY OPTIMIZATION AND TRANSACTION

Query Optimization: Transformation of relational expressions, Equivalence rules, Examples of transformations. Transaction: Concept, Simple Transaction Model, ACID properties, Transaction states, Serializability. Concurrency and possible problems: Lost Update, Inconsistent Read, The Phantom phenomenon, Lock based concurrency control. (10)

Total: 45 Hours

TEXT BOOKS

1. Ramez Elmasri, Shamkant B. Navathe, "*Fundamentals of Database Systems*", Seventh Edition, Pearson Education, 2018.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "*Database System Concepts*", Sixth Edition, McGraw Hill, 2010.

REFERENCE BOOKS

1. Bipin C Desai, "*An Introduction to Database Systems*", Galgotia Publications.

22MDC35 – OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

PREREQUISITE: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1 : Given software requirements, Understand the problem by discovering appropriate classes and objects, identifying attributes and suitable OOP techniques

CO2 : Apply the Object-Oriented concepts to create a design using which solution can be derived which can be utilized to handle exceptions

CO3 : Develop the Java Application using the front-end design and suitable backend based on the design created

CO4 : Analyze the program using various test cases, object-oriented concepts

INTRODUCTION

Introduction to object oriented programming Paradigm- Introduction – Evolution of Higher Level Languages – Complexity of softwares and their Attributes - object oriented programming Paradigm - Introduction to Java Language – Evolution – Salient Features – Java, Internet and World Wide Web – The Java Environment The Java Language Preliminaries (7)

FUNDAMENTALS, OBJECTS AND CLASSES

Fundamental Programming Structures in Java – Objects and Classes – Object Construction – Packages - String Handling – String Constructors, String Length, Character Extractions, String Comparison, Searching, Modifying and Joining Strings, String Buffer Exceptions: Dealing with errors, Catching Exceptions, try, catch, throw, throws and finally (8)

INHERITANCE

Classes, super classes and subclasses – Object: The cosmic superclass – Generic Array List – Object Wrappers and Autoboxing – Method with a variable number of parameters – Enumeration Classes – Constructors – Method Overloading – Method overriding – Constructor overloading – Constructor overriding Interfaces - Inner Classes – Abstract class – final class, method and variable. (10)

COLLECTIONS

The Java Collections Framework, Interfaces in the Collections Framework, Concrete Collections, Maps, Views and Wrappers, Converting between collections and Arrays (7)

User Interface Components with Swings: Introduction to Layout Management - Text Input - Choice Components - Menus- Sophisticated Layout Management - Dialog Boxes. (6)

CONCURRENCY and EVENT DRIVEN PROGRAMMING

Concurrency: Threads – Thread States – Thread Properties – Synchronization. Database Connectivity: JDBC (7)

TOTAL: 45 Hours

TEXT BOOKS

1. M. T. Somashekara, D. S. Guru, K. S. Manjunatha, "*Object Oriented Programming with Java"*, Prentice Hall India Pvt., Limited, 2017 (Para – I).
2. Cay.S. Horstmann, "*Core Java Volume I—Fundamentals"*, 11th Edition, Pearson Education, 2018.
3. Herbert Schildt - "*Java: The Complete Reference"*, Eleventh Edition, McGraw Hill Education, 2018.

REFERENCE BOOKS

1. Joshua Bloch,"*Effective Java"*, Third Edition, Addison-Wesley Publications, 2018.
2. Herbert Schildt , "*Java: A Beginner's Guide",* 8th Edition, McGraw Hill Education, 2018.
3. "*Core and Advanced Java"*, Black Book. Dreamtech Press, 2018.
4. Paul Deitel, Harvey Deitel, —"*Java SE 8 for programmers"*, 3rd Edition, Pearson, 2015.

22MDC36 - DIGITAL MARKETING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC18

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Interpret the impact of social media marketing

CO2 : Customize the website so that the business can be displayed in the Google search engine.

CO3: Correlate analytics into the digital marketing process to gain insights

CO4: Utilize social media for marketing.

CO5: Design the landing page with professional lead magnets and copywriting

CONCEPTS TO BE COVERED

1. Identify a business for which digital marketing is to be launched
   - Design the landing page
   - Create Lead Magnets
   - Perform Copywriting
2. Integrate Google Analytics
3. Email Marketing
   - Plan for Email campaign
   - Create Email templates and designs
   - Track the Email visitors
4. Content and Blog Marketing
5. Practice SEO (Search Engine Optimization) Techniques
6. Social Media Marketing
   - Paid Ads
   - Marketing through Facebook, Instagram, Twitter, LinkedIn, YouTube
7. Social Media Marketing Audit

22MDC37 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Formulate SQL queries using DML statements with the concepts of Sub queries, Joins, Group By, Order By to manipulate the data in real world applications.

CO2 : Apply single row functions, set operations, and create views, indexes, synonyms and sequences in logical databases appropriately.

CO3: Explore simple and advanced reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors for OLTP applications

CO4: Determine Entity Relationship diagram for a given application and create the database based using conversion rules using DDL statements

CO5: Develop real world database application projects by constructing the ER model, creating Tables and generating SQL and PL/SQL blocks

CONCEPTS TO BE COVERED

1. Design a conceptual model from the system requirements specification using ER diagram.
2. Create the relational database using mapping rules and specify referential triggered actions.
3. Implement DDL, DML and TCL statements.
4. Restricting and sorting of data.
5. Single row functions (String, Date and Time, Numeric, Conversion and General functions).
6. Aggregating data using Group By clause.
7. Retrieving data from multiple tables using Joins.
8. Sub queries (Single row, Multiple rows, Correlated, and Multiple column subqueries).
9. Set operations.
10. Views, Sequence, Index, Synonym
11. Simple PL / SQL Programs.
12. Advanced PL/SQL programs (integrated with SQL, Cursors, and Exceptions).
13. Functions, Procedures, Package, Triggers

Business Applications to be considered:

- Financial Accounting
- Marketing
- Sales Management
- Operations Management
- Human Resource Management
- Customer Relations Management
- Supply Chain Management
- Collaborative Workforce Management
- Social Networking Applications

22MDC38 – OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICALS

COURSE OUTCOMES

CO1: Given software requirements, Understand the problem by discovering appropriate classes and objects, identifying attributes and suitable OOP techniques

CO2 : Apply the Object-Oriented concepts to create a design using which solution can be derived

CO3: Investigate the solution with a database and suitable front end

CO4: Analyze the program using various test cases, object-oriented concepts

CO5: Develop the Java Application using the front-end design techniques based on the design created and handle all the possible exceptions

CONCEPTS TO BE COVERED

1. Design use case models and class models using UML notations
2. Creating Classes and Objects using different types of functions
3. Programs using Constructor and Destructor
4. Count the number of objects created for a class using static member function
5. Write programs using Inheritance
6. Write programs to implement Polymorphism
7. Create programs to implement Runtime Polymorphism using Abstract Class and Interface
8. Develop programs for the given scenario using Packages and implement suitable Exception handling mechanisms.
9. Devise problems to implement Multithreading concepts
10. Write programs to choose and implement appropriate Collections for the given scenario
11. Develop a web application using Swings for UI Development and connect it with a database using JDBC connectivity.

22MDC41 – PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

PRE- REQUISITES 22MDC13, 22MDC31

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Analyze various properties like mean vector, covariance, and correlation matrices of multivariate data

CO2 : Analyze time series data and use it for forecasting

CO3: Formulate and compute multiple linear regression model and understand its properties

CO4: Classify objects into different groups using discriminant function, logistic regression equation and cluster analysis techniques

CO5: Identify underlying factors in multivariate data sets using principal component analysis and factor analysis

MULTIPLE REGRESSION ANALYSIS (MLR)

Multivariate Data: Variables in Multivariate Data - Mean Vector, Covariance and Correlation Matrices and their properties - Estimation of missing values
Multiple Linear Regression Equation and Polynomial Regression Models- Estimation of the coefficients using method of least squares–Linear Regression using Matrices-Properties of Least Squares-Inferences in Multiple Linear Regression: ANOVA and testing the partial regression coefficients- Interpretation of R^2-Standardized Regression Coefficient and its interpretation-Inclusion of categorical or indicator variables in MLR –Multi-collinearity problem-Stepwise Regression **(10)**

TIME SERIES FORECASTING

Regression Model for forecasting - Forecasting Time Series data with Seasonal Variation - Auto-Regressive(AR) Models- AR Model Identification: ACF and PACF, Moving Average -MA(q)) and ARMA(p,q) Models-Auto-Regressive Integrated Moving Average (ARIMA) Process-Dickey Fuller Test-Augmented Dickey-Fuller Test-Transforming Non Stationary Process to Stationary Process using Differencing-ARIMA(p,d,q) model building-Ljung-box test for Auto-Correlations-Power of Forecasting: Theil's Coefficient **(10)**

DISCRIMINATION AND CLASSIFICATION

Discriminant Function Analysis- Fisher's discriminant function. Logistic Regression: Logistic Model Definitions of Odds and Logit-Estimation of the logistic regression coefficients - Making Predictions - Multiple Logistic Regression. **(8)**

PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS

Data Reduction Techniques-Definition of Population Principal Components –Principal Components obtained by Standardized variables -Rules to retain number of Principal Components using Scree Plot
Factor Analysis-Definitions-The Orthogonal Factor Model-Its Covariance Structure- Factor Loadings and Interpretations-Exploratory and Confirmatory Factor Analysis. **(9)**

CLUSTER ANALYSIS

Definition-Measures of Similarity or Dissimilarity-Hierarchical Clustering Methods-Single linkage - Complete Linkage-Average Linkage-Centroid-Ward's Hierarchical Clustering Methods-Non-hierarchical Clustering Methods-K-means Method. **(8)**

TOTAL: 45

TEXT BOOKS

1. Alvin C.Rencher "*Methods of Multivariate Analysis"*, 2nd Edition, Wiley Inter-science, 2002 [Para 1, Para 5]
2. R.E.Walpole,R.H.Myers,S.L.Myers and K.Ye, "*Probability and Statistics for Engineers and Scientists"*, 9th Edition, Prentice Hall, 2012 [Para 1 (MLR)]
3. Richard A.Johnson and Dean W.Wichern. "*Applied Multivariate Statistical Analysis"*, 6th Edition, Pearson Prentice Hall, 2007 [Para 3 and Para 4]
4. Dinesh Kumar U, " *Business Analytics*", Wiley, Second Edition, 2021 [Para 2]

REFERENCE BOOK

1. Joseph F. Hair Jr., William C. Black, Barry J.Babin and RolphE.Anderson,"*Multivariate Data Analysis"*, 7th Edition, Pearson, 2010.

22MDC42 - OPERATIONS RESEARCH FOR BUSINESS

PRE- REQUISITES 22MDC12

ASSESSMENT: THEORY

L	T	P	C
3	1	0	4

COURSE OUTCOMES

CO1: Solve Linear Programming, Transportation and Assignment based problems

CO2: Discuss the elementary Inventory models, Price break models and Safety stock problems

CO3: Solve Job sequencing and replacement problems

CO4: Design the optimal model to improve the efficiency and productivity of any organization using the co of mathematical modeling of decision problems

CO5: Analyze any decision situation and offer solutions for the best utilization of limited resources

LINEAR PROGRAMMING:

Linear programming problem -Formulation – Two Variable LP Model - Graphical LP solution - Computer solution with Solver - Simplex method - Sensitivity Analysis. **DUALITY:** Primal–dual relationships – Economic Interpretation of Duality – Dual Simplex Method **(10)**

TRANSPORTATION MODEL: Vogels Approximation method. **ASSIGNMENT MODEL:** Hungarian Technique– Degeneracy - unbalanced problems. Solutions using Solver **(8)**

GOAL PROGRAMMING: Formulation - Algorithm. **INTEGER PROGRAMMING:** Construction of Gomory's Constraints – Fractional Cut method - Branch and Bound method - Applications. **DYNAMIC PROGRAMMING :** Characteristics of Dynamic Programming – Recursive Nature of Computation in Dynamic Programming – Forward, Backward Recursion **Applications:** Shortest Route problem – Cargo loading problem – Resource allocation problem - Investment and Budgeting Problems **(12)**

NETWORK MODEL: Minimum Spanning Tree Algorithm - Shortest Route Problem - Maximal Flow Model - CPM and PERT **(8)**

SEQUENCING – Basic assumptions – Johnson's procedure for Sequencing of: i) n jobs on 2 machines ii) n jobs in 3 machines and iii) n jobs on m machines. **REPLACEMENT** – Need for replacement of equipment – Failure mechanism of items – Replacement policy – Replacement of items that deteriorates gradually – Replacement f items that fail suddenly. **(6)**

INVENTORY: Need for the inventory – Costs involved in inventory – Concepts of average inventory, economic order quantity – Deterministic model: Fixed ordering quantity models – EOQ model with uniform demand, finite / infinite replacement with / without shortages –EOQ with one price break. Inventory control - Buffer stock - Determination of optimum buffer stock – EOQ system of ordering – Multi item EOQ model **(8)**

QUEUING THEORY : Elements of the Queueing Model - Poisson Queueing Models - Specialized Poisson Queues - Queueing Decision Models **(8)**

Total : 60

TEXT BOOKS

1. Hamdy A.Taha, *"Operations Research – An Introduction"*, Tenth Edition, Pearson Education Limited, 2017.

REFERENCE BOOKS

1. Frederick S.Hiller, Gerald, J.Leberman, Bodhibrata Nag and Preetam Basu, *"Introduction to Operations Research"*, 11th Edition, McGraw Hill, 2021

2. Kanti Swarup, P.K. Gupta, Mani Mohan, "*Operations Research"*, Sultan Chand & Sons, 20th Revised Edition, 2022.

3. S. D. Sharma *"Operations Research (Theory Methods & Applications)",* Kedar Nath Ram Nath, 2020.

4. J.C. Pant, "*Introduction to Optimisation: Operations Research*", 7th reprinted edition, Jain Brothers, Delhi, , 2015. Frank R.Giordano, Maurice D.Weir and William P.Fox. Mathematical Modeling, Thomson Brooks/Cole, Vikas Publishing House Pvt Ltd., New Delhi.[Para 1]

22MDC43 FINANCIAL ENGINEERING

L	T	P	C
3	0	0	3

PRE- REQUISITES: 22MDC32

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1 : Understand the Basic financial mathematics and financial markets and evaluate cash flows

CO2 : Apply the Capital market theory for stock performance evaluation

CO3 : Analyze the various models used in the financial markets to a real data in decision making

CO4 : Assess the Bond and Stock Price movements and predict the future price patterns

CO5 : Evaluate and arrive at a financial investment decision employing the knowledge of stock and derivatives

Introduction to Financial Engineering and Basic Financial Mathematics:
Overview of Financial Engineering and its role in finance – Financial Engineering and Computation – Financial Markets : Primary and Secondary.
Time Value of Money : Present and Future Value – Simple Compounding – Annuities – Amortization - Yields – IRR – NPV. (9)

Fixed Income Securities:
Treasury, Agency and Municipal Bonds – Corporate Bonds and its valuation – Bond Valuation: Price Behaviors – Day count conventions – Accrued interest – Yield for a Bond – Bond price volatility – Bond Duration – Bond immunization. (9)

Stocks:
Common Stock Valuation – Present value of dividends – Earnings approach – Efficient Market Theory – Industry Analysis : Industry Life Cycle and Industry Classification - Technical Analysis : Trend Indicators using Moving Average, Volatility Indicators using Bolinger Bands, Momentum Indicators using RSI,ROC and Moving Average. (9)

Derivatives:
Options : Option Basics – Exchange Traded Option – Basic option strategy – Hedge – Spread – Arbitrage in Option Pricing: The Arbitrage Argument – Relative Option Pricing- Put-call parity – Binomial Option Pricing model – Black Scholes Model. Forward Contract – Futures Contract – Futures options and Forward options – Currency swaps – Hedging and Futures – Hedging and Options. (9)

Portfolio Management:
Capital Asset Pricing Model – Arbitrage Pricing Theory – Markowitz Model - Efficient Frontier Theory - Sharpe's Model – Treynor's Model. (9)

Total : 45

Text Book:

1. Yuh Dauhl yuu, " *Financial Engineering and Computation : Principles, Mathematics and Algorithms*", Cambridge University Press, E- book 2020.

Reference Books:

1. Perry .H.Beaumont , *"Financial Engineering Principles*", John Wiley and Sons Inc, New Jersey, 2004.

2. Cornelis. W.Oosterlee and Lech.A.Grzelak, "*Mathematical Modelling and Computation in Finance"*, World Scientific Publishing, Europe , 2020

3. David Ruppert and David.S.Matteson. "*Statistics and Data Analysis for Financial Engineering*", Springer , Second Edition , 2015.

4. Marek Capinski and Tomasz Zastawniak, "*Mathematics for Finance : An Introduction to Financial Engineering"*, Springer, Second Edition, 2011.

22MDC44 - ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC23
ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Design and apply the concept of binary search trees and AVL trees in real time applications.

CO2: Identify and apply the techniques of m-way search tree and Red black trees in various problems in an efficient way.

CO3: Demonstrate the use of search techniques of graphs and heap operations in domain specific situational problems

CO4: Design and apply hashing algorithms to solve real time problems.

CO5: Identify the problem given and design the algorithm using suitable design techniques like Divide and Conquer, Greedy method, Dynamic Programming, Backtracking and Branch and Bound Technique.

TREES
Binary search tree: Definition, operations - AVL Tree: Balancing trees, node operations. **(8)**

MULTIWAY TREES
Definition - m-way search trees - B-trees - Red Black tree – operations, Trie structure **(9)**

GRAPHS
Representation - Breadth first search - Depth first search. **(3)**

HEAP AND HASHING
HEAP- Definition - heap data structures – heap algorithms – applications. Hashing : Basic concepts - hashing methods - hashing algorithms - collision resolution methods. **(10)**

ALGORITHM DESIGN TECHNIQUES
Divide and Conquer: General method – Binary search, Quick sort, Merge sort.
Greedy Method: General method - Knapsack problem -Prim's & Kruskal's algorithm, Tree Vertex Splitting.
Dynamic Programming: General method - Multistage graph- All pair shortest paths.
Back Tracking: General method - Eight queen's problem.
Branch and Bound: Control Abstraction, Bounding, Travelling Salesperson Problem **(15)**

TOTAL : 45

TEXT BOOKS

1. Richard F. Gilbery, Behrouz A.Forouzan, "*Data structures - A Pseudocode Approach with C*", Thomson Asia Pvt Ltd., 2002. (Trees, Multiway trees, Heap, Hashing)
2. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, "*Fundamental of Computer Algorithms*", Galgotia Publications, 2010. (Algorithm Design Techniques)
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivert, Clifford Stein *"Introduction to Algorithms*", Second Edition, Prentice Hall of India, Publications, New Delhi, 2007. (Graphs, Red Black Trees).

REFERENCE BOOKS

1. Anany Levitin , "*Introduction : The Design & Analysis of Algorithm*", Second Edition, Pearson Education,2007.

2. S.K.Basu, "*Design Method & Analysis of Algorithm"*, PHI Learning Pvt.Ltd, 2013.

22MDC45 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Describe Intelligent Agents such as searching, knowledge-based agents and Searching Strategies.

CO2: Build Knowledge based systems by identifying suitable searching strategies and knowledge representation.

CO3: Apply the concept of Artificial Intelligence for business transformation in various domains.

ARTIFICIAL INTELLIGENCE

Introduction: Definition- Foundations- History-State of Art. Intelligent Agents: Agents and Environments-Concepts and Rationality-Nature of Environments-Structure of Agents **(7)**

PROBLEM-SOLVING

Solving Problems by Searching : Problem Solving Agents—Examples – Searching for Solutions – Uninformed Search Strategies – Informed Search Strategies – Heuristic Functions. Beyond Classical Search: Local search algorithms and optimization problems – Local search in continuous spaces – Searching with non-deterministic actions - searching with partial observations. **(11)**

KNOWLEDGE BASED AGENTS

Logical Agents: Knowledge Based Agents – The Wumpus world – Logic – Propositional Logic -Propositional Theorem Proving. Constraint Satisfaction Problems: Definitions -Constraint Propagation: Inferences - Backtracking Search – Local Search **(9)**

KNOWLEDGE BASE REPRESENTATION

First Order Logic: Representation – Syntax and Semantics- Using First Order Logic – Knowledge Engineering in First Order Logic. Inference in First order Logic: Propositional versus First Order Inference – Unification and Lifting – Forward Chaining – Backward Chaining. Knowledge Representation-: Ontological Engineering - Categories and Objects-Events – Reasoning System for Categories. **(10)**

ARTIFICIAL INTELLIGENCE FOR BUSINESS

AI and Analytics Strategy for Business Transformation: A strategic Road Map for Initiating Analytics Adoption – Re-Engineering business to think Analytics - Assessing your Analytics Maturity Curve - Building a Robust Data Monetization Strategy. Applications of AI : Banking – Healthcare – Sports. **(8)**

TOTAL: 45

TEXT BOOK

1. Stuart Russell and Peter Norvig, "*Artificial Intelligence: A Modern Approach*" ,Pearson Eductaion Series, Prentice Hall Publishers, Third Edition, 2014.
2. Sameer Dhanrajani, "*AI and Analytics: Accelerating Business Decisions*", Wiley India Pvt. Ltd, First Edition, 2018.

REFERENCE BOOKS

1. Thomas Dean, James Allen , Yiannis Aloimonos, "*Artificial Intelligence : Theory and Practice*", Addison Wesley Pub.,Co
2. Nils J Nillsson, "*Principles of Artificial Intelligence"*, Morgan Kauffmann Publishers , 2014.
3. Patrick Hendry Winson, " *Artificial Intelligence*", Addition Wesley Publishers, Thrid Edition 1992

22MDC46 - PREDICTIVE ANALYTICS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC31,22MDC41
ASSESSMENT: PRACTICAL

COURSE OUTCOMES

CO1: Compute various Index Numbers used in Economics

CO2: Analyze time series data and perform non parametric tests.

CO3: Develop control charts for variables and attributes and analyze the data with ANOVA and non-parametric methods.

CO4: Analyze multivariate data using multiple linear regression, discriminant function, logistic regression equation models and cluster analysis tools.

CO5: Identify underlying factors in multivariate data by applying factor analysis and principal component analysis models

CONCEPTS TO BE COVERED

1. Compute simple and weighted aggregate index numbers - Laspeyre, Paasche, Marshell – Edgeworth , Fisher's Ideal Index numbers.
2. Apply Exponential Smoothing techniques, Trend Analysis techniques, Auto Correlation and Regression techniques to forecast the time series data generated for the system.
3. Generate control charts for handling quality controls in a statistical way (Shewhart chart,*p*-chart,*np*-chart,*c*-chart, CuSum Chart).
4. Analyze the given data using One-way and Two-way ANOVA.
5. Perform Non-parametric hypothesis tests using the techniques such as Sign test, Wilcoxon Signed Rank test, Mann-Whitney-Wilcoxon test.
6. For the given multivariate data, compute the summary statistics, Mean and Variances per group, Between-groups and within-group variance for a variable, covariance and correlation matrix.

7. Analyze the given data for predicting the classes or numerical values using multiple linear regression, stepwise regression, logistic regression and multiple logistic regression techniques,
8. Apply Principal Component Analysis and Factor Analysis to reduce the dimensions/features of the given dataset.
9. Apply Hierarchical and Non-Hierarchical (K-Means) methods to generate the clusters and allocate given input to the existing clusters.

22MDC47 FINANCIAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITES: 22MDC32, 22MDC42

CO1: Estimate volatility of financial asset returns from historical data

CO2: Investigate Financial Data analysis and modeling skills to make sound business decisions

CO3: Apply quantitative models for Portfolio management and decision making

CO4: Analyze the financial models computationally to price and hedge and make decisions.

CO5: Evaluate the time value of money and value the bonds and shares to make decisions

1. Creating Dynamic Financial Model using EXCEL for;
   - Financial Statement Linkages
   - Forecasting Financial Statements
   - Amortization and Repayment Schedule
2. Using Finance Functions in EXCEL and Python for Time Value of Money Calculation (PV, FV, Annuity, Compounding rate), NPV and IRR.
3. Calculation Bond Value and Equity Value in EXCEL and Python
4. Implementing Binomial tree for option strategy (two and three) in Python
5. Implementing Black Scholes model for option price in Python
6. Identifying Buy and Sell Signals in Charts using Technical Analysis (RSI, ROC, Moving Average) in Python
7. Calculating Expected Return using Capital Asset Pricing Model in Python and EXCEL
8. Portfolio Optimization using Sharpe's and Treyner's Model
9. Project using Mathematical models for financial concepts

22MDC48 ADVANCED DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC23, 22MDC44

ASSESSMENT: PRACTICAL

COURSE OUTCOME·

CO1: Apply tree data structures and its variants for real time applications.

CO2: Implement heap and hashing techniques in various scenarios.

CO3: Identify suitable graph-based algorithms and apply them for solving problems that arise in real world scenarios.

CO4: Choose the suitable algorithm design technique based on the implementation complexity for given problems.

CO5: Devise and implement suitable design techniques for a given scenario.

CONCEPTS TO BE COVERED

1. Applications of Binary search trees and its operations
2. Operations on AVL tree including rotations
3. B-Tree and its operations
4. Operations on Red Black trees
5. Problems related to graphs and graph traversals
6. Construction of heap & its operation
7. Implementation and analysis of Hash Table with collision handling.
8. Implementation of Divide and Conquer technique using Binary search, Quick sort,Merge sort
9. Implementation of Greedy method using Knapsack, Prim's and Kruskal algorithms
10. Implementation of Dynamic Programming technique using Multistage graph.
11. Implementation of Back tracking technique using Eight Queen's problem.
12. Implementation of Branch and Bound technique using TSP.
13. Choose any 5 read world problems/case studies, Analyze and apply appropriate design techniques to solve them and justify the optimal applicability of the technique.

22MDC49 - PERSONALITY DEVELOPMENT

L	T	P	C
0	0	2	1

PRE- REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

- Ascertain the various concepts of Self like the Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self with respect to the Western (Occidental) and Eastern (Oriental) theories of the Self and Personality Development.
- Outline the significant effects of Self Confidence to build team confidence, given the foundation principles of SelfMotivation and Confidence.
- Assess the various personalities and Attitudes and choose the best attitude for making bold decisions in personal and professional contexts.
- Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life. ● Set Career goals and formulate strategies by Prioritizing, organizing and scheduling the required tasks.
- Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.

PERSONALITY DEVELOPMENT

One's Personality Sends Out a Signal That Others Read – Same Person: Consciously Different Personalities can be Powerful – There isn't One Right Personality; It Differs by Role – Learning about Personality Development from the Three Cases – Personality Analysis – Freudian Analysis of Personality Development – Swami Vivekananda's Concept of Personality – Development: Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self – Personality Begets. (7)

LEADERSHIP QUALITIES & INTERPERSONAL SKILLS:

Resolving Conflict – A Smiling Face – Appreciative Attitude – Assertive Nature – Communication Skills – Listening Skills – Developing Empathy – The Personality Attribute of Taking Bold Decisions – Personality Types and Leadership Qualities – Mapping the Different Personality Types – Personality Tests: Example of a Personality Test: Jung Typology Test – Personality Assessment (7)

ETIQUETTE

Social Etiquette – Corporate Etiquette - Personal Grooming – Using minimal Body Language –

Leadership and Entrepreneurship: Corporate Training – Professionalism - Self-awareness – Creativity skills – Cognitive Development – Assertiveness – Positive Thinking and Attitude. (8)

GOAL SETTING AND TIME MANAGEMENT

Goal Setting – Immediate, Short Term and Long-Term Goals – Smart Goals – Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management –Identifying Time Wasters – Time Management Skills. (8)

Total: 30

REFERENCE BOOKS

1. Mitra K.Barun, "*Personality Development and Soft Skills*", Oxford University Press, 2011.
2. Krishna Mohan, Meera Banerji. "*Developing Communication Skills*" Macmillan Publishers, 2012.
3. Sai Lakshmi. B, "*Poly Skills- A Course in Communication and Life Skills*" Cambridge University Press, 2012.
4. Simon Sweeney, *"English for Business Communication*", Cambridge University Press, 2013.
5. Meenakshi Raman, Sangeeta Sharma, *"Technical Communication - Principles and Practice*", 3rd edition, Oxford University Press, New Delhi, 2015.

20MSSE04 - BLOCKCHAIN TECHNOLOGIES

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Explain the basic components of a blockchain, its operations, underlying algorithms, and essentials of trust.*

CO2 : *Explain the working of Bitcoin and Ethereum blockchains.*

CO3 : *Explain the role of cryptography in securing blockchain.*

CO4 : *Apply the learning of solidity and develop smart contracts*

CO5 : *Develop decentralized apps on Ethereum.*

INTRODUCTION

Basics of Distributed Computing - Consensus Mechanisms - Decentralization - Applications of Blockchain - Scalability and Challenges. **(7)**

BITCOIN BLOCKCHAIN

Introduction - working of bitcoin - Reference Implementation - Keys and Addresses - Wallets. **(10)**

BITCOIN BLOCKCHAIN MINING

Transactions - Scripting - Bitcoin Network - Mining and Consensus. **(9)**

ETHEREUM BLOCKCHAIN

Basics - Ethereum Clients - Ethereum Networks - Ethereum Addresses - Wallets -Transactions - Smart Contract Security. **(9)**

SMART CONTRACTS

Basics - Life Cycle of a Smart Contract - Building a Smart Contract with Solidity-Programming with Solidity - Gas Considerations. **(10)**

TOTAL : 45

TEXT BOOKS

1. *Imran Bashir, "Mastering Blockchain", Packt Publishing, First Edition, 2017. (Para I).*
2. *Andreas M. Antonopoulos, "Mastering Bitcoin - Programming the open Blockchain", O'Reilly, 2017. (Para II,III).*
3. *Andreas M. Antonopoulos Dr. Gavin Wood, "Mastering Ethereum - Building Smart Contracts and DApp", O'Reilly, 2019. Para(IV,V).*

REFERENCES

1. *Lorne Lantz, Daniel Cawrey, "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, O'Reilly, 2020.*
2. *Saifedean Ammous, "The Bitcoin Standard: The Decentralized Alternative to Central Banking", Wiley, 2018.*

19MAMEL07 - GENERATIVE AI LAB

[redacted]

PRE-REQUISITES

19MAM62

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

CO1 *: Create impressive Generative deep learning models from scratch including variational autoencoders (VAEs) and Generative Adversarial Networks (GANs)*

CO2 *: Implement state-of-the-art architectures such as StyleGAN2, MuseGAN, pix2pix for text,image and music generation*

CO3 *: Use diffusion models for text, image and video datasets for Generative AI applications*

CO4 *: Store and retrieve Images, Text using Vector Database*

CO5 *: Build real time Generative AI applications like chatbots, image,audio,video generation and synthetic dataset generation for various domains*

CONCEPTS TO BE COVERED

- Train GANs to generate images based on your own dataset.
- Implement paired and unpaired style transfer with networks like StyleGAN.
- Use facial landmarks, auto encoders, and pix2pix GAN to create deepfakes.
- Compose music using Generative/LSTM models and the intricate MuseGAN.
- Use VAEs/C-GAN that can change facial expressions in photos.
- Use Image based diffusion models to produce new varieties of flowers
- Generate Text and other text based applications using GPT,Llama,Langchain etc..(AI chatbots)
- Applications of vector databases(Image,Text)
- Text/Image to video Generation (Modelscope.Gen-2 etc..)
- Create a own generative models using DALL.E 2, Imagen or Stable Diffusion-models

TOTAL : 60

Software Used : Python, Open Source Pretained Generative AI Models

19MAMEL08 - SOFTWARE TESTING LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

CO1 *: Learn the fundamentals of software testing methods.*

CO2 *: Design and develop the best test strategies in accordance to the development model*

CO3 *: Design test cases suitable for a software development for different domains.*

CO4 *: Apply the automation testing tools in the production environment*

CO5 *: Develop and validate a test plan.*

Concepts to be covered

- Unit testing - Junit
- Functional testing - Win Runner
- Synchronization Test
- Performance testing using Load Runner
- GUI checkpoint for single/multiple objects using Win Runner
- Design and development of Test Cases for Window Application
- Boundary Value Analysis of Application
- Testing load of Web Application using Load Runner
- Regression testing using Silk Test Tool
- Reliability Testing and Automation Testing using Jmeter
- Unit test cases using MLOps

TOTAL : 60

Software Tools : J Unit 5, WinRunner, Apache Jmeter, Kubeflow, MLflow

ONE CREDIT COURSES

19MAMOC03 - SOFTWARE ENGINEERING

PRE-REQUISITES

Consent of the Instructor

COURSE OUTCOMES

CO1 *: Understand different software life cycle models.*

CO2 *: Identify the functional and non-functional software requirements.*

CO3 *: Apply systematic methodologies for software design and deployment.*

CO4 *: Recognize various testing approaches and maintenance related issues.*

CO5 *: Plan project schedule, and estimate project cost and effort required.*

SOFTWARE PROCESS AND AGILE DEVELOPMENT

Introduction to Software Engineering-Software Process-Software Development Life Cycle Models --Agile Process-Extreme Programming. **(2)**

REQUIREMENTS ANALYSIS AND SPECIFICATION

Functional and Non-Functional-User Requirements-System and Software Requirements Document-Requirement Engineering Process-Requirements Elicitation and Analysis. **(3)**

SOFTWARE DESIGN

Design Process-Design Concepts-Design Model-Architectural Design and Styles-User Interface Design: Interface Analysis-Interface Design

TESTING AND MAINTENANCE

Software Testing Fundamentals-White Box Testing- Basis Path Testing-Control Structure Testing-Black Box Testing- Acceptance Testing - Regression Testing-Unit Testing- Integration Testing-Validation Testing- System Testing & Debugging. **(5)**

PROJECT MANAGEMENT

Software Project Management: Estimation- LOC- Function Point Based Estimation- Make/Buy Decision COCOMO I & II Model-Project Scheduling- Project Plan-Planning Process- Risk Identification and Management-Case Tools. **(5)**

PRACTICALS **(15)**

TOTAL : 30

REFERENCE

1. *Roger S. Pressman, Software Engineering - A Practitioners Approach, Seventh Edition, Mc Graw-Hill International Edition, 2020.*

19MAMOC04 - MACHINE LEARNING OPERATIONS LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

COURSE OUTCOMES

CO1 *: Understand the fundamentals of Machine Learning Operations(MLOPs) and AI pair programming.*

CO2 *: Select and implement web applications and Command line tools for Machine Learning model Interaction.*

CO3 *: Design MLOps pipeline and deploy ML models on cloud.*

CO4 *: Deploy Large Language Models and Containerized models*

CONCEPTS TO BE COVERED

1. Build Python script to automate data pre-processing and feature extraction for machine learning models.
2. Develop a real-world ML/AI solution using AI pair programming and GitHub Copilot, showcasing the ability to collaborate with AI.
3. Create web applications and command-line tools for ML model interaction using Gradio library, Hugging Face, and the Click framework package.
4. Implement GPU-accelerated ML tasks using Rust language for improved performance and efficiency.
5. Train, optimizing, and deploying ML models on cloud such as Amazon SageMaker/Azure ML/Google Cloud Platform for cloud-based MLOps.
6. Design a full MLOps pipeline with MLflow, managing projects, models, and tracking system features.
7. Containerize models using the ONNX format with Hugging Face.

Software/Tools : GitHub Copilot, Hugging Face, Any Cloud Platform.

TOTAL : 30

LIST OF NPTEL / SWAYAM COURSES

19MAMON01 - ECONOMICS OF BANKING AND FINANCE MARKETS

INTRODUCTION TO CYBER CRIME

The course aims at providing adequate exposure to the basic concepts and policy issues related to the working of the financial markets nationally and globally. The course will cover basic economic theories related to banking and finance markets, and then will apply those to understand the working of both national and global monetary and other related economic variables. The course will follow a macroeconomic perspective and will discuss recent finance market developments and controversies. The course aim to develop the learning skills of the students in a way that they can apply their knowledge not only at the academic level but also at the managerial and leadership level in the field of financial sector.

COURSE LAYOUT

1. An overview of the financial system; debt (bond) markets
2. Debt (bond) markets; interest rate determination
3. Equity markets; basics of banking
4. Banking sector
5. Asymmetric information and the rationale for regulations of finance markets
6. Asymmetric information; Conflicts of interest and rationale for regulations
7. Rationale for regulations; financial crisis
8. Financial crisis; central banking
9. Central banking
10. Central banking and monetary policy tools
11. Effectiveness of policy
12. Monetary policy tactics and strategies

REFERENCES

1. *Mishkin, Frederic S., The Economics of Money, Banking and Financial Markets (AddisonWesley) Ninth Edition, 2010*
2. *Baye, Michael R., & D.W. Jansen, Money, Banking & Financial Markets, An Economics Approach (A.I.T.B.S.), Indian Edition, 1999.*
3. *Froyen, Richard T. Macroeconomics: Theory and Policies.2009*
1. *Websites of Regulatory and Promotional institutions: RBI (www.rbi.org); IMF data (www.imf.org/en/Data); FRED (http:// research.stlouisfed.org/fred2); RBI: Handbook of Statistics On Indian Economy*
2. *Economic Dailies: Economic times, Business standard, Financial express, Hindu business line, The Wall Street Journal (www.wsj.com), Financial Times (www.ft.com), Bloomberg (www.bloomberg.com), and The Economist (www.economist.com)*

19MAMON02 - INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS

ABOUT THE COURS

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.This course has been organized into the following modules:

PRE-REQUISITES

Basic knowledge of computer and internet

Course layout

1. Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II
2. Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories
3. Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis
4. Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

5 . IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

6. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.
7. Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.
8. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.
9. Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.
10. Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.
11. Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.
12. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II : Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab

Case study - VII : Steel Technology Lab

REFERENCES

1) *S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.*
2) *S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.*

19MAMON03 - ETHICAL HACKING

ABOUT THE COURSE

Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them. There will be hands-on demonstrations that will be helpful to the participants. The participants are encouraged to try and replicate the demonstration experiments that will be discussed as part of the course.

PRE-REQUISITES

Basic concepts in programming and networking

Course layout

1. Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.
2. IP addressing and routing. TCP and UDP. IP subnets.
3. Routing protocols. IP version 6.
4. Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool.
5. Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.
6. Introduction to cryptography, private-key encryption, public-key encryption.
7. Cryptographic hash functions, digital signature and certificate, applications.
8. Steganography, biometric authentication, network-based attacks, DNS and Email security.
9. Packet sniffing using wireshark and burpsuite, password attack using burp suite. Social engineering attacks and Denial of service attacks.
10. Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.
11. Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross site scripting.
12. Case studies: various attacks scenarios and their remedies.

REFERENCES

Data and Computer Communications -- W. Stallings.

Data Communication and Networking -- B. A. Forouzan

TCP/IP Protocol Suite -- B. A. Forouzan

UNIX Network Programming -- W. R. Stallings

Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. Irwin

Cryptography and Network Security: Principles and Practice -- W. Stallings

19MAMON04 - AFFECTIVE COMPUTING

ABOUT THE COURSE

Affective Computing focuses on enabling the machines with emotion recognition and adaptive interaction. It lies in the intersection of Computer Science, design and human psychology. This course will overview the emotion theory, computational modelling of emotions, analysis of emotions using different modalities (such as voice, facial expressions, physiological signals etc) and related machine learning and/or signal processing techniques. We will also discuss ethical, legal and social implications of affective computing particularly in relation to Human-Machine Interaction.

PREREQUISITES

Mandatory Prerequisites

Programming, Artificial Intelligence, Machine Learning

Desirable Prerequisites

Human-Computer Interaction, Deep Learning

Course layout

1. Fundamentals of Affective Computing
2. Emotion Theory and Emotional Design
3. Experimental Design: Affect Elicitation; Research and Development Tools
4. Emotions in Facial Expressions
5. Emotions in Voice
6. Emotions in Text
7. Emotions in Physiological Signals
8. Multimodal Emotion Recognition
9. Emotional Empathy in Agents/Machines/Robots
10. Online and Adaptive Recognition of Emotions: Challenges and Opportunities
11. Case Study: Updated from Time to Time
12. Ethical Issues: Ethical, legal and Social Implications of Affective Computing

REFERENCES

1. Affective Computing. MIT Press
2. The Oxford Handbook of Affective Computing. Oxford University Press
3. The Encyclopaedia of Human-Computer Interaction, 2nd Ed.
4. Interaction Design: Beyond Human-Computer Interaction. 2019. (5th Edition) by Jenny Preece, Helen Sharp, Yvonne Rogers (Wiley)

Year- 2 (2022-23)			
Sl.No	**Name of the programme**	**Name of the Course**	**Course Code**
Civil Engineering			
1	BE - Civil Engineering	Human Value and Professional Ethics	23MC302
Mechanical Engineering			
2	B.E. Mechanical Engineering	Fundamentals of Automotive Systems	19MEE44
3	B.E. Mechanical Engineering	The Joy of Computing using Python	19MEE46
4	B.E. Mechanical Engineering	Introduction to Aerospace Engineering - Flight	19MEE47
5	B.E. Mechanical Engineering	Work System Design	19MEE48
6	B.E. Mechanical Engineering	Classical Sociological Theory	19MEE49
7	B.E. Mechanical Engineering	Industrial Safety Engineering	19MEE50
Electrical and Electronics Engineering			
8	B.E.Electrical and Electronics Engineering	Switched Mode Power Conversion	19EEE41
9	B.E.Electrical and Electronics Engineering	Utilization and Solar Energy	19EEE42
10	B.E.Electrical and Electronics Engineering	Wearable Sensors	19EEE43
11	B.E.Electrical and Electronics Engineering	Principles of Operating Systems	19EEE44
Electronics and Communication Engineering			
12	B.E.Electronics and Communication Engineering	Problem Solving With Algorithms And Data Structures	19ECOC03

Sl.No	Name of the programme	Name of the Course	Course Code
13	B.E.Electronics and Communication Engineering	Quantitative Aptitude for Engineers/ Verbal Aptitude for Engineers	19ECOCO2
14	B.E.Electronics and Communication Engineering	Programming in C++	19ECOCO5
15	B.E.Electronics and Communication Engineering	Foundation skills for integrated product development	19ECE54
Computer Science Engineering			
16	BE Computer Science Engineering	Introductio to Industry 4.0 and Industrial Internet of Things	19MCSE31
17	BE Computer Science Engineering	Cyber Security Tools Techniques Counter Measures	19MCSE32
18	BE Computer Science Engineering	Professional Readiness for Innovation, Employability and Entrepreneurship (Nalaiya Thiran)	19ECI01
Information Technology			
19	B.Tech Information Technology	Internet of Things	19IT72
20	B.Tech Information Technology	Internet of Things Laboratory	19ITL73
21	B.Tech Information Technology	Mobile Application Development Laboratory	19ITL74
Chemical Engineering			
22	B.Tech. Chemical Engineering	Carbon Capture	19CHE31
23	B.Tech. Chemical Engineering	Material Science and Technology	19CHE32
24	B.Tech. Chemical Engineering	Bioprocess Technology	19CHE33
25	B.Tech. Chemical Engineering	Pilot Plant and Scaleup Methods	19CHE34

Sl.No	Name of the programme	Name of the Course	Course Code
26	B.Tech. Chemical Engineering	Hertitage of Tamil	OC
Decision and Computing Sciences			
27	MSc Decision and Computing Sciences	Managerial Communication Skills	17MDC49
28	MSc Decision and Computing Sciences	Minor Project - Decision Tool Development	17MDC95
29	MSc Decision and Computing Sciences	Project Work and Viva Voce I	17MDC71
30	MSc Decision and Computing Sciences	Project Work and Viva Voce II	17MDC101
31	MSc Decision and Computing Sciences	Technical English	22MDC11
32	MSc Decision and Computing Sciences	Applied Algebra and Calculus	22MDC12
33	MSc Decision and Computing Sciences	Statistical Methods	22MDC13
34	MSc Decision and Computing Sciences	Principles of Management	22MDC14
35	MSc Decision and Computing Sciences	Problem Solving and Programming in C	22MDC15
36	MSc Decision and Computing Sciences	Mathematical and Statistical Computing Laboratory	22MDC16
37	MSc Decision and Computing Sciences	C Programming Laboratory	22MDC17
38	MSc Decision and Computing Sciences	Foundations of Computer Science Laboratory	22MDC18
39	MSc Decision and Computing Sciences	Employability Skills	22MDC19
40	MSc Decision and Computing Sciences	Professional English	22MDCLE01

Sl.No	Name of the programme	Name of the Course	Course Code
41	MSc Decision and Computing Sciences	Probability Distributions and Applications	22MDC21
42	MSc Decision and Computing Sciences	Organisational Behavior	22MDC22
43	MSc Decision and Computing Sciences	Data Structures and Algorithms	22MDC23
44	MSc Decision and Computing Sciences	Computer Organisation and Operating Systems	22MDC24
45	MSc Decision and Computing Sciences	Applied Probability Laboratory	22MDC25
46	MSc Decision and Computing Sciences	Data Structures and Algorithms Laboratory	22MDC26
47	MSc Decision and Computing Sciences	Python Programming Laboratory	22MDC27
48	MSc Decision and Computing Sciences	English for Employability	22MDC28
49	MSc Decision and Computing Sciences	Advanced Machine Learning	17MDCE52
Data Science			
50	MSc Data Science	Business Statistics	21MDS31
51	MSc Data Science	Discrete Structures and Automata Theory	21MDS32
52	MSc Data Science	Operating Systems	21MDS33
53	MSc Data Science	Database Systems	21MDS34
54	MSc Data Science	Data Structures and Algorithms II	21MDS35
55	MSc Data Science	Database Systems Laboratory	21MDS36
56	MSc Data Science	Data Structures and Algorithms Laboratory II	21MDS37

Sl.No	Name of the programme	Name of the Course	Course Code
57	MSc Data Science	Web Technology Framework Laboratory	21MDS38
58	MSc Data Science	Multivariate Data Analysis	21MDS41
59	MSc Data Science	Graph Theory	21MDS42
60	MSc Data Science	Design and Analysis of Algorithms	21MDS43
61	MSc Data Science	Computer Networks	21MDS44
62	MSc Data Science	Machine Learning	21MDS45
63	MSc Data Science	Design and Analysis of Algorithms Laboratory	21MDS47
64	MSc Data Science	Machine Learning Laboratory	21MDS48
Artificial Intelligence & Machine Learning			
65	M.Sc. (Artificial Intelligence & Machine Learning)	Generative Adversarial Networks	19MAME22
66	M.Sc. (Artificial Intelligence & Machine Learning)	Blochchain Technologies	20MSSE04
67	M.Sc. (Artificial Intelligence & Machine Learning)	Software Testing Laboratory	19MAMEL08
68	M.Sc. (Artificial Intelligence & Machine Learning)	Innovation, Startups and Entrepreneurship	19MAMOC05
69	M.Sc. (Artificial Intelligence & Machine Learning)	Cyber Security Lab	19MAMEL06
Master of Business Administration			
70	Master of Business Administration	Logistics and Supply Chain Management	21MBAE68
71	Master of Business Administration	B2B & B2C Sales & Marketing	21MBAE66
72	Master of Business Administration	Talent Acquisition and Management	21MBAE51

19ME32 ENGINEERING MECHANICS FOR MECHANICAL ENGINEERS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of this course, the students will be able to

CO1 *: Analyze the effect of forces on rigid bodies in equilibrium.*

CO2 *: Compute the first and second moment of inertia for simple and composite geometries.*

CO3 *: Apply concepts of energy conservation and virtual work to predict stability of equilibrium.*

CO4 *: Analyze translatory and rotary motions and examine the frictional and gyroscopic effects.*

CO5 *: Examine free and forced vibrations in damped and undamped systems.*

RIGID BODY EQUILIBRIUM

Rigid body equilibrium in space- Analysis of force and moments of system - Analysis of trusses- Method of section and joints, beams - Cables, frames and machine bodies. **(9)**

SYSTEM OF PARTICLES

First moment of mass/area of simple geometry using first principles - Centre of Mass of composite sections. Second moment of mass/area of standard geometry - Ring, disc, sphere - Parallel and perpendicular axis theorem- Moment of Inertia for composite sections and geometries. **(9)**

ENERGY CONSERVATION AND CONCEPTS OF VIRTUAL WORK

Principle of virtual work - Virtual displacements of rigid bodies, degrees of freedom - Systems with friction - mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. **(12)**

KINEMATICS OF PARTICLES

Analysis of translatory and rotary motions- Displacement- Velocity- Acceleration for motion in straight line- Projectile- Circular motion - Newton's law of motion- Rate of change of momentum/angular momentum - Impulse- Collision- Elastic and Inelastic. Rotation about a fixed axis - Absolute and relative velocity- Instantaneous center of rotation - Effects of friction in rolling- Rolling with and without slipping. Gyroscope- gyroscopic couple in automobile, aircrafts and ships - grinding mills. **(15)**

MECHANICAL VIBRATIONS

Analysis of Free vibration of damped 1 DOF system - Newton's II law and Energy Method - equivalent springs and dashpots - damped frequency - Logarithmic decrement - Forced vibration - harmonic excitation - forced and motion transmissibility - resonance - vibration isolation with and without damper - whirling of shafts - critical speed of shaft - longitudinal and transverse vibration - Free torsional vibration of two and three rotor system with geared systems. **(15)**

TOTAL : 60

TEXT BOOKS

1. *F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II, - Dynamics, 12th Edition, Tata McGraw Hill, 2019.*
2. *Irving H. Shames, Engineering Mechanics, 4th Edition, Prentice Hall, 2018.*

REFERENCES

1. *R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 14th Edition, 2017.*
2. *Andy Ruina and Rudra Pratap, Introduction to Statics and Dynamics, Oxford University Press, 2019.*
3. *S. S. Bhavikkatti, Engineering Mechanics, New age international, 2019.*
4. *https://nptel.ac.in/courses/112/106/112106286/*

19HOC41 - COMMUNICATION SKILLS FOR ENGINEERS - II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Solve objective questions on analogy, Statement and Argument, Statement and Conclusion, Data Sufficiency and Sentence improvement within a given time.*

CO2 *: Construct grammatically correct sentences*

CO3 *: Speak confidently to describe a process, present information on the specified topic and disseminate information in a professional manner.*

SELF EVALUATION

Self believe and self Esteem - Activities based on Current Events **2**

VERBAL AND LOGICAL RESONING

Analogy - Introduction, Types and Exercises - Statement and Argument - Statement and Conclusion - Data Sufficiency - Sentence Improvement - Critical Reasoning/Theme Detection **5**

GRAMMAR

Basic Grammar- Subject Verb Agreement - One word substitute - Preposition- Cause and Effect -Basic level questions and Moderate level questions **4**

PRESENTATION TECHNIQUES

Describing a Process - Presentation Skills - Introduction, Planning and Preparation - Presentation on a Topic - Group Discussion - Dos and Don'ts - Functional Expressions used in Group Discussion - Interview Skills - Ideal Grooming for an interview, Preparing for the Interview. **9**

TOTAL : 20

REFERENCES

1. *Sanjay Kumar, PushpLata, Communication Skills 2nd Edition, published by Oxford University Press, New Delhi, India, 2015.*
2. *Anthony Manning, Chris Sowton and Craig Thaine, Cambridge Academic English, published by Cambridge University Press, U P, India, 2012.*

19CHOE01 - INDUSTRIAL SAFETY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are able to

CO1 *: Practice the safety norms and inspect turning machines, boring machines, milling machine, planning machine, grinding machines, CNC machines and wood working machinery to create risk free working environment.*

CO2 *: Assess the adequacy of machinery guarding to eliminate or reduce the hazards from the point operation, flying chips and sparks and moving parts.*

CO3 *: Apply the safety concepts in welding, gas cutting, storage and handling of gas cylinders, metal forming processes, etc.,*

CO4 *: Predict, identify and evaluate, hazardous conditions and practices safety rules in in cold forming and hot working of metals*

CO5 *: Employ the safety rules in inspection and testing process and take plan the preventive measures in health and welfare of workers' aspects in engineering industry.*

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards. **(9)**

PRINCIPLES OF MACHINE GUARDING

Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS - guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability: lathe - drilling - boring - milling - grinding - shaping - sawing- shearing presses - forge hammer - flywheels - shafts - couplings -gears - sprockets wheels and chains pulleys and belts - authorized entry to hazardous installations-benefits of good guarding systems **(9)**

SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing - explosive welding, selection, care and maintenance of the associated equipment and instruments - safety in generation, distribution and handling of industrial gases-colour coding - flashback arrestor - leak detection-pipeline safety-storage and handling of gas cylinders. **(9)**

SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills - hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes. **(9)**

SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, electro plating, paint shops, sand and shotblasting, safety in inspection and testing, dynamic balancing, hydrotesting, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal

monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation. Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal **(9)**

TOTAL : 45

TEXT BOOKS

1. *Wells G.L.,R.M.C. Seagrave-Flow sheeting for safety, Indian Institute of Chemical Engineering, London U.K,1977.*
2. *TrevurKletz Butterworth, Learning from accidents, - London, 1988.*
3. *John Barton and Richard Rogers, Chemical reaction Hazards - A guide to safety, Institution of Chemical Engineering London, 1997.*
4. *Philip Hagan "Accident Prevention Manual for Business and Industry", N.S.C.Chicago, 13th edition 2009.*

REFERENCES

1. *Rohatgi A.K, Safety handling of Hazardous Chemicals Enterprises, Bombay, 1986.*
2. *Shukla S.K., Envirohazards and Techno Legal aspects, Shashi Publications, Jaipur India, 1993.*
3. *John V.Grimaldi and Rollin H.Simonds," Safety Management", Richard D Irwin, 1994.*
4. *Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.*
5. *"The Indian boilers act 1923 with amendments", Law Publishers (India) Pvt. Ltd., Allahabad.*
6. *"Health and Safety in welding and Allied processes", Welding Institute, UK, High Tech. Publishing Ltd., London, 1989.*
7. *"Safe use of wood working machinery", HSE,UK,2005.*

19EEE41 - SWITCHED MODE POWER CONVERSION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Recall the concepts of switched mode power conversion*

CO2 *: Analyze different non isolated DC-DC converters under steady-state condition.*

CO3 *: Design of magnetic components of dc-dc converters*

CO4 *: Analyze different soft-switched and resonant converters and power-factor correction techniques*

CO5 *: Select the EMI suppression techniques for different switched mode converters*

INTRODUCTION AND TRANSFORMER-ISOLATED CONVERTERS

Linear converters Vs switching converters - Basic principles of switch-mode power conversion - Single-switch and multi-switch transformer-isolated DC-DC converters - Flyback and forward converters; transformer isolated half-bridge, full-bridge converters. Push-pull converters. Voltage fed and current-fed converters. **9**

MAGNETIC COMPONENT DESIGN

Magnetic core materials and performance; basic inductor and transformer design; practical magnetic design; design aspects to be considered for designing transformers for specific applications - flyback, push-pull, bridge, forward converters. **9**

SWITCHING REGULATOR CONTROL

Small-signal models for switching regulators - Performance analysis and design of closed-loop system under different control methods, and operating modes. Measurement of small signal transfer functions. **9**

SOFT-SWITCHED AND RESONANT CONVERTERS

Hard-switching vs soft-switching - Introduction to resonant power converters and their characteristics - Detailed study of a few soft-transition converters - **7**

POWER-FACTOR CORRECTION, ELECTROMAGNETIC INTERFERENCE AND CHAOS ANALYSIS

Problems due to harmonics in the current drawn by equipment - Basic concept of active single phase power factor correction (PFC) techniques - Performance analysis and comparison of different PFC techniques -Introduction to EMI and Non-linear phenomena in switched mode power converters: Chaos. **11**

TOTAL : 45

TEXT BOOKS

1. *Middlebrook, R. D. (Robert David), and Slobodan Cuk, Advances in Switched-Mode Power Conversion, TESLA , Volumes I and II, 2nd Edition, 1983.*
2. *Marty-Brown, "Practical Switching power supply design" Academic Press, 1990*
3. *Abraham Pressman, Keith Billings, Taylor Morey," Switching Power Supply Design", Third edition, 2009.*

REFERENCE BOOKS

1. *Robert W. Erickson and DraganMaksimovic, "Fundamentals of Power Electronics", Springer, reprint of the original 2nd edition, 2012.*
2. *Flynn Whittington, "Switched Mode Power Supplies", Universities Press; Second edition, 2009*
3. *Simon Ang, Alejandro Oliva, "Power-Switching Converters ", CRC Press, Vol. No., third Edition, 2010. 1. Philip T Krein, "Elements of Power Electronics ", Oxford University Press, 2nd Edition, 2012.*
4. *Ned Mohan, Undeland and Robbin, "Power Electronics: converters, Application and design" John Wiley & sons. 2013 (reprint).*
5. *Keith Billings, Taylor Morey "Switch mode Power Supply Handbook, "McGraw Hill, third edition, November 2010.*
6. *L Umanand, S R Bhat , "Design Of Magnetic Components For Switched Mode Power Converters", New Age International (P) Ltd., Publishers, 2017*
7. *Lazar Rozenblat, "Switching Power Supply Design: A Concise Practical Handbook", Kindle Edition, 2021.*
8. *Tse, C.K., di Bernardo, M, "Complex behavior in switching power converter", CRC Press 2003.*

19EEE42 - UTILIZATION OF SOLAR ENERGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Infer the solar thermal energy system for thermal energy collection and storage and its' use in the buildings.*

CO2 *: Design the solar PV system for the given applications and to explain the data monitoring system.*

CO3 *: Interpret and analyze the applications of solar thermal energy system*

CO4 *: Interpret and analyze the applications of solar PV system*

CO5 *: Identify the factors involved in economic analysis and explain about E-waste management.*

SOLAR THERMAL ENERGY SYSTEM

Solar collectors: Liquid flat plate collectors, Concentrating collectors, advantages and disadvantages and comparison - Thermal energy storage: Sensible heat storage and latent heat storage - solar pond - Solar heating of buildings: Principle and system components - Solar cooling of buildings: Principle and system components - Solar pond: Principle of operation, applications of solar ponds - Basic concepts of energy efficient buildings **9**

SOLAR PHOTOVOLTAIC ENERGY SYSTEM

Design aspects of solar PV installation: Technical and general requirements of solar PV module, Main components of solar PV system: Solar panel, Batteries (types, parameters and factors affecting battery performance, Charge controllers, Converter requirements) - installation practices of solar panel -sizing of wires - Electrical safety standards and requirements - Data monitoring system: Remote monitoring - On-site monitoring **10**

SOLAR THERMAL APPLICATIONS

Principle of operation: Solar furnace, Solar Distillation, Solar Water Heating, Solar Air Heating and solar pumping system - Industrial process heat: Types and choice of solar collectors, examples for industrial applications - Solar green house concepts **10**

SOLAR PV APPLICATIONS

Home Lighting Systems - Street lighting systems - Battery Charging Stations - PV powered water pumping system - PV powered refrigeration system - Military uses - Solar lanterns - Solar energy utilization in space - MNRE schemes for grid connected and off-grid applications **9**

ECONOMIC ANALYSIS AND E-WASTE HANDLING

Initial cost - Annual cost - Annual savings - Cumulative savings - Life cycle savings - Payback period - Present worth factor - operation and maintenance cost - Economic Analysis Methods.

E-waste - Indian Scenario - Health and environmental hazards - Recycling concepts of E-waste - E waste generation and handling of solar power plants **7**

TOTAL : 45

REFERENCE BOOKS

1. *S.P. Sukhtme & J.K. Nayak, "Solar Energy: Principles of thermal collection and storage", McGraw-Hill Education (India), 3rd edition, 2015*
2. *G.D. Rai," Solar energy utilization", Khanna Publishers, New Delhi, 2017*
3. *H P Garg & J. Prakash, "Solar Energy - Fundamentals and applications", Mcgrew Hill Education, New Delhi, 2016*
4. *Chetan Singh Solanki, "Solar Photovoltaics, Fundamentals, Technologies and Applications", PHI learning, New Delhi 2009.*
5. *Hand book on installation and maintenance of solar panel - Government of India*
6. *Ministry of Electronics and Information Technology (MeitY) - Relevant downloads*

19EEE43 - WEARABLE SENSORS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Identify the development areas of wearables and its impact on various sectors*

CO2 *: Design & recognize various electrodes in monitoring devices for healthcare applications*

CO3 *: Discuss biochemical and gas sensors as wearable devices in medical & other allied industries*

CO4 *: Realize Electronic textiles in wearable technology and acquire the knowledge in textile sensors*

CO5 *: Comprehend the design & development of various wearable's for physiological changes and other detections in human body*

INTRODUCTION

Wearable Devices development -advent of wearable computing -wearable sensors in various sectors: Industry sectors' overview - sports, healthcare, Fashion and entertainment, military, environment monitoring, mining industry, public sector and safety.

Wearable haptics: World of wearable's - Attributes of wearable's - Intelligent clothing: The meta wearable - Challenges and opportunities - Future of wearable's - Need for wearable haptic devices - Categories of wearable haptic and tactile display **9**

WEARABLE DEVICES FOR HEALTH CARE

Design, fabrication & geometry of Electrode- Wearable Bioelectric impedance devices for Galvanic skin response; Wearable ECG device, wearble EEG device, Wearable EMG devices: EMG/ SEMG Signals, EMG Measurement - wearable surface electrodes, SEMG Signal Conditioning- Wearable Blood Pressure (BP) Measurement: Cuff-Based Sphygmomanometer, Cuffless Blood Pressure Monitor- Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles - thermistor, infrared radiation, thermopile **9**

WEARABLE SENSORS

Introduction - Challenges in chemical and biochemical sensing -Types Invasive, Non-invasive Wearable inertial sensors- Flex sensor, pulse oximeter, glucose sensor, Inertial sensor, dehydration sensor, pH sensor, heart rate sensor, gas sensor, haptic glove, fitness tracker-Applications for wearable motion sensors - Practical considerations for wearable inertial sensor - Conductive textile electrodes, Knitted Piezoresistive Fabric (KPF) sensors **9**

TEXTILE SENSOR TECHNOLOGY

Introduction to Textile electrode- smart fibers to textile sensors - Interlaced network-Textile sensors for physiological state monitoring - Biomechanical sensing - Noninvasive sweat monitoring by textile sensors- FBG sensor in Intelligent Clothing and Biomechanics.- textile sensor technology for athletes **9**

APPLICATIONS OF WEARABLE'S

Wearable's for the Monitoring of Physical and Physiological Changes in Daily Life- Wearing Sensors Inside and Outside of the Human Body for the Early Detection of Diseases- Wearable and Non-Invasive

Assistive Technologies- Application of Optical Heart Rate Monitoring -Wearable's with Global Positioning System (GPS) integration for tracking and navigation- Applications of wearables for military personnel's & its design difficulties -Photoplethysmography (PPG) **9**

TEXT BOOKS

1. *Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York*
2. *Edward Sazonov, Michael R. Newman, "Wearable Sensors: Fundamentals, Implementation and Applications", 2014, 1st Edition, Academic Press, Cambridge*
3. *Kate Hartman, "Make: Wearable Electronics: Design, prototype, and wear your own interactive garments", 2014, 1st Edition, Marker Media, Netherlands*

REFERENCE BOOKS

1 *John G Webster, "Measurement, Instrumentation and sensor Handbook", 2017, 2nd edition, CRC Press, Florida*

2 *Michael J. McGrath, Cliodhna Ní Scanaill, "Sensor Technologies Healthcare, Wellness, and Environmental Applications" 2013, Apress, springer*

3 *Subhas C. Mukhopadhyay" Wearable Electronics Sensors For Safe and Healthy Living",2015, Springer International Publishing*

4 *Katsuyuki Sakuma "Flexible, Wearable, and Stretchable Electronics" 2020,CRC Press*

5 *Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland*

6 *Gerd Keiser, "Optical Fiber Communications", 2017, 5th edition, McGraw-Hill Science, Delhi.*

19CIOC01 - C++ PROGRAMMING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Be able to explain the difference between object-oriented programming and procedural programming.*

CO2 *: Be able to program using C++ features such as objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, exception handling, etc.*

CO3 *: Be able to build C++ classes using appropriate encapsulation and design principles.*

TOPICS TO BE COVERED

C++ Overview - Classes and Encapsulation- Member Functions- Instantiating and Using Classes- Constructors and Destructors- Overview of Inheritance- Defining Base and Derived Classes-Types of Inheritance-Overview of Polymorphism and Abstract Classes-Exceptions- Inheritance and Exceptions- Exception Hierarchies.

REFERENCES

1. *E.Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 7th Edition, 2018.*
2. *Bjarne Stroustrup, "The C++ Programming Language", Addison Wesly , 4th Edition, 2013.*

19ECOC03 - PROBLEM SOLVING WITH ALGORITHMS AND DATA STRUCTURES

(ONE CREDIT COURSE- LABORATORY)

LIST OF EXPERIMENTS

- Sparse and Dense Matrix operations using arrays
- Implementation and Applications of Linked List- Singly linked, Doubly linked and Circular lists
- Implementation and applications of stacks
- Implementation and application of queues
- Binary search trees and Minimum cost spanning tree
- Graphs - Depth First Search and Breadth First Search
- Sorting algorithms

REFERENCES

1. *Jean Paul Tremblay and Sorenson, An Introduction to Data Structures with Applications, McGraw Hill Publishing Company, New Delhi, 2012.*
2. *Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, MIT Press, England, 2009.*
3. *Venkatesan R and Lovelyn Rose S, Data Structures, Wiley India Pvt Ltd, New Delhi, 2015.*
4. *Laboratory Manual , Prepared by Department , CIT*

19ECOC02 - QUANTITATIVE APTITUDE FOR ENGINEERS / VERBAL APTITUDE FOR ENGINEERS

APTITUDE SYLLABUS

QUANTITATIVE

- Time And Work
- Time, Speed, Distance
- Averages
- Ratios & Proportion
- Sequence, Series and Progressions
- Co-Ordinate Geometry
- Statistics
- Combinatorics
- Percentage
- Trigonometry
- Set Theory
- Theory of Equation
- Logarithms
- Functions and Graph
- Data Interpretation on Multiple Charts
- Profit and Loss
- Simple Equations
- Algebra
- Geometry
- Data Interpretion
- Alligations and Mixtures
- Simple Interest & Compound Interest
- Pipes and Cisterns
- Problems on HCF and LCM
- Linear Algebra
- Probability
- Percentages
- Permutations & Combinations
- Numbers
- Functions
- Mensuration
- Sudoku
- Areas Shapes, Perimeter
- Height and Distance
- Partner ship
- Races and Games

- Simplification
- Clocks & Calendars
- Problems on Ages
- Surds & Indices
- Data Sufficiency
- Problems on Trains
- Cryptarithmetic
- Divisibility
- Numbers and Decimal Fractions
- Spatial Ability
- Chain Rule

VERBAL

- Paragraph Formation
- Sentence Completion
- Reading Comprehensions
- Sentence Correction
- Spotting Errors
- Sentence Selection
- Antonyms
- Synonyms
- Theme Detection
- Parts of Speech
- Jumbled Sentences
- Selecting Words
- Sentence Improvement
- Odd Words
- Sentence Formation
- Fact - Inference - Judgement
- Fill in the Blanks
- One Word Substitution
- Idioms and Phrases
- Spellings

19ECOC05 - PROGRAMMING IN C++

BASICS OF C++ & ABSTRACT DATA TYPE IN C++

Introduction to C++ - Programming Paradigms - Procedural Programming - Conquering Complexity - Built-in Types - Arrays and Pointers - Comments, Keywords & I/O Streams- Built-in Operators and Control Constructs - Structures, References and Functions

Encapsulation: Data Members, Member Functions, Private and Public - Constructors and Destructors: Default Arguments, Storage Allocation and Deallocation, this Pointer, Copy Constructors. **(7)**

OPERATOR OVERLOADING & POLYMORPHIC PROGRAMMING

Operator functions - Binary and unary operators - Member and non-member operators - Friend functions - Initialization vs. Assignment - Stream Input and Output Inheritance: Public Inheritance and Subtyping, Base and Derived Classes, Constructors and Destructors, Base Class Initialization, Using Protected keyword- Virtual Functions: Base Class Pointers and References - Dynamic Binding: Abstract Base Classes, Pure Virtual Functions & Virtual Destructors -Exceptions: try, catch & throw -Exception Hierarchies - File streams. **(8)**

TOTAL : 15

REFERENCES

1. *BjarneStroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2000.*
2. *Stanley B Lippman, Jove Lajoie, and Barbara Moo "C++ Primer", 5th Edition, Addison Wesley, 2012.*

19CIOC06 - COMPREHENSIVE EXAM TRAINING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To prepare and equip the students for various competitive exams*

CO2 *: To relearn and refresh the core concepts in the domains like Data Structures, Digital Design, Database Management Systems, Programming, Computer Architecture, Operating Systems and Automata Theory.*

C PROGRAMMING

Programming in C, Recursion, Arrays, Structures and Pointers.

DATA STRUCTURES AND ALGORITHMS

Linked Lists, Stacks, Queues, Trees, Graphs, Sorting and Searching.

DIGITAL DESIGN

Boolean algebra, Combinational and Sequential circuits, Minimization, Number representations, Fixed and floating point computer arithmetic.

DATABASE MANAGEMENT SYSTEMS

ER-model, Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, Normal forms, B+ tree indexing, Transactions and concurrency control.

COMPUTER ARCHITECTURE

Machine instructions and Addressing modes, ALU, Data-path and Control unit, Instruction pipelining, Pipeline hazards, Memory hierarchy: cache, main memory and secondary storage, I/O interface: interrupt and DMA mode.

OPERATING SYSTEMS

System calls, Processes, Threads, Deadlock, CPU and Disk scheduling, Memory management and Vrtual memory.

FORMAL LANGUAGES AND AUTOMATA THEORY

Regular Expressions and Finite Automata, Context-Free Grammars and Push-Down Automata, Contex-Free Languages, Pumping lemma, Turing machines.

19ECI01 - PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP (NALAYA THIRAN)

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

On completion of the course, the students will be able to:

CO1 *: Upskill in emerging technologies and apply to real industry-level use cases*

CO2 *: Understand agile development process*

CO3 *: Develop career readiness competencies, Team Skills / Leadership qualities*

CO4 *: Develop Time management, Project management skills and Communication Skills*

CO5 *: Use Critical Thinking for Innovative Problem Solving*

CO6 *: Develop entrepreneurship skills to independently work on products*

Choosing a Project : Selecting a project from the list of projects categorized various technologies & business domains. **(2 weeks)**

Team Formation : Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves. **(1 week)**

Hands on Training : Students will be provided with hands-on training on selected technology in which they are going to develop the project. **(2 weeks)**

Project Development : Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform. **(6 weeks)**

Code submission, Project Doc and Demo : Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub. **(3 weeks)**

Mentor Review and Approval : Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team. **(1 week)**

Evaluation and Scoring : Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics. **(1 week)**

TOTAL : 16 weeks

19IT72 - INTERNET OF THINGS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Describe the physical and logical design of IoT with suitable enabling technologies*

CO2 *: To Assess the technologies such as M2M , SDN, NFV with IoT and IoT system management*

CO3 *: Discuss the implementation of logical design of IoT using Python.*

CO4 *: To provide Hands on Knowledge on Physical devices such as Arduino and Raspberry Pi.*

CO5 *: To learn Data Analytics for IoT and IoT use cases in specific domains.*

INTRODUCTION TO IOT

Physical design of IoT - Logical design of IoT - Enabling Technologies - IoT Levels -Domain specific IoT (Principle only) use cases. **(8)**

IoT AND MACHINE TO MACHINE

Introduction to IoT and M2M - SDN and NFV for IoT -IoT systems Management with NETCONF-YANG - Need for IoT system Management -SNMP - IoT Design Methodology. **(9)**

IoT LOGICAL DESIGN METHODOLOGY

IoT System Logical Design using Python: Introduction - Python DataTypes and Data Structures - Control Flow - Functions- Modules- Packages- File Handling - Date/time Operations - Classes - Python Packages for IoT. **(10)**

IoT PHYSICAL DEVICES - ARDUINO AND RASPBERRY PI

Basic Building Blocks - Arduino - Raspberry Pi - About the Board - Linux on Raspberry Pi - Interfaces- Programming Raspberry Pi with Python - IoT Devices : pcDuino - Beagle Bone Black -Cubie Board - Introduction to Cloud Storage model and Communication APIs. **(9)**

DATA ANALYTICS FOR IOT AND USECASES

Introduction - Apache Hadoop - Using Hadoop MapReduce for Batch data Analytics - Apache Oozie - Apache Spark - Apache Strom - Using apache Strom for Real Time Data Analytics - IoT UseCases - Agriculture - Home Automation - Smart City - Smart Grid - Building Automation - Structural - Health Care - Industry 4.0. **(9)**

TOTAL : 60

TEXT BOOK

1. *Arshdeep Bahga, Vijay Madisetti, "Internet of Things - A hands -on approach", Universities Press, 2017.*

REFERENCES

1. *Adrian Mcewn, Hakin Cassimally, "Designing the Internet of Things", Wiley Publications, 2015.*
2. *Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Ley Applications and Protocols", Wiley Publications, 2015.*
3. *CunoPfister, "Getting Started with the Internet of Things", Shroff, First Edition, 2011.*

19ITL73 - INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO 1 *: Develop Simple Assembly Language Program*

CO 2 *: Develop Embedded C programs*

CO 3 *: Develop applications based on IOT and Sensors*

LIST OF EXPERIMENTS

1. Sensor based application development
2. IOT Study experiments on Smart Dustbin, Sound Sensor and Optical Light Sensor
3. Implementation of Magnetic Reed switch controls
4. Implementation of DC motor Operations
5. Implementation of Touch Sensor applications
6. Implementation of Ultra Sonic Sensor applications
7. IoT Implementation on various use cases

19ITL74 - MOBILE APPLICATION DEVELOPMENT LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Knowledge on the structure of mobile application development framework for mobiles.*

CO2 *: Design mobile applications using appropriate GUI components.*

CO3 *: Develop mobile applications for real world applications using the appropriate interfaces available on mobile devices.*

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Study of Android architecture and Mobile Application Development Framework.
2. Mobile Application Design using GUI components and layouts
3. Event Handling in Mobile Applications
4. Mobile Application Development with databases such as sqlite
5. Accessing other applications in the device such as SMS
6. File Handling to manipulate data in SD Card
7. Mobile applications utilizing GPS location information
8. Mobile Applications to create alert messages, setting notifications/alarms etc.
9. Communication with internet applications/network communications

19CHE31 - CARBON CAPTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students will be able to

CO1 *: Discuss the impacts of climate change and the measures that can be taken to reduce emissions.*

CO2 *: Discuss carbon capture and carbon storage and Explain the fundamentals of power generation.*

CO3 *: Explain methods of carbon capture from power generation and industrial processes.*

CO4 *: Explain different carbon storage methods: storage in coal seams, depleted gas reservoirs and saline formations.*

CO5 *: Explain Carbon dioxide compression and pipeline transport.*

INTRODUCTION

The Carbon Cycle, Mitigating Growth of The Atmospheric Carbon Inventory, The Process of Technology Innovation. Carbon Capture, Carbon Storage. **(9)**

FUNDAMENTALS OF POWER GENERATION

Physical and Chemical Fundamentals, Fossil-Fuelled Power Plant, Combined Cycle Power Generation, Future Developments in Power-Generation Technology. **(9)**

CARBON CAPTURE FROM POWER GENERATION

Introduction, Pre-combustion Capture, Post-combustion Capture, Oxy- fuel Combustion Capture, Chemical Looping Capture Systems, Capture-Ready and Retrofit Power Plant, Approaches to Zero-Emission Power Generation. **(9)**

MEMBRANE SEPARATION SYSTEMS

Physical and Chemical Fundamentals, Membrane Configuration and Preparation and Module Construction, Membrane Technology RD&D Status, Membrane Applications in Pre-combustion Capture, Membrane and Molecular Sieve Applications in Oxy-fuel Combustion, Membrane Applications in Post-combustion CO2 Separation, Membrane Applications in Natural Gas Processing **(9)**

CRYOGENIC AND DISTILLATION SYSTEMS

Physical Fundamentals, Distillation column configuration and operation, Cryogenic oxygen production for oxy-fuel combustion, Ryan-Holmes process for CO2 - CH4 separation, R&D in cryogenic and distillation technologies. **(9)**

TEXT BOOK

1. *Carbon Capture and Storage Stephen A. Rackley Elsevier 2010.*

19CHE32 - MATERIAL SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students will be able to

***CO1** : Demonstrate selection criteria of materials based on their relevant applications in process industries.*

***CO2** : Explain various mechanical properties of material with their end use*

***CO3** : Construct Phase diagrams for various unary and binary situations and to interpret properties from Iron-Carbide diagrams.*

***CO4** : Explain properties of ferrous and non-ferrous metals and its composites.*

***CO5** : Explain nanomaterials and their applications.*

INTRODUCTION

Structure - Property relationship - Selection criteria and processes: General criteria of selection of materials in process industries. Properties: Mechanical, Thermal, Physical, Chemical, Electrical, Magnetic and Technological properties. Processing of Metals and Alloys- Casting, Hot and cold rolling, Forging, Extrusion, Deep drawing. **(9)**

MECHANICAL BEHAVIOUR

Elastic, Anelastic and Viscoelastic Behaviour - Introduction to Slip, Slip planes, Plastic Deformation by Slip: Critical resolved shear stress, Mechanism of Creep, Creep Resistant Materials - Fracture: Ductile and Brittle, Fatigue fracture, Griffith's theory, S-N curves, Fracture toughness. **(9)**

PHASE DIAGRAMS AND PHASE TRANSFORMATIONS

Gibb's Phase rule : Uniary and Binary phase diagrams , Al2CO3 - Cr2O3 , Pb-Sn, Ag-Pt and Iron- Iron Carbide Phase Diagram - Lever rule - Invariant reactions- TTT diagrams - Micro structural changes - Nucleation and growth - Martensitic transformations - Solidification and Crystallization - Glass transition - Recrystallization and Grain growth **(9)**

FERROUS, NON-FERROUS METALS AND COMPOSITES

Pig iron, Cast iron, Mild Steel-Manufacturing process, properties &, Applications Stainless steels, Special Alloy steels-properties and uses; Heat treatment of plain-carbon steels Manufacturing methods of Lead, Tin and Magnesium. Properties and applications in process industries. FRP-Fiber Reinforced Plastics (FRP), manufacturing methods; Asphalt and Asphalt mixtures; Wood. **(9)**

NANOMATERIALS

Introduction to Nanotechnology- Zero Dimensional Nano Structures - Nano particles - One .Dimensional Nano Structures- Nano wires and Nano rods - Two Dimensional Nano Structures, Films - Special Nano Materials - Nano Structures fabricated by Physical Techniques - Characterisation and Properties of Nano Materials - Applications of Nano Structures. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Khanna O P, "Material Science and metallurgy" Dhanpat Rai Publications (1995)*
2. *Raghavan V, "Materials and Engineering" Prentice Hall of India, Newdelhi (2006)*
3. *Brenner D, "Hand book of Nanoscience and technology" (2002)*
4. *Material Science & Engineering, Callister*

REFERENCES

1. *Henry R Clauster, "Industrial and Engineering Materials" McGraw Hill Book Co. (1975)*
2. *Kingery W D and Bowen H K and Unimann D R, "Introduction to Ceramics" John Wiley and Sons, Second edition (1991)*
3. *Fahrner W R, "Nanotechnology and Nanoeletronics" Springer International edition(2005)*
4. *Budinsky K G and Budinsky K M "Engineering Materials- Properties and Selection" Prentice Hall of India (2002)*
5. *Arumugam M, "Material Science" Anuradha Technical Book Publishers (1997)*

19CHE33 - BIOPROCESS TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students will be able to

CO1 *: Explain the mechanism of fermentation process*

CO2 *: List and differentiate different inoculum for bacterial and fungal process*

CO3 *: Explain the various microbial kinetics used in bioprocess technology*

CO4 *: Design bioreactor for given duty'*

CO5 *: Design bio reactor with various configurations.*

BIOPROCESS DEVELOPMENT

An interdisciplinary challenge, Biotechnology & Bioprocess Engineering, steps in bioprocess development, Microbial culture, Screening and selection for fermentation processes; Preservation and improvement of industrially important microorganisms, Strain development. **(9)**

MEDIA FOR INDUSTRIAL FERMENTATIONS

Media ingredients, medium formulation, oxygen requirements, antifoams, medium optimization, Ingredients for mammalian cell culture and plant cell culture. Inoculum production for bacterial and fungal processes. Media sterilization, Batch Process (thermal death kinetics), continuous sterilization process; sterilization of fermenter and other ancillaries, filter sterilization of air and media. **(9)**

INOCULUM DEVELOPMENT FOR INDUSTRIAL FERMENTATION & MICROBIAL KINETICS

Introduction, Criteria for transfer of inoculum, development of inocula for bacterial processes, yeast processes and mycelial processes. Inoculum development for plant fermenter, aseptic method of inoculation, achievement and maintenance of aseptic conditions. Fermentation Material and Energy balance, Microbial growth kinetics: Microbial growth cycle, measurement of growth, Batch culture, continuous culture, fed-batch culture, applications and examples. **(9)**

DESIGN OF BIOREACTORS

Basic objective of fermenter design, aseptic operation & containment, body construction, agitator and sparger design, baffles, stirrer glands and bearings. Process parameters and measurement techniques: measurement of temperature, pressure and pH, DO, foam etc.; flow rate of liquid and gases; Automation (processes computerization). Validation of Fermentor. **(9)**

BIOREACTOR CONFIGURATIONS AND TYPES

Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Solid state fermenter, Animal and plant cell bioreactors. Scale up and Scale down studies of bioreactors. Heat and Mass transfer in Bioprocess, Relationship in between heat transfer, cell concentrations and stirring conditions, Measurement of KLa, Rheological properties of fermentation broths, Factors affecting broth viscosity, Mixing in Fermenters. **(9)**

TEXT BOOKS

1. *Comprehensive biotechnology, vol 1, 2, 3 and 4 Murray moo young, Pergamon press2004.*
2. *Principles of fermentation technology P.F. Stanburry& Whitaker Pergamon Press, II Ed, Butterworth Heinemann-Elsevier, 2005.*
3. *Bioprocess Engineering, Basic Concepts, II Ed. Michael L Shuler, FikretKargi, Prentice Hall of India pvt. Ltd. 2002.*
4. *Pauline M. Doran, Bioprocess Engineering Principles, Academic Press an Imprint of Elsevier.*
5. *Coulson & Richardson's Chemical Engineering, R.K. Sinnotl, III Ed. Vol 6 ButterworthHeinemann-Elsevier Pub, 1999.*

REFERENCES

6. *Coulson & Richardson's Chemical Engineering, J F Richardson & J H Harker, 5th Ed, Vol 2, Butterworth- Heinemann-Elsevier Pub, 2003.*
7. *Manual of Industrial Microbiology & biotechnology, Arnold Demain& Julian E. Davis, II Ed, ASM Press. Washington DC, 1999.*
8. *Current developments in Solid Substrate fermentation, Ashok Pandey, Carlos Ricardo Soccol, Christian Larroche - 2008.*
9. *Industrial Biotechnology by Rita Singh, S. Ghosh, Global Vision Publishing Ho, 2004*
10. *Industrial Biotechnology: Sustainable Growth and Economic success by WimSoetaert, Erick J. Vandamme.*

19CHE34 - PILOT PLANT AND SCALE-UP METHODS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are able to

CO1 *: Understand the techniques to solve problems relevant to the general practice of chemical engineering and engineering design.*

CO2 *: Experience in the process of original chemical engineering design in the three areas of equipment design, process design, and plant design through the process of formulating a design solution to a perceived need and then executing the design and evaluating its performance including economic considerations and societal impacts.*

CO3 *: Understand the effects of scale on the relative rates of mass, heat and momentum transfer, mixing effects, utility of various reactor operating modes and the acquisition of reliable kinetic, thermodynamic and transport data.*

CO4 *: Ability to use different approaches for process scale - up and perform a power analysis and understand flow regimes basic to scale up.*

PRINCIPLES OF SIMILARITY, PILOT PLANTS AND MODELS

Introduction to scale up methods, pilot plants and models and principles of similarity. **(9)**

DIMENSIONAL ANALYSIS AND SCALE - UP CRITERION

Dimensional Analysis, Regime concept, similarity criterion and scale up methods used in chemical engineering. **(10)**

SCALE - UP OF MIXING AND HEAT TRANSFER EQUIPMENT

Typical problems in scale - up of mixing equipment and heat transfer equipment. **(9)**

SCALE - UP OF CHEMICAL REACTORS

Kinetics, Reactor Development and scale - up techniques for chemical reactors. **(9)**

SCALE - UP OF DISTILLATION COLUMN AND PACKED TOWERS

Scale - up of distillation columns and packed towers for continuous and batch process. **(8)**

TOTAL : 45

TEXT BOOKS

1. *John stone,Thring, Pilot plants models and scale - up methods in chemical Engineering, McGraw - Hill, New York, 1962.*
2. *Marko Zlokarnik, Dimensional Analysis and scale - up in Chemical Engineering, Springer - Verlag, Berlin, Germany, 1986.*

REFERENCE

1. *Donald. G. Jordan. Chemical Process Development (Part 1 and 2), Interscience Publishers, 1988.*

17MDC49 - MANAGERIAL COMMUNICATION SKILLS

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Conceive appropriate verbal responses from the learners to a given social situation, using the guidelines to effective speaking skills and body language.*
- *Generate trouble shooting solutions to develop team building and interpersonal skills with case studies that focus on body language and empathy.*
- *Develop appropriate responses for business phone calls and formulate effective resolutions to professional conflicts that arise out of cross cultural communication gaps in a given managerial context.*
- *Compose appropriate written responses to professional problems faced by a team at the workplace arising out of ineffective communication skills.*

INTRODUCTION

Introduction - Code and Content - Stimulus and Response: Source - The Encoding Process - The Channel - The Decoding Process - The Receiver - Speaking Skills - Effective Speaking Guidelines - Communicating Soft Skills: A Self-assessment - Closing Tips **(6)**

SOFT SKILLS

Introduction to Soft Skills - Lessons from the Three Case Studies - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft Skills: Time Management - Attitude - Responsibility - Ethics, Integrity, Values and Trust - Self-confidence and Courage - Consistency and Predictability - Teamwork and Interpersonal Skills - Communication and Networking - Empathy and Listening Skills - Problem Solving, Troubleshooting and Speed reading - Leadership - Body Language **(7)**

TELEPHONING SKILLS & NEGOTATIONS

Preparing to make a telephone call - Receiving calls - Taking and leaving messages - Asking for and giving repetition - The secretarial barrier - Cross-cultural communication on the telephone - Setting up appointments - Changing arrangements - Ending a call - Cross-cultural communication on the telephone - Problem-solving on the telephone - Complaints - Negotiations: Types of negotiation - Preparation for a negotiation - Making an opening statement - Bargaining and making concessions - Accepting and confirming - Summarizing and looking ahead - Types of negotiator - Dealing with conflict - Rejecting - Ending the negotiation **(10)**

WRITING SKILLS TO CREATE AN IMPRESSION

Introduction- Fifteen Principle to Increase Clarity in Communication - Edit-Edit-Edit: The Reader's Perspective - Clarity of Thought - Clarity of Text. **(7)**

Total : 30

REFERENCE BOOKS

1. *Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.*
2. *Krishna Mohan, Meera Banerji. "Developing Communication Skills" Mac Million Publishers, 2012.*
3. *Sai Lakshmi. B, "Poly Skills- A Course in Communication and Life Skills" Cambridge University Press, 2012.*

17MDC58 - PERSONALITY DEVELOPMENT

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Ascertain the various concepts of Self like the Physical Self - Energy Self - Intellectual Self - Mental Self - Blissful Self with respect to the Western(Occidental) and Eastern(Oriental) theories of the Self and Personality Development.*
- *Outline the significant effects of Self Confidence to build team confidence, given the foundation principles of Self Motivation and Confidence.*
- *Assess the various personalities and Attitudes and choose the best attitude for making bold decisions in personal and professional contexts.*
- *Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.*

PERSONALITY DEVELOPMENT

One's Personality Sends Out a Signal That Others Read - Same Person: Consciously Different Personalities can be Powerful - There isn't One Right Personality; It Differs by Role - Learning about Personality Development from the Three Cases - Personality Analysis - Freudian Analysis of Personality Development - Swami Vivekananda's Concept of Personality - Development: Physical Self - Energy Self - Intellectual Self - Mental Self - Blissful Self - Personality Begets. **(10)**

LEADERSHIP QUALITIES & INTERPERSONAL SKILLS:

Resolving Conflict - A Smiling Face - Appreciative Attitude - Assertive Nature - Communication Skills - Listening Skills - Developing Empathy - The Personality Attribute of Taking Bold Decisions - Personality Types and Leadership Qualities - Mapping the Different Personality Types - Personality Tests: Example of a Personality Test: Jung Typology Test - Personality Assessment **(10)**

ETIQUETTE

Social Etiquette - Corporate Etiquette - Personal Grooming - Using minimal Body Language - Leadership and Entrepreneurship : Corporate Training - Professionalism - Self awareness - Creativity skills - Cognitive Development - Assertiveness - Positive Thinking and Attitude. **(10)**

Total : 30

REFERENCE BOOKS

1. *Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.*
2. *Krishna Mohan, Meera Banerji. "Developing Communication Skills" Mac Million Publishers, 2012.*
3. *Sai Lakshmi. B, "Poly Skills- A Course in Communication and Life Skills" Cambridge University Press, 2012.*

17MDC95 - MINOR PROJECT - DECISION TOOL DEVELOPMENT

L	T	P	C
0	0	8	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Investigate the business problem in detail*
- *Identify the logical and ordered process to address all the critical elements of the business problem*
- *Analyze various alternatives and select the best alternative for the problem*
- *Develop the decision tool with the help of the analysis*

Effectiveness in managing the business decision making will ultimately determine the success of the company. But this is a problem for companies of all sizes particularly with the companies that are growing rapidly. At this point a clear mechanism for managing, communicating and confirming decision implementation is essential. Hence this minor project concentrates on developing a decision tool for the Chosen business process.

In this minor project students have to :

- Choose a business problem and develop a decision tool for to address the same.

17MDC71 - PROJECT WORK AND VIVA VOCE - I

L	T	P	C
18			

PRE-REQUISITES

Should have undergone all courses upto 6th Semester

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

17MDC101 - PROJECT WORK AND VIVA VOCE - II

L	T	P	C
			18

PRE-REQUISITES

Should have undergone all courses

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

22MDC11 TECHNICAL ENGLISH

L	T	P	C
2	0	1	2

ASSESSMENT: THEORY

COURSE OUTCOME:

CO 1: Compose appropriate dialogues, construct descriptive paragraphs and review, for a given communication context

CO 2: Categorize the barriers to communication and formulate solutions for a Communication context. Generate functional expressions and construct dialogues, for a given situation, like introducing oneself, asking questions, disagreeing, expressing preferences, asking for and giving directions.

CO 3: Specify appropriate responses and construct a summary, for a given short conversations and Monologues for listening

CO 4: Interpret the given technical graphical representation and compose passages. summarize and paraphrase technical texts in about 250 to 300 words.

CO 5: Apply the rules of the grammar viz., word formation, Verbs, Tenses, Question Tags, Prepositions, Articles, Conjunctions, Concord, Idiomatic Expressions, One Word Substitutes, Homophones and Homonyms, Linking words, adjectives and degrees of comparison, use appropriate patterns in the given sentence.

FOCUS ON LANGUAGE: GRAMMAR & VOCABULARY

Tenses – Question Tags – Prepositions – Articles – Conjunctions – Subject Verb Agreement – Idiomatic Expressions - Word Formation: Prefixes & Suffixes - One Word Substitutes – Homophones and Homonyms – Contracted form of Verbs – Emphasis - Linking Words – Common Errors and Redundancies – Adjectives - Degrees of Comparison

(5 hours)

TECHNICAL COMMUNICATION

Importance of Technical Communication - Objective & Characteristics of Technical Communication – General and Technical Communication – Process of Communication - Levels of Communication – Flow of Communication –Visual Aids in Technical Communication - Barriers to Communication: Noise – Classification of Barriers –Non-verbal Communication: Kinesics – Proxemics- Chronemics - Social Media Etiquette

(5 hours)

READING

Reading Comprehension – Skimming and Scanning – Summarizing **–** Sequencing of Sentences - Intensive & Extensive Reading- Note Making – SQ3R Reading Technique.

(4 hours)

WRITING

Gadget Review – Types of Paragraphs – Description – Describing Structures – Information Transfer - Describing Trends – Paragraph Construction - Paragraph Patterns – Kinds of Paragraph – Writing a First Draft, Revising & Finalizing - Steps to Effective Précis Writing - Dialogue Writing – Essay Writing.

(6 hours)

LISTENING

Meaning and Art of Listening-Importance of Listening & Empathy in Communication – Reasons for Poor Listening – Traits of a good listener – Listening modes - Listening and Filling Information – Identifying parts from a discussion.

(4 hours)

SPEAKING

Introducing Oneself- Asking Questions –Retelling an Incident – Small Talk – Disagreeing – Expressing Preferences – Asking for and Giving Directions -Achieving Confidence, Clarity & Fluency – Vocal Cues - Barriers to Speaking – Types of Speaking – Persuasive Speaking – Public Speaking - Effective Presentation Strategies – Planning - Outlining & Structuring – Nuances of Delivery – Controlling Nervousness & Stage Fright – Making an Oral Presentation -Visual Aids in Presentation – Applications of MS Power Point.

(6 hours)

22MDC12- APPLIED ALGEBRA AND CALCULUS

L	T	P	C
3	1	0	4

PRE-REQUISITES
Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME:

CO 1: Gain knowledge about the basic concepts in financial mathematics and application of numerical methods in solving equations occurring in business modelling
CO 2: Apply matrix methods to solve real world problems
CO 3: Apply differential calculus to solve optimization problems in economics and business
CO 4: Apply integral calculus to solve real world problems in economics and finance
CO 5: Perform empirical data analysis

ALGEBRA

SEQUENCES AND SERIES: Arithmetic, geometric and harmonic sequences-Finite and infinite series. Convergence and divergence of infinite series-Simple examples - nth term test for divergence and p-series convergence.

Applications of series in financial mathematics: Simple and Compound Interest-Nominal and Effective Interest Rates-Continuous Compounding -Future Value and Present Value-Annuities-Ordinary Annuity: Future and Present Value, Annuity Payment, Principal Sum, Period and Interest Rate, Annuity Due, Deferred Annuity and Perpetuity.

(6 hours)

SOLUTION OF EQUATIONS: Algebraic and transcendental equations - Bisection Method and Newton Raphson method-Real World Applications of Newton Raphson Method: Finding the Break Even Point of a Firm and finding the interest rates of Annuities.

(4 hours)

MATRICES AND VECTOR SPACES:

MATRICES: The Inverse of a Matrix-Properties and Algorithm to find the Inverse of a Matrix: Gauss Jordan Method- Solving a system of Linear Equations Using Matrix Inverse. Eigen values and Eigen vectors - Cayley Hamilton theorem (without proof) - Application to find the inverse and higher powers of a matrix - Diagonalization - Quadratic forms - Orthogonal reduction to Canonical form. Applications of Matrices: The Leontief Input Output Model in Economics, Leslie's Population Growth Model, Homogeneous Coordinates and their applications to Computer Graphics. **(9 hours)**

VECTOR SPACES: Vector spaces and Subspaces - Linear dependence and independence of vectors- Linear transformations- Linearly independent sets and Bases - Dimension of a vector space

(4 hours)

CALCULUS

Differential Calculus: Definition of limit and derivative of a function. Applications to marginal analysis in Business and Economics, Relative Rate of Change and Elasticity of Demand - Maxima and Minima of function of single variables - Applications to Optimization of area and perimeter, Relation between Average Cost and Marginal Cost, Maximizing Revenue and Profit and Inventory Control. Functions of Several Variables - Partial Derivatives- Homogeneous functions and Euler's Theorem - Optimization of functions of two variables - Constrained Optimization using Lagrange Multipliers. **(8 hours)**

Integral Calculus: Integration as a process of Summation - Application of Area between two curves to find the Net Excess Profit - Application to study Lorenz Curves in Economics - Calculation of present value of an income stream using definite integrals. Special Functions: Beta and Gamma Functions - Double and triple integrals - Applications: Area - Volume.

(6 hours)

EXPERIMENTAL DATA ANALYSIS

Curve fitting: Least Square Method. Interpolation: Newton's method - Lagrange's method. Numerical Differentiation: Application to Maxima and Minima of functions. Numerical Integration: Trapezoidal rule - Simpson's 1/3rd rule. Applications to Real World Problems and finding Area, Volume and Numerical Solutions of Ordinary Differential Equations: Taylor's Series - Runge Kutta Fourth order methods - Milne's Predictor - Corrector Method.

(8 hours)

Theory : 45 hours
Tutorial: 15 hours
Total: 60 hours

TEXT BOOKS

1. Ahmad Nazri Wahidudin, "Financial Mathematics and Its Applications", Ventus Publishing ApS, ISBN 978-87-7681-928-6, 2011.
2. David C Lay "Linear Algebra and its Applications", Fourth edition Pearson 2012.
3. R.A.Barnett, M.R.Ziegler and K.E.Bylen, Calculus for Business, Economics, Life Sciences and Social Sciences, 12th Edition, Prentice Hall, 2011.
4. L.D.Hoffman and G.L.Bradley, Calculus for Business, Economics and the Social and Life Sciences, 10th Edition, McGraw Hill, Higher Education, 2010.

REFERENCE BOOKS

1. Kandasamy, P.et al., "Engineering Mathematics", Volume - I & II (8th Fully Revised Edition), S. Chand & Co, 2008.
2. Kandasamy .P et al., "Numerical Methods", (First Revised Edition) Tata McGraw Hill Publishing company Ltd., 2008. (para 5)
3. Veerarajan T, "Engineering Mathematics (For First Year)", (first revised edition), Tata McGraw Hill Publishing company Ltd, 2008.
4. Venkataraman. M.K., "Engineering Mathematics", (First year), The National Publishing Company, 2008.

22MDC14 –PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : **THEORY**

COURSE OUTCOMES:

CO 1 : *Demonstrate the necessity and importance of effective management for the success of any activity.*
CO 2 : *Apply the Management concepts to solve problems in the given business scenario*
CO 3 : *Identify the usage of management techniques in decision making*
CO 4 : *Describe various theories related to management and understand the management decision making process in particular.*
CO 5 : *Gather and analyse both qualitative and quantitative information from a business scenario to isolate an issue and formulate best control methods.*

OVERVIEW OF MANAGEMENT : Management : Definition – Nature and Purpose – Evolution of Management Thought – Management: Science or Art – Approaches to Management.Management and Society : Organisation and External Environment – Social Responsibility of Business – Ethics in Business – Trends and Challenges in Global Scenario.Case Study.

(9 hours)

PLANNING : Purpose – Types of Plans – Steps in Planning – Objectives : Evolving concepts in Management by Objectives – Strategies, Policies and Planning Premises: Nature and Purpose – Strategic Planning Process – TOWS Matrix – Blue Ocean Strategy – Portfolio Matrix – Kinds of Strategies and Policies – Portor's Industry Analysis and Generic Competitive strategies – Premising and Forecasting – Decision Making: Importance and Limitations – Development of Alternatives – Limiting Factor – Heuristics in Decision Making – Evaluation and Selection of Alternatives – Programmed and Unprogrammed Decisions - Case Study.

(9 hours)

ORGANISING AND STAFFING: Nature of Organising – Organisational levels – Entrepreneuring and Intrapreneuring – Reengineering and Organisation – Structure and Process – Organisation Structure – Line and Staff Authority – Empowerment – Authority and Power – Decentralisation of Authority – Delegation –Effective Organising by avoiding mistakes.Staffing : Meaning and Purpose – Case Study.

(9 hours)

LEADING : Human Factors in Managing – Need for Motivation - System and Contingency approach to Motivation. Leadership: Definition – Ingredients – Trait Approach – Leadership Behaviour and Styles – Committees – Teams. Communication : Purpose – Process – Barriers – Electronic Media in Communication – Case Study.

(9 hours)

CONTROLLING : Control Process – Critical Control Points, Standards and Bench Marking – Control as a Feedback System – Feedforward or Preventive Control – Control of Overall Performance – Requirement of Effective Control – Budget as Control Device – Traditional Non Budgetary control devices –Opportunities and Challenges created by IT – Digital Economy- Digitising the Control System – Case Study.

(9 hours)
Total: 45 Hours

22MDC15 – PROBLEM SOLVING AND PROGRAMMING IN C

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **THEORY**

COURSE OUTCOMES:

CO 1 : *Design algorithmic solutions to the real-world problems*
CO 2 : *Choose and implement the concepts of Arrays, Pointers, Strings, Structures, Unions and Files in different applications*
CO 3 : *Analyse the given problem statement, and develop modular programming using functions and program structures*
CO 4 : *Develop efficient programs using pointers, structures, and unions*
CO 5 : *Develop applications with persistent data storage using various file handling techniques*

INTRODUCTION
Introduction to Problem Solving -Fundamental Algorithms -Flowcharts/Pseudo codes - Introduction to Programming-Programming design methodologies – Evolution of programming languages.

Introduction to C programming – Character Set - Identifiers and Keywords-Data Types-Variables and Constants –Declarations – Expressions – Statements – Symbolic Constants - Operators and Expressions - Precedence and Associativity of Operators - Type Conversion- Library functions. Data Input and Output–Error Diagnostics and Debugging Techniques - Command-line Arguments - Control Statements – Macros and Pre-processor Directives – Enumerations.

(11 hours)

ARRAYS AND STRINGS
Defining and Processing an Array – Multidimensional Arrays. Defining a String – Null Character – Initialization– Reading and Writing – Processing –Character Arithmetic – Searching and Sorting.

(8 hours)

FUNCTIONS AND PROGRAM STRUCTURE
Overview – Defining and Accessing a Function – Prototypes – Passing Arguments –Passing Arrays to Functions – Recursion. Storage classes – Automatic, External and Static Variables – Multi file Programs.

(8 hours)

POINTERS AND STRUCTURES
Pointer Fundamentals – Declaration – Null Pointer- Passing Pointers to a Function – Pointers and Arrays –Dynamic Memory Allocation – Operations on Pointers –Pointers and Multidimensional Arrays – Arrays of Pointers –Passing Functions to Other Functions – Pointers and Strings.
Structures: Defining and Processing Structures – typedef–Structures and Pointers – Passing Structures to Functions – Self-Referential Structures –Unions.

(12 hours)

FILE HANDLING
Need – Opening and Closing a Data File – Reading, Writing, and Processing – Unformatted Data File – Concept of Binary Files – Random Access of Files.

(6 hours)

Total: 45 Hours

22MDC17 – C PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOMEs:

CO 1 : *Analyse the given problem, and generate solution by devising an algorithm and converting it into C program*
CO 2 : *Create decision making applications with the support of arrays and strings*
CO 3 : *Develop reusable solutions using functions and / or recursive functions in C*
CO 4 : *Generate efficient programming solutions using various concepts of Pointers, Structures and Functions*
CO 5: *Implement various file handling techniques in different applications*

CONCEPTS TO BE COVERED

1. Write programs using different forms of input and output statements using various data types and operators
2. Write programs to get familiarity on using conditional, control and repetition statements.
3. Develop application programs using one and two dimensional arrays.
4. Perform String manipulations by using built-in and user-defined functions.
5. Develop application programs using simple structure, and array of structures.
6. Write Simple programs to implement functions with / without arguments and with / without return type.
7. Implement modular programming using functions, nested functions, recursive function
8. Develop application programs by passing arrays, structures, arrays of structures, functions as parameters to the function.
9. Develop applications using pointers with arrays, functions, structures, array of structures, and self referential structures
10. Implement various dynamic memory allocation techniques.
11. Develop simple applications using union, enumeration type, preprocessor directives, and macros.
12. Develop Applications using file operations.

22MDC18 FOUNDATIONS OF COMPUTER SCIENCE LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **PRACTICAL**

COURSE OUTCOMES:

CO 1 : *Execute commands through command line interface and setup the system environment for a Windows system*
CO 2 : *Execute commands through command line interface in Linux and work with shell scripts*
CO 3 : *Apply advanced features of Word processing with MS Word and OpenOffice Writer*
CO 4 : *Prepare professional presentations using advanced features of MS Powerpoint and OpenOffice Impress*
CO5: *Create new websites or enhance the existing websites to be more responsive using HTML5, CSS, Javascript, jQuery, BOOTSTRAP, PHP and MySQL*

A. COMMAND-LINE INTERFACE IN WINDOWS

1) Run Folder management commands
2) Run File management commands
3) Work with Path settings and System environment variables settings

B. COMMAND-LINE INTERFACE COMMANDS IN LINUX

1. Work with vi Editor in Linux.
2. Learn the use of basic Linux commands.
3. Learn the use of redirection and File access permissions.
4. Work with filters.
5. Work with commands such as find, cmp, comm, uniq.
6. Write efficient Shell Scripts.

C. WORD PROCESSING : MS Word and OPEN OFFICE - WRITER

1. Work with Documents- Formatting Documents - Setting Page style- Creating Tables - Drawing- Tools - Printing Documents
2. Use Tools – Word Completion, Spelling and Grammar Checks, Mail merge, Templates, Using Wizards, Tracking Changes, Security, Digital Signature.

D. PRESENTATION: MS Power point & OpenOffice-Impress:

1. Create Presentations, Insert links and media, Master Templates & Re-usability, Slide Transition and Animation, Print Handouts, Record and Export presentations

E. INTERNET

1. Work with Google Forms, Google Docs, Google Sheet and Google Slides

F. BASIC WEBSITE DEVELOPMENT

1. Create web pages using HTML formatting tags, tables, images, lists and frames
2. Create interactive pages using anchors, image maps and forms
3. Design responsive web pages using CSS, and BOOTSTRAP
4. Create an online Registration form for a website and validate using jQuery
5. Construct a JSON structure for an application and validate it using JSON and use jQuery for parsing

22MDC19 EMPLOYABILITY SKILLS

L	T	P	C
0	0	2	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO 1 : *Solve timed objective question on logical reasoning and verbal ability*
CO 2 : *Generate ideas and speak confidently, for a given specific speaking task on topics like describing a picture, movie reviews, storytelling, and extempore*
CO 3 : *Use appropriate functional expressions, for a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions*
CO 4 : *Produce language structures accurately and fluently, for a given 2 to5 minutes speaking activity like Extempore and Debate. Prepare a powerpoint presentation for 15 minutes, for a given technical topic*
CO 5: *Specify appropriate responses and construct a summary for given short conversations and monologues for listening. Construct dialogues for a given social scenario, interpret the given graphic information and write creative paragraphs*

Self-Introduction - Barriers to Speaking and Listening - Introduction to Spoken English, Greetings, Thanking - Apologizing, Congratulating - Giving Directions, Shopping – Role Play

(6 hours)

Activity based on newspaper articles - Word Building - A picture and a few words activity - Current Events.

(4 hours)

Alphabet test – Alphabet Order, Alphabet Series - Letter Word Problem, Word Formation and Scramble - Series Completion –Para Jumbles- Synonyms and Antonyms- Types and Exercises- Sentence Completion –Types and Exercises.

(8 hours)

Reading Comprehension- Skimming and Scanning - Reading Prose – Bacon's Essays (Speaking Activity based on the essays) - Story Building- Extempore - Movie Reviews.

(4 hours)

Speech Sounds - Word Vocabulary - Reading Comprehension - Listening Practice- I - Dialogue Writing - Conversational Exercise – I - Focus on Language - Creative Writing Conversational Exercise – II - Listening Practice – II

(8 hours)

Total – 30 hours

PROFESSIONAL ENGLISH

L	T	P	C
2	0	1	2

ASSESSMENT: THEORY

COURSE OUTCOME:

CO1: Apply the rules of grammar, namely Active and Passive voice, Direct and Indirect speech, Cause and effect, Purpose and Function, Prepositions, Conditional sentence, Modal Verbs and use suitable patterns in a given sentence or passage

CO2: Construct appropriate responses to greet, transfer, place the caller on hold, enquires, callbacks, unintentional disconnects, interruptions, using suitable language and telephoning etiquettes. Construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator for a given business communication scenario

CO3: Specify the type and barrier to listening, provide solutions and justify, for a given a communication context

CO4: Compose a Business Letters, Memo, Emails, Reports, Minutes of the Meeting, Technical Proposals, Instructions and Recommendation and Checklist using appropriate language and format for a given business communication context. Prepare a job application letter with resume, for a given job requirement

CO5: Construct dialogues with appropriate functional expression, for a given communication content viz., giving advice and Suggestions, Apologizing, Asking for and giving permission.

FOCUS ON LANGUAGE: ENGLISH GRAMMAR & VOCABULARY

Reported Speech – Active Passive Voice – If Clause – Modal Verbs – Verb Preposition Combinations – Confusing Words **–** Abbreviations and Acronyms – Business and Job Related Vocabulary – Relative Clause – Pronouns – Cause and Effect Expressions – Purpose and Function.

(5 hours)

BUSINESS ENGLISH

Telephoning Skills: Understanding Telephone communication – Telephonic Conversations and Etiquettes - Handling Calls – Leaving a Message – Making Requests –Asking for and Giving Information – Giving Instructions - Negotiations: Types of Negotiation –Six Basic Steps of Negotiations – Informal and formal Negotiations

(5 hours)

READING

Reading a Procedure – Researching for supporting Evidence – Categorizing Information - Cloze Comprehension – Critical Reading: Creative and Critical Thinking **-** – Reading Proverbs.

(4 hours)

WRITING

Business Letters – Job Application Letters – Describing a Product and Process – Minutes of the Meeting **-** Report Writing – Proposal Writing –Memos – Emails **-** Instructions & Recommendations – Checklist.

(6 hours)

22MDC21 PROBABILITY DISTRIBUTIONS AND APPLICATIONS

L	T	P	C
3	0	0	3

PRE-REQUISITES:
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1: Apply various discrete and continuous probability distributions to data and also situations where they can be applied
CO2: Apply moment generating functions in understanding various properties of random variables
CO3: Apply statistical tests to make inferences on the properties of both discrete and continuous types of data
CO4: Make inferences based on Bayesian estimation

PROBABILITY DISTRIBUTIONS
Discrete:-Geometric distribution and its memory-less property, negative binomial distribution, Hyper-geometric distributions-The Binomial Approximation to the Hyper-geometric distribution, multinomial distribution. **Continuous**: exponential distribution and its memory-less property, gamma, Beta, Chi-square log normal distributions and Weibull distributions –applications and their properties.

(9 hours)

FUNCTIONS OF RANDOM VARIABLES
Moments and Moment Generating functions – properties-MGF of important distributions - Transformations of Variables (using Jacobians) and finding their distributions - method of direct transformation and method of moment generating functions- Joint and Marginal Probability mass functions(for discrete) and density functions(for continuous) for two and more than two random variables. Conditional probability distributions-conditional mean and variance-Covariance of random variables-Statistically independent random variables-mean and variance of linear combination of random variables

(9 hours)

ESTIMATION
Estimation of parameters using method of moments-Maximum Likelihood Point Estimation(MLE) **–**Properties of estimators-Unbiasedness, minimum variance, efficiency and sufficiency -Mean Square Error-Asymptotic properties-consistency-Fisher Information and Cramer-Rao's Inequality – Interval Estimation –Interpretation-Confidence interval for mean when variance is i) known and ii) unknown and determination of sample size-Concept of a Large-Sample Confidence Interval-Prediction Intervals

(9 hours)

22MDC23 – DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC15

ASSESSMENT: **THEORY**

COURSE OUTCOME

CO1: Evaluate algorithms in terms of time and space complexity using asymptotic notations
CO2: Design suitable algorithms for real world problems and implement using arrays, stack, and queue
CO3: Develop substantial solutions using linked list and tree structure for scenario based problems
CO4: Choose appropriate data structures and use them to design customized and solutions for a given real-life problem
CO5: Compare and evaluate the searching and sorting techniques based on complexity measures

ANALYSIS OF ALGORITHMS

Introduction to Performance Analysis – Template Functions - Recursive Functions - Space Complexity – Time Complexity – Asymptotic Notations.

(6 hours)

INTRODUCTION TO DATA STRUCTURES

Primitive data structures – ADT - Arrays: Arrays as ADT, one dimensional array, two dimensional array, multidimensional array, representation - sparse matrix.

(6 hours)

STACK AND QUEUE

Stack: Definition – Stack as ADT – Sequential representation - operations, Applications: Conversion & Evaluation of expression. Recursion: Definition, Properties, Examples. Queue : Definition-queue as ADT, Sequential Representation – Operations – Circular Queue – Priority queue. Applications: Categorizing data and Queue Simulation.

(12 hours)

LINKED LIST AND TREES

Linked List : Definition – Operations – Linked representation of stacks & queue – Circular Lists –Operations – Doubly Linked List - Application: Addition of polynomial. Trees: Terminologies –binary tree: Operations, Traversals, Representation – Threaded Binary Tree - Properties.

(12 hours)

SEARCHING AND SORTING STRATEGIES

Linear Search -Binary Search. Introduction –Bubble sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort. Searching: Linear search, Binary search.

(9 hours)
Total:45 Hours

22MDC25 APPLIED PROBABILITY LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **PRACTICAL**

COURSE OUTCOME

CO1: Solve problems using R
CO2: Perform numerical analysis using R
CO3: Demonstrate the properties of probability distributions and perform statistical tests using MS-Excel and R
CO4: Perform Hypothesis testing using MS-Excel and R

Topics to be covered

R PROGRAMMING

1. Introduction to R Programming environment
2. Create Datasets in R: Data Structures-Vectors-Matrices-Arrays-Data frames-factors-Lists
3. Read and Write Data-read.Table, read.csv -Sub setting a vector - Subsetting a Matrix
4. Generate Basic Graphs-Bar, Pie Charts-Histograms-Box Plots
5. Basic Statistics-Descriptive Statistics-Frequency and Contingency Tables-Correlations and t-tests
6. Regression Analysis
7. Numerical analysis using R
   i) Numerical differentiation: Newton's formula, Lagrange's formula
   ii) Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule
   iii) Curve fitting: Linear, quadratic, polynomial and exponential
   iv) Numerical solution of ordinary differential equations using Runge-Kutta 4th order method

PROBABILITY DISTRIBUTIONS AND HYPOTHESIS TESTING USING EXCEL AND R

8. Probability Distributions using Excel and R

   Use functions in MS-Excel and R to calculate the probabilities and inverse probabilities and cumulative distribution functions for

   i) Binomial, Poisson, Normal,
   ii) Geometric, Negative Binomial and Hypergeometric distributions
   iii) Exponential, Gamma, Beta and
   iv) Normal and lognormal distributions
   v) t, F, Chi-square distributions

9. Perform Hypothesis testing Using Excel's Analysis ToolPak and R
   i) Testing Single mean, difference between two means large samples- Z test
   ii) Testing Single mean, difference between two means small samples- t- test
   iii) Single proportion, Difference between two proportions
   iv) Chi-square for i) goodness of fit and ii) independence of attributes
   v) Equality of Variances

22MDC26 – DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC15

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Choose appropriate data structure for a specified application and implement using C
CO2: Develop efficient programming solutions for various data structures such as stacks, queues in real-world applications
CO3: Trace and code recursive methods and compare with iterative methods
CO4: Generate dynamic solutions using various forms of linked lists and trees based on the suitability of applications
CO5: Find the best sorting and searching techniques for the given scenario and implement it

CONCEPTS TO BE COVERED

Consider various scenarios/ case studies / real-world applications to implement the following concepts.

1. Application of One-dimensional and Two-dimensional arrays.
2. Implementation of basic operations of stack.
3. Conversion of expressions and evaluation of expressions using stack.
4. Implementation of Recursive algorithms for suitable applications and comparing them with iterative solutions.
5. Implementation of basic queue operations, priority queue, circular queue.
6. Implementation of operations on Linked stack and Linked queue.
7. Implementation of solutions using Doubly linked list, and Circular linked list.
8. Implementation of operations on binary trees, and tree traversal methods.
9. Conversion of binary tree to Threaded binary tree.
10. Application of sorting and searching techniques.

22MDC27 – PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME:

CO1: Write, test and debug simple python programs
CO2: Develop Python programs with functions
CO3: Use Python lists, tuples, dictionaries for representing compound data
CO4: Read and write data from/to files in Python
CO5: Perform EDA, preprocessing and data analysis using Python packages

CONCEPTS TO BE COVERED

1. Introduction to Python, Demo on IDE.
2. Simple programs in Python
3. Operations and Expressions in Python
4. Algorithmic approach 1: Sequential
5. Algorithmic approach 2: Selection (if,elif,if…else,nested if else)
6. Algorithmic approach 3: Iteration (while and for)
7. Strings and its Operations
8. List and its operations
9. Sets and its operations
10. Dictionaries and its operations
11. Tuples and its operations
12. Functions, Recursions
13. Files and its operations with command line arguments.
14. Date and Time manipulation
15. User Interface design for applications
16. Packages for Data Analysis: Numpy, Pandas, Scipy, Matplotlib
17. Mini Project using Datasets: EDA, preprocessing and analysis

22MDC28 ENGLISH FOR EMPLOYABILITY

L	T	P	C
0	0	2	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME:

CO1: Solve timed objective questions on logical reasoning and verbal ability
CO2: Generate ideas and speak confidently, for a given speaking task on topics like JAM, Describing an Object, Book Review, and Extempore
CO3: Use appropriate functional language, for a given social situation viz., travel and transport complaining, giving instructions, advising and sympathizing, requesting and warning People
CO4: Generate valid points for and against the topic and present them with appropriate group behaviour, for a given HR topic
CO5: Plan and prepare a 20 min HR mock interview, for any job requirement

Ice Breakers - Just a Minute - Book Reviews - Describing an object – Extempore – Paraphrasing.

(6 hours)

Spoken English - Travel and Transport, Complaining - Giving Instructions, Advising and Sympathizing – Requesting and warning people

(5 hours)

Logical Sequence of Words- Exercises - Sequential Order of Things - Comparison Type Questions – Introduction and Exercises - Idioms and Phrases - Types and Exercises - Vocabulary through Mythology - One word Substitutes, Word Power Exercises - Common Errors in English - Sentence Correction

(7 hours)

Activity based on newspaper articles - Vocabulary – Homophones and Homonyms - Reading Prose – Reading Comprehension Activity

(4 hours)

Professional Communication - Mock Group Discussion – Mock Interview – Telephoning Skills – Personality Development Activities.

(8 hours)

Total - 30

21MDS31 – BUSINESS STATISTICS

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS13, 21MDS22

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Compute Various Index Numbers used in Economics and Business*
- *Apply Statistical methods and Decision Analysis tools to analyze data from time series and Business*
- *Prepare Control Charts for variables and attributes using data from economics*
- *Analyze Data from Statistical Experiments using appropriate Statistical Design of Experiment like CRD, RBD, LSDetc*
- *Analyze Data using Non-parametric methods*

INDEX NUMBERS

Definition, characteristics and uses of Index Numbers-Types of Index Numbers-Price, quantity and value indices- Simple and weighted aggregate index numbers – Laspeyre, Paasche, Marshell – Edgeworth, Fisher's Ideal Index Numbers-Tests of adequacy of Index Numbers-Problems in the construction of Index Numbers and Consumer Price Index. **(9)**

TIME SERIES AND FORECASTING

Definition- Time Series. Components- -Time series decomposition models: multiplicative and additive models –Forecasting error-measurement using Mean Absolute Deviation(MAD), Mean Absolute Percentage Error (MAPE), Mean Squared Error(MSE) and Root Mean Square Error (RMSE)- Smoothing Techniques: Naïve forecasting , moving averages and weighted moving averages-Exponential smoothing –Simple and double Exponential Smoothing- Trend analysis- linear, quadratic and exponential trend-Seasonal Effects-Decomposition methods: method of simple averages, ratio to trend method and ratio to moving average method-Measurement of cyclic and irregular variations. Auto Regressive Models-Fitting and identifying suitable order-Auto correlations and partial auto correlations. **(10)**

STATISTICAL QUALITY CONTROL AND DECISION ANALYSIS

Nature of Control Limits-Purpose of Control Charts-Control Charts for Variables-Control Charts for Attributes-Cusum Control Charts.

Decision making under certainty: Analytic Hierarchy Process - Decision making under risk: Expected value criteria, Expected value of perfect information - Decision making under uncertainty-Criteria of Optimism, Pessimism, Regret, Laplace and Hurwicz-Decision Tree. **(10)**

DESIGNS OF EXPERIMENTS

Analysis of Variance (ANOVA) technique-Design of experiments – basic concepts – treatment – experimental unit –experimental error - basic principle – replication, randomization and local control- One way Analysis of Variance: Completely Randomized Design- Randomized blocks design – description – layout – analysis-Latin Square Design-description-layout-analysis.

(9)

NON PARAMETRIC STATISTICS

Introduction to Nonparametric tests –Sign test – Signed Rank test-Rank-Sum test- Wilcoxon-Mann-Whitmey test (U test), Kruskal Wallis test-Runs test-Spearman's Rank correlation coefficient. **(7)**

TOTAL: 45

TEXT BOOKS

1. *Ken Black, Business Statistics for Contemporary Decision Making, 6th Edition, John Wiley &Sons.Inc, 2010 [Para 1,2,3 and 4]*
2. *R.P.Hooda, Statistics for Business and Economics, 5th Edition, Vikas Publishing House Pvt. Ltd., Noida, 2013 [Para 1]*
3. *Richard I. Levin, David S. Rubin, Statistics for Management, 7th Edition Pearson Education, 2011.[Para 2 and Para 3]*
4. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 9th Edition, Prentice Hall,2012 [Para 3, 4 and 5]*

REFERENCE BOOKS

1. *D M Levine, M L Berensen, T C Krehbiel and P.K.Viswanathan- Business Statistics: A First Course, 5th Edition, Pearson Education, Delhi, India, 2011*
2. *Dinesh Kumar U. Business Analytics, Wiley, First Edition, 2017*

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H								
CO2	H	M		L					
CO3	H								
CO4	H		M						
CO5	H		L						

21MDS32-DISCRETE STRUCTURES AND AUTOMATA THEORY

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Apply logical reasoning in verifying the correctness and validity of simple instances of valid logical arguments*
- *Identify to devise encoding and decoding procedures for error detection and correction in data transmission problems*
- *Classify in constructing system models which are the natural extension of automata that are used to devise decision procedures*
- *Analyze specification of languages using grammars*
- *Develop problems in automata types and turing machines*

MATHEMATICAL LOGIC

Connectives - Conditional and Biconditional statements - Statement formulae and Truth tables- Tautologies and tautological Implications - Normal forms - Disjunctive and Conjunctive Normal forms - The Predicate Calculus. (7)

ALGEBRAIC STRUCTURES I

Introduction – Semigroups and Monoids – Grammars and language – Rings, Integral domains and fields - Properties Rings - Construction of finite fields-Irreducible Polynomials-Primitive element of a finite field- Primitive Irreducible Polynomials. (8)

ALGEBRAIC STRUCTURES II

Residue arithmetic for Computers- Coding theory - Error Detection - Correction - Distance between Code words - Minimum distance and weight - Group Code , Linear Code and Cyclic code -Problems under Encoding and Decoding Techniques. (8)

FINITE AUTOMATA AND GRAMMARS

Basic Machines : - Moore & Mealy Machine-Finite State Systems - Basic definitions - Transition diagrams- Deterministic & Nondeterministic Finite Automata -Regular Expressions- Equivalence of Finite Automata and Regular Expressions Grammars: Definition - Types - Leftmost , Rightmost Derivations-Syntax trees-Ambiguity. (10)

PUSH DOWN AUTOMATA

Definitions - Deterministic & Non deterministic - Acceptance by empty stack and final state.

TURING MACHINES

Introduction - Turing machine - Types - Universal TM-Multiple TM - Multilevel TM -Offline TM-Halting problem - - Rice theorem - Linear bounded TM

(12)

TOTAL :45

TEXT BOOKS

1. *J.P.Tremblay, R. Manohar, "Discrete Mathematical structures with Applications to computer science", Tata McGraw - Hill, Edition, 1997 , Thirty Eighth reprint , 2010*
2. *Hopcroft J.E., Motwani R., Ullman J.D, " Introduction to Automata Theory, Languages and Computations" , Second Edition , Pearson Education , 2009.*
3. *Ralph P.Grimaidi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley Publishing Company, Fifth Edition, Pearson Education, Second Impression , 2008.*

REFERENCE BOOKS

1. *Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw -Hill , Seventh Edition, 2012.*
2. *John C Martin , "Introduction to Languages and the Theory of Computation" , Third Edition , Tata McGraw Hill Publishing Company , New Delhi, Seventh reprint ,2010.*
3. *Mishra K.L.P, Chandrasekaran . N. "Theory of Computer Science: Automata, Languages and Computation", Prentice Hall of India , Third edition , 2008.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**								**M**
CO2	**H**					**L**			**M**
CO3	**H**					**L**			**M**
CO4	**H**								**M**
CO5	**H**					**L**			**M**

21MDS33 - OPERATING SYSTEMS

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS23

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the basics of computer systems and Operating systems.*
- *Reveal Kernel Management for Inter Process Communication systems.*
- *Evaluate the system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first.*
- *Recognize the memory allocation and deallocation for both static and dynamic storage.*
- *Describe the simple File System using Disk and File System Management of Windows Operating System.*

COMPUTER SYSTEMS OVERVIEW

Basic elements, Instruction Execution, Interrupts, The Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization.

INTRODUCTION TO OPERATING SYSTEM

Operating System Objectives and Functions, Evolution of Operating Systems. (8)

PROCESS DESCRIPTION PROCESS DESCRIPTION AND CONTROL

Process states, Process description, Process control, Processes and threads, Types of Threads.

CONCURRENCY

Principles of Concurrency, Mutual Exclusion: Hardware support, Semaphores, Monitors.

Deadlock and Starvation: Principles of Deadlock, deadlock prevention, deadlock avoidance, deadlock detection. Windows 7 Concurrency Mechanisms. (10)

MEMORY MANAGEMENT

Memory management requirements, Memory partitioning, Paging, Segmentation.

Virtual Memory: Hardware and Control Structures, Operating System Software, Windows Memory Management. (12)

UNIPROCESSOR SCHEDULING

Types of Processor Scheduling, Scheduling Algorithms. (6)

I/O MANAGEMENT, DISK SCHEDULING

I/O Devices, Organization of the I/O function, Operating System Design Issues, I/O buffering, Disk Scheduling, RAID, Windows I/O.

FILE MANAGEMENT

File Management : Overview, File Organization and Access, File directories, File sharing, Secondary Storage Management, Windows file system. (9)

TOTAL : 45

TEXT BOOK

1. William Stallings, "Operating systems Internals and Design Principles", 7th edition, PHI, 2016.

REFERENCE BOOKS

1. Umakishore Ramachandran, William D. Leahy Jr., "Computer Systems: An Integrated Approach to Architecture and Operating
Systems", International Edition, Pearson, 2011.
2. Silberschatz A., Peterson J.L and Galvin P., "Operating System Concepts", John Wiley Publishing Company, 2002.
3. H.M.Deital, "An introduction to Operating System", Pearson Education, 2001
4. Morris Mano, ”Computer System Architecture”, Pearson Education,2014.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**		**M**				**L**		
CO2	**H**	**H**			**M**			**L**	
CO3	**H**	**M**			**L**				
CO4	**M**			**H**				**L**	
CO5			**L**			**M**			**H**

21MDS34 - DATABASE SYSTEMS

Contact Hours

PRE- REQUISITES

L	T	P	C
3	0	0	3

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the purpose and architecture of database systems from the perspective of persistent storage of real world data*
- *Analyse the problem statement, construct the Entity Relationship model and map it into relational model and conform the normal forms*
- *Generate Relational Algebra and SQL statements to perform queries of real-world applications and learns how transactions are performed*
- *Apply the concepts and techniques of NoSQL MongoDB in real world applications*
- *Understand and represent temporal and spatial data in real world applications*

INTRODUCTION TO DATABASES

Databases and Database Users: Introduction, Characteristics of the Database Approach – Actors – Advantages. Database system Concepts and Architecture: Data models, Schemas and Instances – Three schema architecture and Data Independence – Database Languages and Interfaces – DBMS Component Modules – Centralized and Client/Server Architecture – Classification of Database Management Systems –Relational Model Concepts, Constraints and Schemas. **(7)**

DATABASE DESIGN AND NORMALIZATION

Database Application – Entity Types, Entity sets, Attributes and Keys – Relationship Types, Relationship Sets, Roles and Structural Constraints – Weak Entity Types – Refining the ER design – ER Diagrams, Naming Conventions – Enhanced Entity Relationship Model, ER and EER to Relational Mapping.

Normalization: Informal Design Guidelines – Functional Dependencies –Normal Forms based on Primary keys – General Definitions of 2NF and 3NF – BCNF – Inference rules, Equivalence, Minimal cover - Properties of Relational Decompositions. **(10)**

STRUCTURED QUERY LANGUAGE AND TRANSACTION PROCESSING

SQL Data Definition and Data types – Constraints – Basic Queries – Complex Queries - Views – Triggers - Programming with PL/SQL - Relational Algebra – Unary Operations – Set Operations – Binary Operations – Additional Operations.

Transaction Processing: Introduction to Transaction Processing - Need for Concurrency Control – Need for Recovery - Transaction states - Desirable properties of transaction **(12)**

NOSQL DATABASES

Introduction to NOSQL Systems: Emergence of NOSQL, Characteristics of NOSQL, Categories of NOSQL – The CAP theorem – Document based NOSQL systems and Mongo DB – NOSQL Key-value stores – Column based NOSQL systems - Graph Databases and Neo4j. **(8)**

SPATIAL AND TEMPORAL DATABASE

Temporal Database: Time representation, Incorporating time in Relational Databases, Temporal Querying constructs, Time series data.

Spatial Database: Representation, Design databases, Geographic data, spatial queries, Indexing of Spatial data. **(8)**

TOTAL: 45

TEXT BOOKS

1. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2016. (Para 1-5)*
2. *Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2006. (Para 5 – Spatial Database)*

REFERENCE BOOKS

1. *Bipin C Desai, "An Introduction to Database systems", Revised Edition, Galgotia Publications Pvt Ltd, 2012.*
2. *Date C.J, "An introduction to Database Systems" Eighth Edition, Pearson Education, 2003.*
3. *Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence", AddisonWesley, Reprint 2013.(Open Source Non Relational Databases, Implementation Of Non Relational Databases)*
4. *Brad Dayley, "Sams Teach Yourself NoSQL with MongoDB in 24 Hours", Pearson Education, 2015*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**L**	**M**	**L**	**L**					
CO2	**H**	**M**	**H**	**H**					**M**
CO3	**H**	**M**	**H**	**H**					**M**
CO4	**H**	**H**	**H**	**H**			**M**	**M**	**H**
CO5	**H**	**H**	**H**	**H**			**M**	**M**	**H**

21MDS35 - DATA STRUCTURES AND ALGORITHMS II

Contact Hours

PRE- REQUISITES

L	T	P	C
3	0	0	3

21MDS23

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the organization and operations to access the data using the data structures such as binary and general tree structures, search trees, B-trees, Tries, graph , heaps, hash tables, AVL Tree, Multi way Tree .*
- *Select advanced data structures and algorithms for autonomous realization of simple programs or program parts.*
- *Recognize and apply advanced data structures to improve the performance of a problem.*
- *Formulate new solutions for programing problems or improve existing code using learned algorithms and data structures*

TREES - Preliminaries - Implementation of Trees - Tree Traversals with an Application. **BINARY TREES** – Definition - An Example: Expression Trees. **BINARY SEARCH TREES** -Searching – Insertion and deletion of elements – randomly built binary search trees- analysis. **AVL TREES** - Single rotation – double rotation - Splay trees 10)

MULTIWAY SEARCH TREES - B-Tree – Searching, insertion and deletion - B+ trees, B*-trees, Red Black trees - Tries
MULTIDIMENSIONAL SEARCH TREES - Range search -k-d trees-Quad trees – point data – R trees. (10)

HASHING - Hash Function - Separate Chaining -Hash Tables without Linked Lists - Rehashin (7)

HEAPS – Binary heap – Applications **-** d-Heaps- Leftist Heaps - Property and operations- Binomial heap (9)

DATA STRUCTURES FOR DISJOINT SETS - Disjoint set operations-linked list representation of disjoint sets- disjoint set forests- path compression - analysis.
GRAPHS - Definition – Representations – Topological sort - Graph search methods (Breadth first and depth first traversals). (9)

TOTAL : 45

TEXT BOOKS:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition , Addison-Wesley, 2014.

2. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms” , Third Edition , MIT Press, 2012.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahani, “Fundamentals of Data Structures”, Galgotia Publications, 1994.
2. Dinesh P. Mehta, Sartaj Sahni, “ Handbook Of Data Structures And Applications”, CHAPMAN & HALL/CRC, 2005

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		**H**	**M**	**L**					
CO2	**H**		**M**	**M**					**L**
CO3			**H**		**M**	**M**	**M**	**L**	
CO4				**H**	**M**			**M**	

21MDS36 – DATABASE SYSTEMS LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS34

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

- *Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application*
- *Formulate simple DML SQL queries to retrieve the required data for real world applications*
- *Generate DML queries with Subqueries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications*
- *Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors*
- *Develop a database project by constructing the ER model, creating Tables and generating SQL and PL/SQL blocks using RDBMS platform*
- *Execute queries in NoSQL platform*

CONCEPTS TO BE COVERED

1. Design a database for an application and represent it through ER diagram

2. Create and manage tables

3. Execute basic SQL SELECT statements

4. Restricting and sorting data

5. Implement single row functions

6. Display data from multiple tables

7. Aggregating data using Group function, Group By

8. Working with Subqueries

9. Implement Views, Sequence, Index and Synonym

10. Perform SET operators, Date and Time functions

11. Write simple PL/SQL Programs

12. Implement Exception Handling, Cursors, Functions, Procedures, Package and Triggers

13. CRUD operations using MONGO DB

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	H	H			M	M	M
CO2	H	M	H	H					H
CO3	H	M	H	H					H
CO4	H	M	H	H			M	M	H
CO5	H	M	H	H			H	H	H
CO6	H	M	H	H			H	H	H

21MDS37 - DATA STRUCTURES AND ALGORITHMS LABORATORY II

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS26, 21MDS35

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

- *Apply tree data structures and its variants for real time applications.*
- *Select and apply suitable data structures in implementing practical problems.*
- *Identify suitable graph based algorithms and apply them for solving problems that arise in real world scenarios.*
- *Perform operations on heaps, for real time problems.*
- *Implement Hash Table techniques for a given application.*

CONCEPTS TO BE COVERED

1. Binary trees and its operations.
2. Applications of binary search tree and its operations.
3. AVL tree including all rotations.
4. B-tree and its operations.
5. Operations on Red Black trees.
6. Graphs - Breadth First Search, Depth First Search.
7. Construction of heap and its applications.
8. Implementation and analysis of Hash Table with collision handling.
9. Disjoint set operations and some applications.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**M**	**H**	**H**					
CO2	**H**	**M**	**H**	**H**					
CO3	**H**	**M**	**H**	**H**					
CO4	**H**	**M**	**H**	**H**					
CO5	**H**	**M**	**H**	**H**					

21MDS38 – WEB TECHNOLOGY FRAMEWORK LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

- *Create responsive user interface web pages using HTML5, CSS, BOOTSTRAP, JSON and jQuery*
- *Employ Java Script for client side programming that uses a regular expression to validate form entry and processing.*
- *Develop simple web applications using R and SHINY.*
- *Design web applications using ReactJS and establish server side programming skills to work with Node framework.*
- *Design and develop fully functional web applications using Flask and Django.*

CONCEPTS TO BE COVERED

- Create interactive and responsive web pages using HTML5, CSS, BOOTSTRAP, JavaScript, JSON and jQuery.
- Develop an interactive web application using R, SHINY and MySQL.
- Working with REST API.
- Create an E-Commerce single page web application using ReactJS and implement CRUD operations using NodeJS with MySQL/MONGO DB.
- Develop a fully functional web application (prediction/recommendation systems) using Flask/Django.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**L**		**H**	**H**				**H**	**H**
CO2	**L**		**H**	**H**				**H**	**H**
CO3	**L**	**M**	**H**	**H**			**H**	**H**	**H**
CO4	**L**	**M**	**H**	**H**			**H**	**H**	**H**
CO5	**L**	**M**	**H**	**H**			**H**	**H**	**H**

21MDS41 – MULTI VARIATE DATA ANALYSIS

Contact Hours

PRE- REQUISITES

21MDS13, 21MDS22

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Analyze various properties like mean vector and variance-covariance matrix of multivariate data*
- *Formulate and compute multiple linear regression model and understand its properties*
- *Classify objects into different groups using discriminant function, logistic regression equation and cluster analysis techniques*
- *Identify underlying factors in multivariate data sets using principal component analysis and factor analysis*

MULTIVARIATE DATA

Variables in Multivariate Data-Mean Vector, Covariance and Correlation Matrices and their properties-Mean vectors and covariance matrices for subsets of variables–Sample properties of linear combination of variables-Estimation of missing values-Distance between vectors-Multivariate Normal Density-Visualization of multivariate data: The Scatter Plot Matrix and three dimensional plots. **(9)**

MULTIPLE REGRESSION ANALYSIS(MLR)

Multiple Linear Regression Equation and Polynomial Regression Models- Estimation of the coefficients using method of least squares–Linear Regression using Matrices-Properties of Least Squares-Inferences in Multiple Linear Regression: ANOVA and testing the partial regression coefficients- Interpretation of R^2-Standardized Regression Coefficient and its interpretation-Inclusion of categorical or indicator variables in MLR –Multi-collinearity problem-Stepwise Regression **(9)**

DISCRIMINATION AND CLASSIFICATION

Discriminant Function Analysis- Fisher's discriminant function. Logistic Regression: Logistic Model-Definitions of Odds and Logit-Estimation of the logistic regression coefficients-Making Predictions-Multiple Logistic Regression. **(9)**

PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS

Data Reduction Techniques-Definition of Population Principal Components –Principal Components obtained by Standardized variables -Rules to retain number of Principal Components using Scree Plot-. Factor Analysis-Definitions-The Orthogonal Factor Model-Its Covariance Structure- Factor Loadings and Interpretations-Exploratory and Confirmatory Factor Analysis. **(10)**

CLUSTER ANALYSIS

Definition-Measures of Similarity or Dissimilarity-Hierarchical Clustering Methods-Single linkage-Complete Linkage-Average Linkage-Centroid-Ward's Hierarchical Clustering Methods-Non-hierarchical Clustering Methods-K-means Method. **(8)**

TOTAL: 45

TEXT BOOKS

1. *Alvin C.Rencher Methods of Multivariate Analysis, 2nd Edition, Wiley Inter-science, 2002 [Para 1,Para 5]*
2. *R.E.Walpole,R.H.Myers,S.L.Myers and K.Ye, Probability and Statistics for Engineers and Scientists, 9th Edition, Prentice Hal, 2012 [Para 2]*
3. *Richard A.Johnson and Dean W.Wichern. Applied Multivariate Statistical Analysis, 6th Edition, Pearson Prentice Hall, 2007[Para 3 and Para 4]*

REFERENCE BOOK

1. *Joseph F. Hair Jr., William C. Black, Barry J.Babin and RolphE.Anderson, Multivariate Data Analysis, 7th Edition, Pearson, 2010.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**		**M**	**M**	**M**			**M**	**L**
CO2	**M**	**L**	**H**	**L**	**H**			**L**	**M**
CO3	**H**	**H**	**H**	**M**	**L**			**H**	**L**
CO4	**H**	**M**	**L**	**H**	**M**			**H**	**M**

21MDS42 - GRAPH THEORY

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS12, 21MDS23, 21MDS35

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Describe various fundamental terminologies of graph theory with Examples*
- *Categorize the Spanning trees, connectivity, circuits and planarity of graphs*
- *Apply matrices in studying properties of colouring and directed graphs*
- *Analyze various properties of graphs like connectedness, spanning trees and so on using algorithms including shortest path, DFS and planarity testing.*

INTRODUCTION

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –

Connectedness – Components – Euler Graphs – Hamiltonian Paths and Circuits – Trees- Properties of trees – Distance and Centers in Tree – Rooted and Binary Trees. (9)

TREES, CONNECTIVITY, PLANARITY

Spanning trees – Fundamental Circuits – Spanning Trees in a Weighted Graph – CutSets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets –Connectivity and Separability – Network flows – 1-Isomorphism – 2-Isomorphism –Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph. (9)

MATRICES, COLOURING

Incidence matrix – Submatrices – Circuit Matrix – Path Matrix – Adjacency Matrix –Chromatic Number – Chromatic partitioning – Chromatic polynomial – Matching –Covering – Four Color Problem. (9)

DIRECTED GRAPH

Directed Graphs – Types of Directed Graphs –Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs –Adjacency Matrix of a Digraph. (9)

ALGORITHMS

Connectedness and Components – Spanning tree – Finding all Spanning Trees of a Graph – Set of Fundamental Circuits – Cut Vertices and Separability – Directed Circuits. Shortest Path Algorithm – DFS – Planarity Testing – Isomorphism.

(9)

TOTAL : 45

TEXT BOOK

1. *NarsinghDeo, Graph Theorywith Application to Engineering and Computer Science,Prentice Hall of India, 2003.*

REFERENCE BOOKS

1. *R.J. Wilson, Introduction to Graph Theory, 4th Edition, Pearson Education, 2003.*

2. *J.A.Bondy and U.S.R.Murty, Graph Theory with Applications, Publishing, 1982.*

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	H					L	
CO2				H	M				L
CO3	M	H	L						
CO4	H	M	L		L			M	

21MDS43 - DESIGN AND ANALYSIS OF ALGORITHMS

Contact Hours

PRE- REQUISITES

L	T	P	C
3	0	0	3

21MDS23, 21MDS35

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem*
- *Enhance their expertise in algorithmic analysis and algorithm design techniques*
- *Comprehend and select algorithm design approaches in a problem specific manner to solve real world problems*
- *Select a proper pattern matching algorithm for given problem*
- *Extrapolate from them in order to apply those algorithms and techniques to solve problems*

DIVIDE AND CONQUER Merge sort - Integer multiplication, Strassen's matrix multiplication, Finding the Closest Pair of Points. (6)

GREEDY METHOD - Knapsack Problem ,Minimum cost spanning tree (Kruskal and Prim's algorithms) , Shortest Paths in a Graph - Dijkstra's Algorithm, Huffman codes and data compression.

DYNAMIC PROGRAMMING - Principles of dynamic programming – Multistage Graphs, all pairs shortest Paths, travelling salesman problem. (11)

BACKTRACKING - General Method - 8 Queens Problem – Sum of Subsets- Graph Coloring - Hamiltonian Cycles.

BRANCH AND BOUND - General Method - 0/1 Knapsack Problem - Traveling Salesperson Problem. (11)

STRING MATCHING: The naïve string-matching algorithm, Rabin-karp algorithm and analysis.

NETWORK FLOW: The Maximum-Flow Problem and the Ford-Fulkerson Algorithm , The Bipartite Matching Problem (10)

NP AND COMPUTATIONAL INTRACTABILITY: Basic concepts – Polynomial time reductions, satisfiability problem NP complete problems., NP Hard problem. (7)

TOTAL : 45

TEXT BOOKS

1. *Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms" , Third Edition , MIT Press, 2012.*
2. *Jon Kleinberg and Eve Tardos, "Algorithm Design", Pearson Education, 2013.*

REFERENCE BOOKS

1. *Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamental of Computer Algorithms", Galgotia Publications, 1998.*
2. *Michael T. Goodrich and Roberto Tamassia, "Algorithm Design, Foundations, Analysis, and Internet Examples", Wiley, 2014.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**M**	**M**	**M**	**H**					
CO2	**M**	**M**	**M**	**M**					**L**
CO3	**M**	**M**	**H**	**H**					
CO4			**M**	**M**					
CO5			**H**	**H**					

21MDS44 - COMPUTER NETWORKS

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Comprehend the characteristics and applications of various networking technologies*
- *For a given network application, can identify the protocols involved at the various layers and demonstrate the role of the protocols*
- *For a given inter-network, find the best route to a destination by applying the various routing protocols*
- *Resolve various domain names in URLs*
- *Implement ML models for simple network problems*

INTRODUCTION

Uses of Computer Networks - Types of Computer Networks -Reference Models - Guided Transmission Media - Wireless Transmission (9)

DATA LINK LAYER

Data Link Layer Design Issues - Error Detection and Correction - Ethernet - Wireless LANs - Bluetooth (8)

NETWORK LAYER

Network Layer Design Issues - Routing Algorithms in Single Network - Internetworking - Software Defined Networking (8)

TRANSPORT LAYER AND APPLICATION LAYER

The Transport Service - Elements of Transport Protocols - Congestion Control - The Internet Transport Protocols: UDP, TCP. Application Layer: DNS - Electronic Mail - The World Wide Web - Streaming Audio and Video.
(13)

MACHINE LEARNING FOR NETWORKING

Introduction- Traffic- prediction, classification and routing, congestion control. (7)

TOTAL : 45

TEXT BOOKS

1. Andrew S. Tanenbaum, Nick Feamster, and David J. Wetherall, "Computer Networks", 6th Edition, Pearson Education, 2021.(Para 1- 5)

2. *Raouf Boutaba, Mohammad A. Salahuddin, Noura Limam, Sara Ayoubi, Nashid Shahriar, Felipe Estrada-Solano,and Oscar M. Caicedo, "A comprehensive survey on machine learning for networking: evolution, applications and research opportunities", Boutaba et al. Journal of Internet Services and Applications (2018), https://doi.org/10.1186/s13174-018-0087-2. (Para – 5).*

REFERENCE BOOKS

1. William Stallings, —Data and Computer Communications, Pearson Education Ninth Edition, 2013

2. Larry L.Peterson and Bruce S. Davie, —Computer Networks – A systems Approach Fifth Edition, Morgan Kaufmann Publishers, 2011

3. BehrouzA.Foruzan, —Data Communication and Networking, Tata McGraw Hill, Fifth Edition, 2013

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1							**H**		**L**
CO2							**H**		**M**
CO3			**L**				**H**		**M**
CO4			**M**						**M**
CO5			**M**						**M**

21MDS45 - MACHINE LEARNING

Contact Hours

L	T	P	C
3	0	0	3

PRE- REQUISITES

21MDS13, 21MDS22, 21MDS31

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Describe the concepts, Methods and Applications of Machine Learning*
- *Apply the machine learning techniques like Bayesian, Decision theory, Parametric, Non-Parametric methods, reinforcement learning and Graphical Models to solve the real time analytical problems*
- *Compare the various machine learning techniques and choose the appropriate technique for the given problem*
- *Perform evaluation of learning algorithms and model selection.*

INTRODUCTION

Machine Learning -Examples of Machine Learning Applications- High-Performance Computing - Data Privacy and Security - Model Interpretability and Trust- Data Science- Supervised Learning - Bayesian Decision Theory. (8)

PARAMETRIC METHODS

Maximum Likelihood Estimation - Bias and Variance - Bayes Estimator - Parametric Classification - Regression - Tuning Model - Model Selection Procedures - Multivariate Classification - Multivariate Regression. (8)

NONPARAMETRIC METHODS

Nonparametric Density Estimation - Generalization to Multivariate Data - Nonparametric Classification - Condensed Nearest Neighbour - Distance-Based Classification - Outlier Detection - Nonparametric Regression - Smoothing Parameter. (8)

DECISION TREES AND KERNAL MACHINES

Uni variate Trees - Pruning - Rule Extraction from Trees - Learning Rules from Data - Multivariate Trees - Ensemble learning - Bagging- Boosting- Random Forest Algorithm -Kernel Machines- SVM

(11)

GRAPHICAL MODEL AND REINFORCEMENT LEARNING

Graphical Models: Introduction-canonical cases for conditional independence-Examples of Graphical Models-Undirected Graphs.

Single State Case: K-Armed Bandit- Elements of Reinforcement Learning- Model-Based Learning Temporal Difference Learning - Generalization - Partially Observable States. (10)

TOTAL : 45

TEXT BOOKS

1. *Ethem Alpaydin, "Introduction to Machine Learning", The MIT Press Cambridge, Massachusetts London, Fourth edition, 2020 (para 1,2,3,4,5)*
2. *Kevin_Patrick_Murphy ,"Probabilistic Machine Learning: An Introduction", MIT Press, March 2022. (para -4, Kernel Machines, Ensemble Learning)*

REFERENCE BOOKS

1. *Machine Learning, Tom Mitchell, McGraw , 1997, 0-07-042807-7*
2. *Bishop, C. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag, 2006.*

Course Outcomes(CO)	Programme Outcomes (PO)						
	PO1	PO2	PO3	PO4	PO5	PO8	PO9
CO1	H	M	L		L		L
CO2	M	M	H	H	M	M	M
CO3	M	M	H	H	H	M	M
CO4	M		M	L	H	M	M

21MDS46 - PREDICTIVE ANALYTICS LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS31, 21MDS41

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

- *Compute various Index Numbers used in Economics*
- *Analyze time series data and perform non parametric tests.*
- *Develop Shewhart Control charts for variables and attributes*
- *Analyze multivariate data using multiple linear regression, discriminant function, logistic regression equation models and cluster analysis tools*
- *Identify underlying factors in multivariate data by applying factor analysis and principal component analysis models*

CONCEPTS TO BE COVERED

1. Creation and access of the Data Sets.(Include Time Series Data Set).
2. Compute the descriptive statistics, variance-covariance and correlation matrix for given data.
3. Apply Principal Component Analysis and Factor Analysis to reduce the dimensions/features of the given dataset.
4. Compute index numbers such as Laspeyre, Paasche, Marshell – Edgeworth , Fisher's Ideal Index numbers
5. Apply Exponential Smoothing techniques, Trend Analysis techniques, Auto Correlation and Regression techniques to forecast the time series data generated for the system.
6. Analyse the given data for predicting the classes or numerical values using multiple linear regression, stepwise regression, logistic regression and multiple logistic regression techniques,
7. Apply Hierarchical and Non-Hierarchical(K-Means) methods to generate theclusters and allocate given input to the existing clusters.
8. Generate control charts for handling quality controls in statistical way.
9. Perform Non-parametric hypothesis tests using the techniques such as Sign test and Wilcoxon Signed Rank test

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**H**	**H**	**H**	**M**				
CO2	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO3	**H**	**M**	**H**	**M**	**M**				
CO4	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**

21MDS47 - DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS26, 21MDS37, 21MDS43

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

- *Design, develop, and optimize the performance of divide-and-conquer algorithms, greedy, dynamic programming ,backtracking, and branch and bound algorithms*
- *Implement and empirically compare fundamental algorithms and data structures to real-world problems*
- *Effectively combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem*
- *Implement a proper pattern matching algorithm for given problem*

CONCEPTS TO BE COVERED

1. Problem using closest pair algorithm

2. Minimum cost spanning tree using Prims and .Kruskal's algorithm

3 Applications of all pairs shortest path problem

4. Application of N QUEENS using back tracking

5. TSP using branch – and – bound

6. String matching algorithms

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	M	M	H	H					
CO2	M	M	M	M					
CO3	H	M	H	H					
CO4			M	M					

21MDS48 - MACHINE LEARNING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE- REQUISITES

21MDS45

ASSESSMENT: **PRACTICAL**

COURSE OUTCOMES

- *Apply various machine learning techniques to generate the analytic solutions*
- *Apply machine learning frameworks to build the learning models*
- *Evaluate the performance of machine learning models using performance metrics*
- *Identify the suitable machine learning model for the given problem*
- *Generate the Visualization model to present the insights of the data using the machine learning frameworks*

CONCEPTS TO BE COVERED

1. Develop Regression models to predict values for the real time system. Apply Cross Validation for evaluating the performance of the models.
2. Build classification models using the methods such as decision tree, Naïve Bayes Classifier, and k-Nearest neighbor Classifier. Evaluate the models using various performance metrics.
3. Implement Clustering and Dimensionality Reduction Methods. Compare the results of these two algorithms and comment on the quality of clustering.
4. Implement Ensemble methods for classification and regression problems.
5. Implement the non-parametric locally weighted regression algorithm to fit data points. select the appropriate data set for your experiment and draw graphs
6. Apply Machine Learning Frameworks such as Azure Machine Learning Workspace and Amazon Machine Learning Platform to build intelligent analytic solutions for real time analytical applications.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**H**	**H**	**M**	**H**	**M**	**L**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**H**	**M**	**L**	**M**	**M**
CO3	**M**	**M**	**M**	**M**				**M**	**M**
CO4	**M**	**M**	**H**	**H**	**H**		**M**	**L**	**L**
CO5	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**	**M**

21MDS49 - PERSONALITY DEVELOPMENT

Contact Hours

L	T	P	C
0	0	2	1

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

- *Ascertain the various concepts of Self like the Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self with respect to the Western(Occidental) and Eastern(Oriental) theories of the Self and Personality Development.*
- *Outline the significant effects of Self Confidence to build team confidence, given the foundation principles of Self Motivation and Confidence.*
- *Assess the various personalities and Attitudes and choose the best attitude for making bold decisions in personal and professional contexts.*
- *Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.*
- *Set Career goals and formulate strategies by Prioritizing, organizing and scheduling the required tasks. Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.*

PERSONALITY DEVELOPMENT

One's Personality Sends Out a Signal That Others Read – Same Person: Consciously Different Personalities can be Powerful – There isn't One Right Personality; It Differs by Role – Learning about Personality Development from the Three Cases – Personality Analysis – Freudian Analysis of Personality Development – Swami Vivekananda's Concept of Personality – Development: Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self – Personality Begets. **(7)**

LEADERSHIP QUALITIES & INTERPERSONAL SKILLS:

Resolving Conflict – A Smiling Face – Appreciative Attitude – Assertive Nature – Communication Skills – Listening Skills – Developing Empathy – The Personality Attribute of Taking Bold Decisions – Personality Types and Leadership Qualities – Mapping the Different Personality Types – Personality Tests: Example of a Personality Test: Jung Typology Test – Personality Assessment **(7)**

ETIQUETTE

Social Etiquette – Corporate Etiquette - Personal Grooming – Using minimal Body Language – Leadership and Entrepreneurship : Corporate Training – Professionalism - Self awareness – Creativity skills – Cognitive Development – Assertiveness – Positive Thinking and Attitude.

(8)

GOAL SETTING AND TIME MANAGEMENT

Goal Setting – Immediate, Short Term and Long Term Goals – Smart Goals – Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management –Identifying Time Wasters – Time Management Skills. **(8)**

TOTAL: 30

REFERENCE BOOKS

1. Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.

2. Krishna Mohan, Meera Banerji. "Developing Communication Skills" Mac Million Publishers, 2012.

3. Sai Lakshmi. B, "Poly Skills- A Course in Communication and Life Skills" Cambridge University Press, 2012.

4. Simon Sweeney, "English for Business Communication", Cambridge University Press, 2013.

5. Meenakshi Raman, Sangeeta Sharma, "Technical Communication - Principles and Practice", 3rd edition, Oxford University Press, New Delhi, 2015.

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1						H			L
CO2					H	M			L
CO3						H			L
CO4						H			L
CO5						H			L

19MAMOC02 - JAVA PROGRAMMING

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Able to learn and implement classes and objects in Java.*

CO2 *: Able to apply inheritance and create interfaces for the given requirement.*

CO3 *: Able to handle the different kinds of exceptions arising in a Java program.*

CO4 *: Able to use IO streams for reading and writing data in Java.*

CO5 *: Able to write socket programs in Java to create network applications.*

INTRODUCTION TO OBJECT ORIENTED PROGRAMMING

Object Oriented Programming - Abstraction - objects and classes - Encapsulation- Inheritance - Polymorphism.

OOP in Java -Characteristics of Java - The Java Environment - Java Source File -Structure - Compilation-Fundamental Programming Structures in Java -Objects and Classes - Strings **(6)**

INHERITANCE AND INTERFACES

Inheritance - Using Super - Creating a Multilevel Hierarchy - Constructors - Method Overriding - Using Abstract Classes - Using Final with Inheritance - The Object Class

Packages and Interfaces - Packages - Access Protection - Importing Packages - Interfaces **(10)**

EXCEPTION HANDLING AND I/O

Exceptions - Exception Hierarchy - Throwing and Catching Exceptions - Built-in exceptions - Creating own exceptions. Input / Output Basics - Streams - Byte streams and Character streams - Reading and Writing Console - Reading and Writing Files **(8)**

SOCKET PROGRAMMING

Basic Concepts- Protocols and Terminology-Starting Network Programming in Java-Multithreading and Multiplexing. Database Connectivity: JDBC **(6)**

Programming exercises based on the above concepts

TOTAL : 30

REFERENCE

1. *Herbert Schildt, "Java The complete reference", 11th Edition, McGraw Hill Education, 2020*

19MAME15 - FEDERATED LEARNING

PRE-REQUISITES

19MAM42

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Explore the key concepts and issues behind Federated Learning*

CO2 : *Gain Knowledge of the basic concepts of DML and applications of FL.*

CO3 : *Analyze horizontal federated learning and it architecture*

CO4 : *Interpret and get familiar with key theoretical results of Federated Learning with new research and application trends in FL.*

CO5 : *Understand the significance of Federated Learning for Vision, Language, and Recommendation.*

INTRODUCTION AND BACKGROUND

Motivation- Federated Learning as a Solution- Definition-Categories of Federated Learning- Current Development in Federated Learning - Research Issues-Open - Source Projects- Standardization Efforts-Federated AI Ecosystem

Privacy-Preserving Machine of Learning- PPML and Secure ML - Threat and Security Models- Privacy Threat Models - Adversary and Security Models - Privacy Preservation Techniques-Secure Multi-Party Computation - Homomorphic Encryption- Differential Privacy **(10)**

DISTRIBUTED MACHINE LEARNING

Introduction to DML - The Definition of DML - DML Platforms - Scalability-Motivated DML- Large-Scale Machine Learning, Scalability-Oriented DML Schemes- Privacy-Motivated DML, Privacy-Preserving Decision Trees, Privacy-Preserving Techniques, Privacy-Preserving DML Schemes, Privacy-Preserving Gradient Descent, Vanilla Federated Learning, Privacy-Preserving Methods **(8)**

HORIZONTAL AND VERTICAL FEDERATED LEARNING

The Definition of HFL - Architecture of HFL - The Client- Server Architecture- The Peer-to-Peer Architecture- Global Model Evaluation- The Federated Averaging Algorithm- Federated Optimization- The FedAvg Algorithm- The Secured FedAvg Algorithm, -Improvement of the FedAvg Algorithm- Communication Efficiency- Client Selection

Vertical Federated Learning: The Definition of VFL, Architecture of VFL- Algorithms of VFL- Secure Federated Linear Regression, - Secure Federated Tree-Boosting **(9)**

FEDERATED TRANSFER LEARNING AND DESIGN

Heterogeneous Federated Learning-Federated Transfer Learning- The FTL Framework-Additively Homomorphic Encryption- The FTL Training Process- The FTL Prediction Process- Security Analysis- Secret Sharing-Based FTL. **Incentive Mechanism Design for Federated Learning:** Paying for Contributions, Profit- Sharing Games -Reverse Auctions - A Fairness-Aware Profit Sharing Framework- Modeling Contribution- Modeling Cost- Modeling Regret- Modeling Temporal Regret- The Policy Orchestrator - Computing Payoff Weightage **(9)**

FEDERATED LEARNING FOR VISION, LANGUAGE, AND RECOMMENDATION

Federated Learning for Computer Vision- Federated CV - Federated Learning for NLP- Federated NLP- Federated Learning for Recommendation Systems- Recommendation Model- Federated Recommendation System. **Federated Reinforcement Learning:** Distributed Reinforcement Learning - Asynchronous Distributed Reinforcement Learning - Synchronous Distributed Reinforcement Learning- Federated Reinforcement Learning-Background and Categorization **(9)**

TOTAL : 45

TEXT BOOK

1. *Federated Learning, Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and Han Yu Synthesis Lectures on Artificial Intelligence and Machine Learning, Morgan & Claypool publishers, 2019. Chapters (1-9)*

REFERENCES

1. *Advances and Open Problems in Federated Learning, Peter Kairouz and H. Brendan McMahan conceived, March 2021.*

19MAME16 - GENERATIVE ADVERSARIAL NETWORKS

[redacted]

PRE-REQUISITES

19MAM62

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Explore the concept of Generative Adversarial Network*

CO2 *: Understand about Unsupervised Learning with GAN*

CO3 *: Describe DCGAN, Conditional GAN and Cycle GAN*

CO4 *: Build Realistic Images from the Text*

CO5 *: Generate images and deploying a deep model on the cloud*

GENERATIVE ADVERSARIAL NETWORK (GAN)

Introduction- Deep Neural Networks - Architecture structure basics - Basic building block - generator - Basic building block - discriminator - Basic Building Block - loss functions - Training - The work process - GAN output - Benefits of a GAN structure. **(8)**

UNSUPERVISED LEARNING WITH GAN

Automating human tasks with deep neural networks - Implementation of GAN - Challenges of GAN models - Improved training approaches and tips for GAN. **Dreaming of New Outdoor Structure using DCGAN:** Definition - A simple pseudocode example - Tools - Parsing the data - Code implementation (Generator and Discriminator) - Training - Evaluation - Adjusting parameters for better performance. **(10)**

TRANSFER IMAGE STYLE ACROSS VARIOUS DOMAINS

Bridging the gap between Supervised and unsupervised learning - Conditional GAN - The training procedure of BEGAN - Image to Image style transfer with CycleGAN. Building Realistic Images from Text: Introduction to StackGAN - Discovering cross-domain relationships with DiscoGAN - Generating handbags from edges with PyTorch - Gender transformation using PyTorch - DiscoGAN versus CycleGAN. **(9)**

GENERATE IMAGES

Transfer Learning - Large scale deep learning with Apache Spark - Generating artistic hallucinated images using DeepDream - Generating handwritten digits with VAE using TensorFlow - A real World analogy of VAE - A Comparison of two generative models GAN and VAE. **(8)**

TAKING MACHINE LEARNING TO PRODUCTION

Building an image correction system using DCGAN - Microservice architecture using containers - Various approaches to deploying deep models - serving Eras-Based deep models on Docker - Deploying a deep model on the cloud with GKE - Serverless image recognition with audio using AWS Lambda and Polly - Practical Applications of GANs : GANs in Medicine and fashion **(10)**

TOTAL : 45

TEXT BOOKS

1. *Kuntal Ganguly, "Learning Generative Adversarial Networks: Next-generation deep learning simplified", I Edition, Packt Publishing Ltd., 2017, (Para II, III, IV and V).*
2. *Josh Kalin, "Generative Adversarial Networks Cookbook", First Edition, Packt Publishing Ltd., (Para I, II),2018*

REFERENCES

1. *Jakub Langr and Vladimir Bok, "GANs in Action: Deep Learning with Generative Adversarial Networks", Manning Publications; First Edition, 2019.*
2. *David Foster, "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, First Edition, O'Reilly* Media, 2019.

20MSSE04 - BLOCKCHAIN TECHNOLOGIES

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Explain the basic components of a blockchain, its operations, underlying algorithms, and essentials of trust.*

CO2 *: Explain the working of Bitcoin and Ethereum blockchains.*

CO3 *: Explain the role of cryptography in securing blockchain.*

CO4 *: Apply the learning of solidity and develop smart contracts*

CO5 *: Develop decentralized apps on Ethereum.*

INTRODUCTION

Basics of Distributed Computing - Consensus Mechanisms - Decentralization - Applications of Blockchain - Scalability and Challenges. **(7)**

BITCOIN BLOCKCHAIN

Introduction - working of bitcoin - Reference Implementation - Keys and Addresses - Wallets. **(10)**

BITCOIN BLOCKCHAIN MINING

Transactions - Scripting - Bitcoin Network - Mining and Consensus. **(9)**

ETHEREUM BLOCKCHAIN

Basics - Ethereum Clients - Ethereum Networks - Ethereum Addresses - Wallets -Transactions - Smart Contract Security. **(9)**

SMART CONTRACTS

Basics - Life Cycle of a Smart Contract - Building a Smart Contract with Solidity-Programming with Solidity - Gas Considerations. **(10)**

TOTAL : 45

TEXT BOOKS

1. *Imran Bashir, "Mastering Blockchain", Packt Publishing, First Edition, 2017. (Para I).*
2. *Andreas M. Antonopoulos, "Mastering Bitcoin - Programming the open Blockchain", O'Reilly, 2017. (Para II,III).*
3. *Andreas M. Antonopoulos Dr. Gavin Wood, "Mastering Ethereum - Building Smart Contracts and DApp", O'Reilly, 2019. Para(IV,V).*

REFERENCES

1. *Lorne Lantz, Daniel Cawrey, "Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, O'Reilly, 2020.*
2. *Saifedean Ammous, "The Bitcoin Standard: The Decentralized Alternative to Central Banking", Wiley, 2018.*

19MAMEL07 - GENERATIVE AI LAB

[redacted]

PRE-REQUISITES

19MAM62

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

CO1 *: Create impressive Generative deep learning models from scratch including variational autoencoders (VAEs) and Generative Adversarial Networks (GANs)*

CO2 *: Implement state-of-the-art architectures such as StyleGAN2, MuseGAN, pix2pix for text,image and music generation*

CO3 *: Use diffusion models for text, image and video datasets for Generative AI applications*

CO4 *: Store and retrieve Images, Text using Vector Database*

CO5 *: Build real time Generative AI applications like chatbots, image,audio,video generation and synthetic dataset generation for various domains*

CONCEPTS TO BE COVERED

- Train GANs to generate images based on your own dataset.
- Implement paired and unpaired style transfer with networks like StyleGAN.
- Use facial landmarks, auto encoders, and pix2pix GAN to create deepfakes.
- Compose music using Generative/LSTM models and the intricate MuseGAN.
- Use VAEs/C-GAN that can change facial expressions in photos.
- Use Image based diffusion models to produce new varieties of flowers
- Generate Text and other text based applications using GPT,Llama,Langchain etc..(AI chatbots)
- Applications of vector databases(Image,Text)
- Text/Image to video Generation (Modelscope.Gen-2 etc..)
- Create a own generative models using DALL.E 2, Imagen or Stable Diffusion-models

TOTAL : 60

Software Used : Python, Open Source Pretained Generative AI Models

19MAMEL08 - SOFTWARE TESTING LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

CO1 *: Learn the fundamentals of software testing methods.*

CO2 *: Design and develop the best test strategies in accordance to the development model*

CO3 *: Design test cases suitable for a software development for different domains.*

CO4 *: Apply the automation testing tools in the production environment*

CO5 *: Develop and validate a test plan.*

Concepts to be covered

- Unit testing - Junit
- Functional testing - Win Runner
- Synchronization Test
- Performance testing using Load Runner
- GUI checkpoint for single/multiple objects using Win Runner
- Design and development of Test Cases for Window Application
- Boundary Value Analysis of Application
- Testing load of Web Application using Load Runner
- Regression testing using Silk Test Tool
- Reliability Testing and Automation Testing using Jmeter
- Unit test cases using MLOps

TOTAL : 60

Software Tools : J Unit 5, WinRunner, Apache Jmeter, Kubeflow, MLflow

ONE CREDIT COURSES

19MAMOC03 - SOFTWARE ENGINEERING

PRE-REQUISITES

Consent of the Instructor

COURSE OUTCOMES

CO1 *: Understand different software life cycle models.*

CO2 *: Identify the functional and non-functional software requirements.*

CO3 *: Apply systematic methodologies for software design and deployment.*

CO4 *: Recognize various testing approaches and maintenance related issues.*

CO5 *: Plan project schedule, and estimate project cost and effort required.*

SOFTWARE PROCESS AND AGILE DEVELOPMENT

Introduction to Software Engineering-Software Process-Software Development Life Cycle Models --Agile Process-Extreme Programming. **(2)**

REQUIREMENTS ANALYSIS AND SPECIFICATION

Functional and Non-Functional-User Requirements-System and Software Requirements Document-Requirement Engineering Process-Requirements Elicitation and Analysis. **(3)**

SOFTWARE DESIGN

Design Process-Design Concepts-Design Model-Architectural Design and Styles-User Interface Design: Interface Analysis-Interface Design

TESTING AND MAINTENANCE

Software Testing Fundamentals-White Box Testing- Basis Path Testing-Control Structure Testing-Black Box Testing- Acceptance Testing - Regression Testing-Unit Testing- Integration Testing-Validation Testing- System Testing & Debugging. **(5)**

PROJECT MANAGEMENT

Software Project Management: Estimation- LOC- Function Point Based Estimation- Make/Buy Decision COCOMO I & II Model-Project Scheduling- Project Plan-Planning Process- Risk Identification and Management-Case Tools. **(5)**

PRACTICALS **(15)**

TOTAL : 30

REFERENCE

1. *Roger S. Pressman, Software Engineering - A Practitioners Approach, Seventh Edition, Mc Graw-Hill International Edition, 2020.*

19MAMOC04 - MACHINE LEARNING OPERATIONS LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

COURSE OUTCOMES

CO1 *: Understand the fundamentals of Machine Learning Operations(MLOPs) and AI pair programming.*

CO2 *: Select and implement web applications and Command line tools for Machine Learning model Interaction.*

CO3 *: Design MLOps pipeline and deploy ML models on cloud.*

CO4 *: Deploy Large Language Models and Containerized models*

CONCEPTS TO BE COVERED

1. Build Python script to automate data pre-processing and feature extraction for machine learning models.
2. Develop a real-world ML/AI solution using AI pair programming and GitHub Copilot, showcasing the ability to collaborate with AI.
3. Create web applications and command-line tools for ML model interaction using Gradio library, Hugging Face, and the Click framework package.
4. Implement GPU-accelerated ML tasks using Rust language for improved performance and efficiency.
5. Train, optimizing, and deploying ML models on cloud such as Amazon SageMaker/Azure ML/Google Cloud Platform for cloud-based MLOps.
6. Design a full MLOps pipeline with MLflow, managing projects, models, and tracking system features.
7. Containerize models using the ONNX format with Hugging Face.

Software/Tools : GitHub Copilot, Hugging Face, Any Cloud Platform.

TOTAL : 30

19MAMOC05 - INNOVATION, STARTUPS AND ENTERPRENEURSHIP

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the concept development*

CO2 *: Familiarize the startup opportunities and startup equation*

CO3 *: Identify new venture creation opportunities, its resources, and Requirements*

CO4 *: Develop entrepreneurial mindset and new trends in entrepreneurship*

CO5 *: Learn the strategic perspectives in entrepreneurship*

Introduction to Entrepreneurship

Definition of entrepreneurship and its significance.

Characteristics and traits of successful entrepreneurs.

Overview of the start-up ecosystem and the entrepreneurial process.

Identifying Business Opportunities

Understanding market trends and opportunities.

Conducting market research and feasibility analysis.

Idea generation and evaluation.

Business Planning and Strategy

Creating a business plan: key components and importance.

Crafting a unique value proposition.

Developing a competitive strategy.

Legal and Financial Considerations

Business registration and legal structures.

Financial management and budgeting.

Sources of funding and fundraising strategies.

Marketing and Sales Strategies

Market segmentation and targeting.

Branding and positioning.

Sales techniques and customer acquisition.

Product Development and Innovation

Prototyping and minimum viable product (MVP) development.

Lean start-up principles and agile methodologies.

Continuous innovation and improvement.

Building a Team and Leadership

Hiring and team-building.

Effective leadership and management skills.

Creating a positive and productive work culture.

Managing Risks and Challenges

Identifying and mitigating business risks.

Dealing with uncertainty and failure.

Resilience and adaptability in entrepreneurship.

Scaling and Growth Strategies

Scaling a start-up: challenges and opportunities.

Expansion strategies and internationalization.

Managing growth and maintaining organizational culture.

Social Entrepreneurship and Sustainability

Introduction to social entrepreneurship-

Balancing profit and purpose.

Sustainable business practices.

Pitching and Investor Presentations

Crafting a compelling pitch deck.

Presenting to investors and stakeholders.

Negotiation and deal-making.

Entrepreneurship in the Digital Age

Leveraging technology for business growth.

E-commerce and digital marketing strategies.

Emerging trends in entrepreneurship.

Assessment :

Entrepreneurial project : students to develop a business plan or pitch presentation for a start-up idea.

TOTAL : 15

LIST OF NPTEL / SWAYAM COURSES

19MAMON01 - ECONOMICS OF BANKING AND FINANCE MARKETS

INTRODUCTION TO CYBER CRIME

The course aims at providing adequate exposure to the basic concepts and policy issues related to the working of the financial markets nationally and globally. The course will cover basic economic theories related to banking and finance markets, and then will apply those to understand the working of both national and global monetary and other related economic variables. The course will follow a macroeconomic perspective and will discuss recent finance market developments and controversies. The course aim to develop the learning skills of the students in a way that they can apply their knowledge not only at the academic level but also at the managerial and leadership level in the field of financial sector.

COURSE LAYOUT

1. An overview of the financial system; debt (bond) markets
2. Debt (bond) markets; interest rate determination
3. Equity markets; basics of banking
4. Banking sector
5. Asymmetric information and the rationale for regulations of finance markets
6. Asymmetric information; Conflicts of interest and rationale for regulations
7. Rationale for regulations; financial crisis
8. Financial crisis; central banking
9. Central banking
10. Central banking and monetary policy tools
11. Effectiveness of policy
12. Monetary policy tactics and strategies

REFERENCES

1. *Mishkin, Frederic S., The Economics of Money, Banking and Financial Markets (AddisonWesley) Ninth Edition, 2010*
2. *Baye, Michael R., & D.W. Jansen, Money, Banking & Financial Markets, An Economics Approach (A.I.T.B.S.), Indian Edition, 1999.*
3. *Froyen, Richard T. Macroeconomics: Theory and Policies.2009*
1. *Websites of Regulatory and Promotional institutions: RBI (www.rbi.org); IMF data (www.imf.org/en/Data); FRED (http://research.stlouisfed.org/fred2); RBI: Handbook of Statistics On Indian Economy*
2. *Economic Dailies: Economic times, Business standard, Financial express, Hindu business line, The Wall Street Journal (www.wsj.com), Financial Times (www.ft.com), Bloomberg (www.bloomberg.com), and The Economist (www.economist.com)*

19MAMON02 - INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS

ABOUT THE COURS

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.This course has been organized into the following modules:

PRE-REQUISITES

Basic knowledge of computer and internet

Course layout

1. Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II
2. Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories
3. Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis
4. Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

5 . IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

6. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.
7. Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.
8. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.
9. Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.
10. Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.
11. Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.
12. Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II : Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab

Case study - VII : Steel Technology Lab

REFERENCES

1) *S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.*

2) *S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.*

19MAMON03 - ETHICAL HACKING

ABOUT THE COURSE

Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them. There will be hands-on demonstrations that will be helpful to the participants. The participants are encouraged to try and replicate the demonstration experiments that will be discussed as part of the course.

PRE-REQUISITES

Basic concepts in programming and networking

Course layout

1. Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.
2. IP addressing and routing. TCP and UDP. IP subnets.
3. Routing protocols. IP version 6.
4. Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool.
5. Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.
6. Introduction to cryptography, private-key encryption, public-key encryption.
7. Cryptographic hash functions, digital signature and certificate, applications.
8. Steganography, biometric authentication, network-based attacks, DNS and Email security.
9. Packet sniffing using wireshark and burpsuite, password attack using burp suite. Social engineering attacks and Denial of service attacks.
10. Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.
11. Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution, etc. Attack on web servers: password attack, SQL injection, cross site scripting.
12. Case studies: various attacks scenarios and their remedies.

REFERENCES

Data and Computer Communications -- W. Stallings.

Data Communication and Networking -- B. A. Forouzan

TCP/IP Protocol Suite -- B. A. Forouzan

UNIX Network Programming -- W. R. Stallings

Introduction to Computer Networks and Cybersecurity -- C-H. Wu and J. D. Irwin

Cryptography and Network Security: Principles and Practice -- W. Stallings

19MAMON04 - AFFECTIVE COMPUTING

ABOUT THE COURSE

Affective Computing focuses on enabling the machines with emotion recognition and adaptive interaction. It lies in the intersection of Computer Science, design and human psychology. This course will overview the emotion theory, computational modelling of emotions, analysis of emotions using different modalities (such as voice, facial expressions, physiological signals etc) and related machine learning and/or signal processing techniques. We will also discuss ethical, legal and social implications of affective computing particularly in relation to Human-Machine Interaction.

PREREQUISITES

Mandatory Prerequisites

Programming, Artificial Intelligence, Machine Learning

Desirable Prerequisites

Human-Computer Interaction, Deep Learning

Course layout

1. Fundamentals of Affective Computing
2. Emotion Theory and Emotional Design
3. Experimental Design: Affect Elicitation; Research and Development Tools
4. Emotions in Facial Expressions
5. Emotions in Voice
6. Emotions in Text
7. Emotions in Physiological Signals
8. Multimodal Emotion Recognition
9. Emotional Empathy in Agents/Machines/Robots
10. Online and Adaptive Recognition of Emotions: Challenges and Opportunities
11. Case Study: Updated from Time to Time
12. Ethical Issues: Ethical, legal and Social Implications of Affective Computing

REFERENCES

1. Affective Computing. MIT Press
2. The Oxford Handbook of Affective Computing. Oxford University Press
3. The Encyclopaedia of Human-Computer Interaction, 2nd Ed.
4. Interaction Design: Beyond Human-Computer Interaction. 2019. (5th Edition) by Jenny Preece, Helen Sharp, Yvonne Rogers (Wiley)

21MBAE68 - LOGISTICS AND SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *To sensitize the students towards the whole new domain - L&SCM*

CO2 : *To develop the basic knowledge to come out with the optimized logistics mix*

CO3 : *To judiciously select the service providers*

CO4 : *To have an in-depth knowledge on the warehouse practices*

CO5 : *To understand the latest developments in transport sector*

CO6 : *To have the first-hand knowledge on the SCM practices in the new world norm.*

LOGISTICS AND LOGISTICS MIX

Logistics: Definition, Objectives, Scope, Importance and Functions. System concept of Logistics. Value added logistical services. Logistics at the center of world trade - A paradigm shift - Logistics for business excellence.

Logistics Mix: Warehousing - Inventory management - Material handling - Material storage - Transportation management - packing and packaging - Logistics information system. **(9)**

LOGISTICS OUTSOURCING, PROVIDERS, PACKING & PACKAGING

Logistics Outsourcing: Trends - Catalysts for outsourcing - Benefits of outsourcing.

Logistics Providers: 3PL / 4PL / 5 PL - Basis for Selection of service provider.

Packing and Packaging: Labels, Functions of Packaging, Designs, Kinds of Packaging. Packing for Transportation and Marking: Types of Boxes, Container, Procedure, Cost. **(9)**

WAREHOUSE, CONTAINERIZATION AND CHARTERING

Warehouse: The role of the warehouse - Types of warehouses - Warehouse operations - Supply chain trends affecting warehouses - Specialized warehouses.

Containerization: Genesis, Concept, Classification, Benefits and Constraints. Inland Container Depot (ICD): Roles and Functions, Container Freight Station (CFS), Export Clearance at ICD; CONCOR; ICDs under CONCOR.

Chartering: Kinds of Charter, Charter Party, and Arbitration. **(9)**

TRANSPORTATION, E-WAY BILL AND AGENTS

Transportation: Functionality and Principles; Air, Sea, Rail, Road transportation - Indian and International Scenario, Cargo Tariff structure of each mode.

E-Way Bill: Meaning, Impact on GST, Bill generation procedure, Advantages to various stakeholders.

Multimodal Transportation: Modal Characteristics; Modal Comparisons; Optimisation.

Clearing and Forwarding Agents: Role, Responsibilities and entrepreneurial avenues. **(9)**

SUPPLY CHAIN MANAGEMENT AND CONTEMPORARY SUPPY CHAINS

Supply Chain Management (SCM): Overview, objectives, nature, meaning, Scope, Importance of SCM. Decision phases in a supply chain. Process view of a supply chain - Supply Chain dynamics - Focus areas in SCM - Evolution of SCM.

Contemporary Supply Chains: Lean supply chains - Agile supply chains - Green supply chain - Flexible supply chain - World-class SCM practices. Current Issues in Supply Chain Management. **(9)**

TOTAL : 45

REFERENCES

1. *James B. Ayers and Mary Ann Odegaard (2018)., "Retail Supply Chain Management", 2nd Edition, CRC Press.*
2. *Donald J. Bowerson. (2017)Logistic and Supply Chain Management: Prentice Hall of India.*
3. *Bhat, K. S. (2014). Logistics and supply chain management. Himalaya Publishing House.*
4. *MuthiahKrishnaveni.(2011) Logistic Management and World Sea Borne Trade: Himalaya Publication.*

21MBAE66 - B2B & B2C SALES & MARKETING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *To illustrate the applications, challenges and the dynamic environment of B2B marketing, including the unique nature of organizational buying behaviour.*

CO2 : *To help the students to understand business-to-business markets which involves planning, conception, product management, pricing, promotion, distribution, and sales of products from one firm to another firm.*

CO3 : *To equip the students with the knowledge about industrial marketing opportunities and competitive strategies.*

CO4 : *To make the students understand the fundamentals of a business to consumer standpoint.*

CO5 : *To teach the students to identify & enter international markets, select targets and position their brands in marketing with the 7s approach.*

INTRODUCTION TO B2B MARKETING

Business Marketing and Business Market Customers - Market Structure - Environment and Characteristics of Business Marketing - Strategic Role of Marketing - Commercial Enterprises - Commercial and Institutional Customer. **(9)**

ORGANIZATIONAL BUYING AND BUYER BEHAVIOUR

Organizational Buyers' Decision Process - A Stepwise Model and A Process Flow Model - Organizational and Business Markets- Government as a Customer. **(9)**

B2B MARKETING STP

Market Segmentation - Basic Framework of Segmentation - Choosing Target Segments and Positioning - Pricing Strategies for Business Markets - B2B Advertising - Competitive Bidding - Relationship Marketing and CRM. **(9)**

INTRODUCTION TO B2C MARKETING

B2B Marketing vs. B2C Marketing - CSI (Consumer Science Investigation) in International Marketing - Targeted Mini Vision-Strategy-Action - Marketing to Bottom of Pyramid. **(9)**

ENTRY, TARGETING AND POSITIONING

Market Landing - Market Targeting - Market Positioning - Self-Positioning - Identify Your Customer: B2C Market Segmentation - Marketing Mix and Cross Country & Cross Industry Growth - 7S of International Marketing Innovation. **(9)**

TOTAL : 45

REFERENCES

1. *Michael D. Hutt, Dheeraj Sharma, Thomas W. Speh, B2B Marketing: A South Asian Perspective Cengage 2014, 11th Edition.*
2. *Sharad Sarin, Business Marketing: Concepts and Cases McGraw Hill 2013, 1st Edition.*
3. *James C. Anderson, Das Narayandas, James A. Narus and D.V.R. Seshadri, Business Market Management (B2B): Understanding, Creating, and Delivering Value, Pearson 2010, 3rd Edition.*
4. *Robert Vitale, WaldemarPfoertsch, Joseph Giglierano, Business to Business, Marketing, Pearson 2011*
5. *Krishna K Havaldar, Business Marketing: Text and Cases McGraw Hill 2014, 4th Edition.*
6. *In Lee (Western Illinois University, USA), Electronic Commerce Management for Business Activities and Global Enterprises: Competitive Advantages, IGI Global Publisher of Timely Knowledge, 2012.*
7. *Joju Michael Mangalam, Turbocharge Your B2C Marketing Performance: How to leverage Analytics and Data Science in Business-to-Consumer Marketing, Kindle Edition, 2017.*

21MBAE67 - TALENT ACQUISITION AND MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

Equip the students to:

CO1 : *Orient management students on the fundamentals of employee recruitment and selection.*

CO2 : *Provide contemporary knowledge of the theoretical concepts of employee recruitment and selection.*

CO3 : *Present latest knowledge of the applications and issues related to employee recruitment and selection.*

RECRUITMENT AND SELECTION PROCESS

Workforce Planning - Workforce Assessment - Employee Life Cycle - Organizational Need Assessment - JobDesign - Job & Job Families - Position - Occupation. Recruitment Analytics - Causes of Bad Recruitment, Metrics of Effective Recruitment - Yield Pyramid Ratio. **(9)**

RECRUITMENT ANALYSIS AND SOURCES OF RECRUITMENT

Motivational Job Specification, Functional Specification - Process - DOT/O*Net - Job Description - JobElement Analysis - Identify Job Competencies - Behavioural Specification -Quan Competence Framework; Screening, Sourcing and Shortlisting -4S Model - Sources of Recruitment, Internal and External Recruitment Methods. **(9)**

TOOLS AND TECHNIQUES IN RECRUITMENT PROCESS

Assessment Techniques in Recruitment Process - Interview Techniques - Motivational, Behavioural & Functional.Behavioural Even Interview Process, Key Interviewer Skills -Non-Interview methods - Knowledge BasedFiltering - Skill Based Filtering - Attitudinal or Potential Based Filtering. **(9)**

TALENT MANAGEMENT STRATEGIES

Selection and Reference Check - Making the Selection Decision. Evaluation Methods - The Ranking Systems - Checklist Scales - Behaviour Anchored Rating Scale (BARS) - Checking References and Checking Scales - Reliability and Validity of Selection Instruments; Nepotism - On-going Recruitment and Selection Issues. **(9)**

USE OF TECHNOLOGY IN RECRUITMENT AND SELECTION

Future of Recruitment and Selection.AI for Recruiting - Use of Online Communication Tools - Video Interviews - Mobile Recruitment - Gamification in Recruitment - Predictive Analytics and Use of NLP in Recruitment. **(9)**

TOTAL : 45

REFERENCES

1. *Dale M. (2003), Handbook of Successful Recruitment and Selection: A Practical Guide for Managers(1st ed.), New Delhi: Crest Publishing House.*
2. *Edenborough R. (2006), Assessment Methods in Recruitment, Selection & Performance: A Manager'sGuide to Pyschometric Testing, Interviews and Assessment Centres (3rd ed.), London: Kogan Page.*
3. *Jonathan Crawshaw, Pawan Budhwar, Ann Davis, "Human Resource Management - Strategic andInternational Perspectives", Sage Publications Ltd., July-2020.*
4. *SonalMinocha, Dean Hristov, "Global Talent Management - An Integrated Approach, Sage Publications, December-2018.*
5. *Carrie A. Picardi, "Recruitment and Selection - Strategies for Workforce Planning & Assessment, Sage Publications, 2019.*

Year- 3 (2021-22)			
Sl.No	**Name of the programme**	**Name of the Course**	**Course Code**
Civil Engineering			
1	BE Civil Engineering	Green Building Concepts and Practices	19CEE21
2	BE Civil Engineering	Intelligent Transport System	19CEE32
3	BE Civil Engineering	Python for Civil Engineers	19CEOC05
4	BE Civil Engineering	3DPrinting of Civil Engineering Structures	19CEOC06
5	BE Civil Engineering	Sustainability in construction	19CEOC09
6	BE Civil Engineering	Introduction to Image Processing and GIS	19CEOC10
Mechanical Engineering			
7	B.E. Mechanical Engineering	Smart Materials	19MEE49
8	B.E. Mechanical Engineering	Product Design and Manufacturing	19ME45
9	B.E. Mechanical Engineering	Fundamentals of Nuclear Power Generation	
10	B.E. Mechanical Engineering	Applied Ergonomics	
11	B.E. Mechanical Engineering	Innovation and Entrepreneurship	19MEOC14
12	B.E. Mechanical Engineering	3D Scanning Technology	19MEOC15
Electrical and Electronics Engineering			
13	B.E.Electrical and Electronics Engineering	Smart Grid	19EE73
14	B.E.Electrical and Electronics Engineering	Energy Audit in Thermal and Electrical Utilities	19EEE19
15	B.E.Electrical and Electronics Engineering	Automation, Renewable Energy & FPGA Laboratory	19EEE29

Sl.No	Name of the programme	Name of the Course	Course Code
16	B.E.Electrical and Electronics Engineering	Professional Competency	19EEL75
17	B.E.Electrical and Electronics Engineering	Project work phase I	19EE76
18	B.E.Electrical and Electronics Engineering	Project work phase II	19EE81
Electronics and Communication Engineering			
19	B.E.Electronics and Communication Engineering	Communication Skills For Engineering Professionals	19ECOC16
20	B.E.Electronics and Communication Engineering	ENTREPRENEURSHIP AND MANAGEMENT FUNCTIONS	19ECOC17
21	B.E.Electronics and Communication Engineering	HMS Foundation courseon Mobile App Development	19ECOC02
22	B.E.Electronics and Communication Engineering	Baseband Communication- Signal Generation and Analysis	19ECOC23
23	B.E.Electronics and Communication Engineering	RF Measurements	19ECOC24
24	B.E.Electronics and Communication Engineering	Emloyability and Personality Development skills II	19HOC61
Computer Science Engineering			
25	BE Computer Science Engineering	Data Analytics and Decision Making I(NPTEL)	-
26	BE Computer Science Engineering	Ethical Hacking(NPTEL)	-
27	BE Computer Science Engineering	Data Science	19CSE01
28	BE Computer Science Engineering	C++ Programming	19CIOC01

Sl.No	Name of the programme	Name of the Course	Course Code
29	BE Computer Science Engineering	Applications of Probability	19CIOC03
30	BE Computer Science Engineering	User Interface Design	19CIOC04
31	BE Computer Science Engineering	Comprehensive Exam Training	19CIOC06
Information Technology			
32	B.Tech Information Technology	Embedded Systems	19CI53
33	B.Tech Information Technology	Embedded Systems Laboratory	19ITL52
34	B.Tech Information Technology	Employability and Personal Development Skills-I	19HOC51
35	B.Tech Information Technology	Virtual and Augmented Reality	19ITE16
36	B.Tech Information Technology	Internet Technology and Software Engineering Laboratory	19ITL64
Chemical Engineering			
37	B.Tech. Chemical Engineering	Numerical Methods in Chemical Engineering	19CH51
38	B.Tech. Chemical Engineering	Entreprenurship Development	19CHL56
39	B.Tech. Chemical Engineering	Internship-I	19INT51
40	B.Tech. Chemical Engineering	Internship-II	19INT61
41	B.Tech. Chemical Engineering	Employability and personality development skills-I	19HOC51
42	B.Tech. Chemical Engineering	Employability and personality development skills-II	19HOC61

Sl.No	Name of the programme	Name of the Course	Course Code
Advanced Manufacturing Technology			
43	M. E. Advanced Manufacturing Technology	Production Operation and Management	19MMAE37
44	M. E. Advanced Manufacturing Technology	Modeling and Analysis of Supply Chain Management	19MMAE38
Data Science			
45	MSc Data Science	Algebra and Applications	21MDS12
46	MSc Data Science	Problem Solving and Programming in Python	21MDS14
47	MSc Data Science	Principles of Digital Electronics	21MDS15
48	MSc Data Science	Computing Laboratory I	21MDS16
49	MSc Data Science	Programming Laboratory in Python	21MDS17
50	MSc Data Science	Digital Electronics Laboratory	21MDS18
51	MSc Data Science	Language Elective	21MDSLE01
52	MSc Data Science	Calculus and Applications	21MDS21
53	MSc Data Science	Data Structures and Algorithms I	21MDS23
54	MSc Data Science	Computing Laboratory II	21MDS25
55	MSc Data Science	Data Structures and Algorithms Laboratory I	21MDS26
Master of Computer Applications			
56	Master of Computer Applications	Basics of Robotics	20MCAE109
57	Master of Computer Applications	GPU and Parallel Programming	20MCAE110
58	Master of Computer Applications	Digital Image Processing	20MCAE111

Sl.No	Name of the programme	Name of the Course	Course Code
59	Master of Computer Applications	Blockchain Technologies	20MCAE112
60	Master of Computer Applications	Single page web applications	20MCAE113
61	Master of Computer Applications	Computer Vision	20MCAE116
62	Master of Computer Applications	Software Testing and Quality Assurance	20MCAE117
63	Master of Computer Applications	Open Source Ecosystem	20MCAE118
64	Master of Computer Applications	Enterprise Management and Computing	20MCAE119
65	Master of Computer Applications	Natural Language Processing	20MCAE205
66	Master of Computer Applications	Data Mining and Warehousing	20MCAE304
67	Master of Computer Applications	Ad Hoc Networks	20MCAE305
68	Master of Computer Applications	GPU and Parallel Programming Laboratory	20MCAEL06
69	Master of Computer Applications	Image Processing Laboratory	20MCAEL07
70	Master of Computer Applications	Web Frameworks Laboratory	20MCAEL08
71	Master of Computer Applications	Natural Language Processing Laboratory	20MCAEL09
72	Master of Computer Applications	Social Network Analysis Laboratory	20MCAEL10

Sl.No	Name of the programme	Name of the Course	Course Code
73	Master of Computer Applications	Networks Programming Laboratory	20MCAEL11
74	Master of Computer Applications	Devops Essentials	20MCAOC02
Artificial Intelligence & Machine Learning			
75	M.Sc. (Artificial Intelligence & Machine Learning)	Artificial Neural Networks	19MAM52
76	M.Sc. (Artificial Intelligence & Machine Learning)	Knowledge Based Systems	19MAM53
77	M.Sc. (Artificial Intelligence & Machine Learning)	AI Systems Engineering	19MAM54
78	M.Sc. (Artificial Intelligence & Machine Learning)	Distributed and Cloud Computing	19MAM55
79	M.Sc. (Artificial Intelligence & Machine Learning)	Advanced Machine Learning Lab	19MAM56
80	M.Sc. (Artificial Intelligence & Machine Learning)	Full Stack Web Development Lab	19MAM57
81	M.Sc. (Artificial Intelligence & Machine Learning)	Cloud Computing Lab	19MAM58
82	M.Sc. (Artificial Intelligence & Machine Learning)	Intelligent Agents	19MAM61
83	M.Sc. (Artificial Intelligence & Machine Learning)	Information Retrieval and Web Search	19MAM63
84	M.Sc. (Artificial Intelligence & Machine Learning)	Big data Analytics	19MAM64
85	M.Sc. (Artificial Intelligence & Machine Learning)	Deep Learning Lab	19MAM65
86	M.Sc. (Artificial Intelligence & Machine Learning)	Mobile Application Development Lab	19MAM66

Sl.No	Name of the programme	Name of the Course	Course Code
87	M.Sc. (Artificial Intelligence & Machine Learning)	Big Data Analytics Lab	19MAM67
88	M.Sc. (Artificial Intelligence & Machine Learning)	Project Work and Viva Voce-I	19MAM71
89	M.Sc. (Artificial Intelligence & Machine Learning)	Graph Representation Learning	19MAM81
90	M.Sc. (Artificial Intelligence & Machine Learning)	Reinforcement Learning	19MAM82
91	M.Sc. (Artificial Intelligence & Machine Learning)	Meta-Heuristic Optimization Techniques	19MAM83
92	M.Sc. (Artificial Intelligence & Machine Learning)	Meta-Heuristic Optimization Lab	19MAM84
93	M.Sc. (Artificial Intelligence & Machine Learning)	Computer Vision	19MAM91
94	M.Sc. (Artificial Intelligence & Machine Learning)	Cyber Threat Intelligence	19MAM92
95	M.Sc. (Artificial Intelligence & Machine Learning)	Computer Vision Lab	19MAM93
96	M.Sc. (Artificial Intelligence & Machine Learning)	Intelligent Cyber Security Lab	19MAM94
97	M.Sc. (Artificial Intelligence & Machine Learning)	Project Work and Viva Voce-II	19MAM101
98	M.Sc. (Artificial Intelligence & Machine Learning)	Ethics in AI	19MAME01
99	M.Sc. (Artificial Intelligence & Machine Learning)	Healthcare Analytics	19MAME02
100	M.Sc. (Artificial Intelligence & Machine Learning)	Smart Applications	19MAME03

Sl.No	Name of the programme	Name of the Course	Course Code
101	M.Sc. (Artificial Intelligence & Machine Learning)	Spatial Data Modelling and Analysis	19MAME04
102	M.Sc. (Artificial Intelligence & Machine Learning)	Augmented and Virtual Reality	19MAME05
103	M.Sc. (Artificial Intelligence & Machine Learning)	Medical Image Processing	19MAME06
104	M.Sc. (Artificial Intelligence & Machine Learning)	Natural Language Processing	19MAME07
105	M.Sc. (Artificial Intelligence & Machine Learning)	Probabilistic Graphical Models	19MAME08
106	M.Sc. (Artificial Intelligence & Machine Learning)	Cognitive Computing	19MAME09
107	M.Sc. (Artificial Intelligence & Machine Learning)	Robotics and its Applications	19MAME11
108	M.Sc. (Artificial Intelligence & Machine Learning)	Conversational AI	19MAME12
109	M.Sc. (Artificial Intelligence & Machine Learning)	Game Theory	19MAME13
110	M.Sc. (Artificial Intelligence & Machine Learning)	Agile Software Development	19MAME14
111	M.Sc. (Artificial Intelligence & Machine Learning)	SOA and Web Services	19MAME15
112	M.Sc. (Artificial Intelligence & Machine Learning)	Digital Signal and Image Processing	19MAME17
113	M.Sc. (Artificial Intelligence & Machine Learning)	Business Intelligence	19MAME19
114	M.Sc. (Artificial Intelligence & Machine Learning)	Spatial Data Modelling and Analysis Laboratory	19MAMEL01

Sl.No	Name of the programme	Name of the Course	Course Code
115	M.Sc. (Artificial Intelligence & Machine Learning)	Augmented and Virtual Reality Lab	19MAMEL02
116	M.Sc. (Artificial Intelligence & Machine Learning)	Natural Language Processing Lab	19MAMEL03
117	M.Sc. (Artificial Intelligence & Machine Learning)	Graph Analytics Lab	19MAMEL04
118	M.Sc. (Artificial Intelligence & Machine Learning)	Internet of Things Lab	19MAMEL05

19CEE21 - GREEN BUILDING CONCEPTS AND PRACTICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

CO1 *: Outline the basic concept of green building.*

CO2 *: Assess the different components of the green building.*

CO3 *: Assimilate the green building rating system.*

CO4 *: Apply the green building auditing for effective Management.*

GREEN BUILDING PERSPECTIVE

Introduction to Green Buildings: Definition of green buildings and sustainable development - Impact of design, construction & maintenance of buildings on our environment and natural resources - Components of Green Building - Operational energy in Building and Life cycle energy - Embodied energy - Opportunities of Green Building - benefits of green buildings towards sustainable development. **(9)**

SITE SELECTION AND PLANNING

Criteria for site selection- preservation of landscape-minimizing urban heat island effect- maximize comfort by proper orientation of building facades - Rainwater harvesting methods for roof & non-roof, reducing landscape water demand with recycle and reuse of waste water systems. **(9)**

MATERIAL CONSERVATION AND INDOOR ENVIRONMENTAL QUALITY

Waste reduction during construction -materials with recycled content- local materials selection -material reuse-certified wood - Renewable building materials and furniture - day lighting -air ventilation, exhaust systems - low VOC paints, materials & adhesives -Air conditioning - Indoor air quality - Sick building syndrome -Reasons for poor IAQ- Measures to achieve Acceptable IAQ levels. **(9)**

GREEN BUILDING RATING SYSTEM

Green Building initiatives in India - Benefits Experienced in Green Buildings - Indian Green Building Council- - Launch of Green Building Rating Systems - Green Performance rating - requirements of LEED - GRIHA - Energy Conservation Building Code requirements - Concepts of Overall Thermal Transfer Value (OTTV). **(9)**

CASE STUDY

Case study on Green building Auditing- Energy management - water management - carbon footprint- preliminary Audit and Detailed audit - suggestions. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Kent Peterson, Standard for the design for High Performance Green Buildings, IGCC, 2009*
2. *Tomwoolley and Samkimings, Green Building Hand Book,Volume 1, Taylor & Francis 2009.*

REFERENCES

1. *Handbook on Green Practices, Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.*
2. *Wines James &Jodido Philip, "Green Architecture - The Art of Architecture in the age of Ecology", Tachen Publishers, New York, 2000.*
3. *Mackenzie Dorothy, "Green design: design for the Environment", Laurence King, London, 1997.*
4. *Farmer John & Richardson Kenneth, "Green Shift: Changing attitudes in architecture to the Natural World", Architectural Press, Boston, 1999.*
5. *Energy Conservaton Building Code , Bureau of Energy Effeciency, Ministry of Power, Government of India, 2017.*

ONLINE RESOURCE

1. *http://nptel.ac.in*

19CEE32 - INTELLIGENT TRANSPORT SYSTEM

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

CO1 *: Understand the concepts and need for Intelligent Transport Systems.*

CO2 *: Acquire the basic knowledge on data collection using ITS.*

CO3 *: Incorporate the knowledge of management and automation of traffic systems*

CO4 *: Apply the concepts of ITS in the field of Transportation planning*

INTRODUCTION TO ITS

Introduction to Intelligent Transport System (ITS) - Definition of ITS and Identification of ITS- Need for ITS, Objectives, Historical Background, Benefits of ITS **(9)**

DATA COLLECTION TECHNIQUES

ITS Data collection techniques - Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection **(9)**

FUNCTIONAL AREAS

Telecommunication in ITS - functional areas of ITS - Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS) **(10)**

TRAFFIC MANAGEMENT AND AUTOMATION

ITS User Needs and Services - Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management, Mobile Applications; Automated Highway Systems - Overview of ITS implementations in developed countries, ITS in developing countries. **(10)**

ITS IN INDIAN CITIES

Incorporation of ITS technologies in Indian cities - Transportation Planning applications - Metro rail systems - user friendly apps - case studies **(7)**

TOTAL : 45

TEXT BOOKS

1. *Srinivasa R Kumar 'Intelligent Transport Systems', Orient Blackswan Pvt Ltd, 2021*
2. *Pradip Kumar Sarkar & Amit Kumar Jain 'Intelligent Transport Systems', PHI Learning, 2018*
3. *Dr. L. R. Kadiyali 'Traffic Engineering and Transport Planning', Khanna Publishers, 2012*

REFERENCES

1. *ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles*

ONLINE RESOURCES

1. *https://nptel.ac.in*
2. *National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).*

19CEOC05 - PYTHON FOR CIVIL ENGINEERS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

On successful completion of this course, the student will be able to

***CO1** : Develop simple Python program in interactive and script mode.*

***CO2** : Construct Python programs using functions and strings.*

***CO3** : Make use of Python lists, set, tuples, dictionaries to represent compound data.*

***CO4** : Build Python Programs to read and write data from/to files.*

***CO5** : Develop python programs to handle exceptions.*

BASICS OF PYTHON PROGRAMMING

Introduction-Python interpreter- interactive and script mode; values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments. **(2)**

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON

Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion. **(3)**

DATA STRUCTURES: STRINGS, LISTS, SET

Strings: string slices, immutability, string methods and operations; Lists: creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions ; list processing : list comprehension, searching and sorting, Sets: creating sets, set operations. **(3)**

DATA STRUCTURES: TUPLES, DICTIONARIES

Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries. **(2)**

CIVIL ENGINEERING APPLICATIONS

Programming for Concrete Mix Design, Concrete quantity calculation, Brickwork material Calculation, Cement and Sand material calculation for Mortar. **(2)**

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. *Ashok NamdevKamthane,Amit Ashok Kamthane, Programming and Problem Solving with Python , Mc-Graw Hill Education,2018.*
2. *Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.*

REFERENCE

1. *Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.*

19CEOC07 - ALTERNATIVE BUILDING MATERIALS FROM WASTE

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Identify the characteristics related to waste*

CO2 *: Evaluate the properties of blended materials for non-load bearing purpose*

CO3 *: Evaluate the properties of blended materials for load bearing purpose*

INTRODUCTION

Environmental issues - Global warming - Eco friendly materials - Materials related to less energy consumption and carbon di oxide emission **(2)**

BLOCKS & BRICKS

Waste based blocks and bricks - Advantages - Disadvantages - Applications **(2)**

CEMENTS

Pozzolana - Types - Agro and industrial based waste - Characterization - - Process adopted to improve properties - Applications in cement / mortar / concrete **(3)**

AGGREGATES

Artificial aggregates - Waste as replacement for aggregates - Characterization - Applications in Cement / mortar / concrete

Recycled coarse aggregate - Recycled fine aggregate **(3)**

MISCELLANEOUS ELEMENTS

Wastes used for non-structural elements - Partitions - Walls - Roofing system - windows **(2)**

TOTAL : 12+3 (Evaluation) = 15

REFERENCES

1. *Neville, A. M., "Properties of concrete", Pearson Education Limited, 2012.*
2. *Santhakumar A. R., "Concrete Technology", Oxford University Press, New Delhi, 2018.*

19CEOC09 - SUSTAINABILITY IN CONSTRUCTION

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the definition, concept & objectives of sustainable construction.*

CO2 *: Integrate with architects, designers and builders, to improve a building's performance.*

CO3 *: State the concept of energy efficient design used in construction.*

CO4 *: Select the suitability of eco-friendly building materials for construction.*

CO5 *: Assess the appropriate technology for sustainable construction practice.*

FUNDAMENTALS OF SUSTAINABLE BUILDING

The context and principles of sustainable design - A view of the current state of sustainable building in national and internationally - Physical, psychological and financial benefits of Sustainable construction. **(3)**

SUSTAINABLE ARCHITECTURE AND DESIGN

Role of architecture in sustainable construction - An introduction to sustainable site planning and ecological design - Importance of transportation planning, siting and relationship to sustainability - Benefits of adopting a natural systems-based approach - Bio-mimicry as a design tool based on ecosystem analogy. **(3)**

ENERGY EFFICIENT DESIGN

Importance of building energy systems - impacts of energy with human experience and the global environment -Low Energy Building Strategies - Fundamental building energy systems: HVAC, lighting and water conservation. **(3)**

SUSTAINABLE MATERIALS SELECTION

Factors in material selection-Material considerations when designing a green construction - Eco friendly building materials: Environmental impact study of building materials about composition, production and recycling, physical properties - Life cycle assessment. **(3)**

SUSTAINABLE BUILDING TECHNOLOGIES

Introduction to alternative building technologies: Traditional, vernacular, advanced technological such as interlocking blocks, composite beam and panel, cavity walls, core unit slabs, filler slabs, ferro-cement walls and earthen buildings. **(3)**

TOTAL : 12+3 (Evaluation) = 15

TEXT BOOKS

1. *Sustainable Construction - Green Building Design & Delivery,Kibert,Wiley 4th Edition, 2016*
2. *Sustainable Building - Design Manual Pt 1 & 2, The Energy and Resources Institute, TERI, 2004*
3. *Alternative Building Materials and Technologies, K S Jagadeesh, B V Venkatta Rama Reddy & K S NanjundaRao - New Age International Publishers, 2017*
4. *Green Building: Project Planning and Cost Estimating, Karolides, A, R S Means - 3rd Edition 2010*
5. *Integrated Sustainable Design of Buildings, Paul Appleby, Routledge; 1st edition - 2015*

19CEOC10 - INTRODUCTION TO IMAGE PROCESSING AND GIS

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1 *: Carry out remote sensing and GIS applications of various industrial needs.*

CO2 *: Demonstrate the various environmental change detections.*

CO3 *: Use the instrumental data for decision support system*

CO4 *: Create a map incorporating the required features as required.*

CO5 *: Analyze, model and create a database management system*

LIST OF EXPERIMENTS

1. Starting up a GIS map and layer editing & exploring
2. Using tools : Hyperlink, identify and navigate
3. Exploring feature- attribute relationship
4. Exploring benefits of the feature-attribute relationship
5. Creating a map layout
6. Reversing a map layout
7. Finding places by using coordinates
8. Determination of Measurements on maps using Mercator projection, Mollweide projection and Winkel Tripel projection
9. Implementation of Vector and Raster data in ArcMap
10. Working with geographic data and exploring
11. Exploration of Query data based on attributes and locations
12. Analyzing data using Buffer and Overlay
13. Analyzing the GIS analysis process using tools, query and combinations

TEXT BOOKS

1. *Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Company, France, 1996.*
2. *Lillesand, Thomas.M and Raiph W.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2002.*

REFERENCES

1. *Burrough.P.A., "Principles of GIS for Land Resources Assesment, Oxford Publication, 1998.*
2. *Thomas.M.Lillesand and Ralph.W.Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, 2003.*

19MEE11 - SMART MATERIALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

On Completion of the course, the students should be able to:

CO1 *: Analyze the various types of smart materials.*

CO2 *: Evaluate the characteristics of smart material for different domains.*

CO3 *: Analyze and select a smart material according to the requirement.*

INTRODUCTION AND HISTORICAL PERSPECTIVE

Smart materials -The principal ingredients of smart materials - Generation of smart materials - Diverse areas of smart materials - Primitive functions of smart materials - System intelligence- components and classification of smart structures, common smart materials and associated stimulus-response, Application areas of smart systems - Wolff's law, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect. **(9)**

PIEZOELECTRIC MATERIALS

Electrostriction - Pyroelectricity - Piezoelectricity -Piezoelectric effect direct and converse-Industrial piezoelectric materials - PZT - PVDF - PVDF film - Properties of piezoelectric materials - Piezoceramics, Piezopolymers - Bimorphs - SAW filters. Piezeoelctric Strain Sensors, Accelerometers, Active Fibre Sensing. **(9)**

SHAPE - MEMORY (ALLOYS) MATERIALS

Shape memory alloys (SMA) - Nickel - Titanium alloy (Nitinol) - Materials characteristics of Nitinol - Thermoelastic martensitic transformations -SMA memorization process, Shape memory effect (SME), One way and two-way SME, training of SMAs, Functional properties of SMAs - Applications of SMA - SMA fibers - Micro robot actuated by SMA - Satellite antenna applications. **(9)**

ELECTRO-RHEOLOGICAL AND MAGNETORHEOLOGICAL FLUIDS

Bingham-body model - Newtonian viscosity and non-Newtonian viscosity - Principal characteristics of electro rheological and magnetorheological fluids - The electrorheological phenomenon - Charge migration mechanism for the dispersed phase -Magnetorheological effect Applications of electrorheological and magnetorheological fluids. **(9)**

SMART POLYMERS AND HYDROGELS

Thermally responsive polymers, Electroactive polymers microgels, Synthesis, Properties and Applications, Protein-based smart polymers, pH-responsive and photo-responsive polymers, Self-assembly, Molecular imprinting using smart polymers, Drug delivery using smart polymers

Hydrogel: Synthesis, Fast responsive hydrogels, Molecular recognition, Smart hydrogels as actuators, Controlled drug release, Hydrogels in microfluidics. **(9)**

TOTAL : 45

TEXT BOOK

1. *M. V. Gandhi and B.S. Thompson, Smart Materials and Structures, Chapman and Hall, London, 1st Edition, 1992.*

2. *K. Otsuka, C.M. Wayman (Eds.), Shape Memory Materials, Cambridge University Press, 1998.*

REFERENCES

1. *I. Galaev, B. Mattiasson (Eds.), Smart Polymers: Applications in Biotechnology and Biomedicine, 2nd Edition, CRC Press, 2008.*

2. *N. Yui, R. J. Mrsny, K. Park (Eds.), Reflexive Polymers and Hydrogels: Understanding and Designing Fast Responsive Polymeric Systems, CRC Press, 2004.*

19MEOC14 - INNOVATION AND ENTREPRENEURSHIP

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

The students will be able to

CO1 *: Discuss the relationship between innovation and entrepreneurship.*

CO2 *: Recognize societal and environmental needs and propose innovative solutions*

CO3 *: Distinguish between Intrapreneurship, Business and Entrepreneurship and explain the various stages of entrepreneurship.*

INTRODUCTION

Innovation and its Need - Entrepreneurial Stages **(3)**

INNOVATION

Principles of Innovation, Do's and Don'ts - Sources for Innovation, unexpected success and failure, demographics and perception - Motivation for Innovation, Societal and Environmental Needs, Incongruities between perceived and actual customer values and expectations - High-risk High-return Innovation **(6)**

ENTREPRENEURSHIP

Intrapreneurship vs Entrepreneurship - Business vs Entrepreneurship- Entrepreneurial Processes **(6)**

TOTAL : 15

TEXT BOOK

1. *Peter F Drucker, "Innovation and Entrepreneurship", Harper and Row Publishers Inc, USA, 2009.*

REFERENCE

1. *Robert D Hisrich, Michael P Peters and Dean A Shepherd, "Entrepreneurship", Tata Mc Graw Hill, 10th Edition, 2017.*

19MEOC15 - 3-D SCANNING TECHNOLOGY

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of this course, the students will be able to

CO1 *: Apply the 3-D scanning process in any industrial environment*

CO2 *: Demonstrate the postprocessing skills in 3-D scanning process*

INTRODUCTION OF 3-D SCANNING TECHNOLOGY AND SCANNING DEMONSTRATION

3-D scanner working principle - types of 3-D scanners - technical specification - scanning software interface - applications - scanning demonstration. **(3)**

SOFTWARE INTERFACE

Three zones of software interface - workspace panel - scanned model - 3-D window - control panel - functional menu - new project - open project - save project - file format - scan folder - snapshots or frames of object - solid polygonal model - model parameters - number of polygons - number of vertices - size of model in random access memory - visibility of scanned object on workspace - tool panel - scan - scanning mode - edit - registration algorithms - fusion algorithm - post processing algorithms - align - edges - repair - measures - multi-scan - texture - publish. **(2)**

BASIC PROCESSING

Continuous scanning (auto-align) mode - manual alignment - global registration algorithms - geometry registration algorithm - polygonal modelling - sharp fusion algorithm - small object filter algorithm - mesh simplification algorithm - file formats for exporting model. **(2)**

PRACTICE ON POST-PROCESSING OF SCANNED IMAGE FILES **(8)**

TOTAL : 15

REFERENCES

1. *https://artecgroup.zendesk.com/hc/en-us/articles/201926472-Lesson-1-Installing-Artec-Studio*
2. *https://artecgroup.zendesk.com/hc/en-us/articles/201926482-Lesson-2-Artec-Studio-interface*
3. *https://artecgroup.zendesk.com/hc/en-us/articles/202051201-Lesson-3-Basic-processing*
4. *https://artecgroup.zendesk.com/hc/en-us/articles/201837081-How-to-3D-body-scan-with-Artec-Eva*

19EE73 - SMART GRID

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

***CO1** : Explain the basic concepts of smart grid , its components, architecture and distinguish from traditional grid*

***CO2** : Identify suitable power electronic converters for WAMPCS and select appropriate compensation methods for solar PV, micro - hydro, wind and battery storage connected micro - grids*

***CO3** : Diagnose and control the grid quality using different communication algorithms / systems and security concerns*

***CO4** : Summarize various metering services in smart grid & outline the concepts of attacks in metering*

***CO5** : Decide smart grid pathway through various case studies*

INTRODUCTION

Review Basic Elements of Electrical Power Systems - Evolution of Electric Grid - Definitions - Today's Grid Vs the Smart Grid - Need for Smart Grid - smart grid Roadmap -Transforming to smart grid- Interoperability Framework of Smart grid - Functions of Smart Grid and its Components - Overview of the technologies required for the Smart Grid - Concept of Resilient &Self Healing Grid - Present development & International policies in Smart Grid - Smart Grid Market Drivers - Stakeholders Roles and Function - Standards for Smart Grid - Opportunities, Challenges and Benefits. **9**

SMART GRID TECHNOLOGIES

Technology Drivers - Smart Energy Resources - Sustainable Energy Options for the Smart Grid - Variability Issues Associated with Sustainable Energy Technology - Demand Response Issues - Power Electronics in the Smart Grid - Smart substations - Power Quality issues in Smart Grid - Power Quality Conditioners for Smart Grid - Energy Storage Technologies: Batteries - Flow Battery - Fuel Cell and Hydrogen Electrolyze SMES - Super Capacitors E- mobility. **9**

INFORMATION AND COMMUNICATION TECHNOLOGY

Communication Technology - Two - way Digital Communications - Standards for Information Exchange - Communication Infrastructure and Protocols for Smart metering - Standards for smart metering - - IEC 61850 - Interoperability - Smart Grid Network Interoperability - Local Area Network (LAN) - MODBUS - DNP3 - Home Area Networks (HAN) / Home Energy Networks (HEN) - Wide Area Network (WAN) - Broadband over Power Line (BPL) - IP based Protocols - Basics of Web Service - Cloud Computing.

Cyber Security: Symmetric key encryption - Public key encryption - Authentication - Cyber security concerns associated with AMI - Cyber Security Challenges in Smart Grid - Load Altering Attacks - False Data Injection Attacks -Alarming Smart grid threats- Mitigation Approaches - Standards **9**

SMART METERS AND ADVANCED METERING INFRASTRUCTURE

Introduction to Smart Meters - Sensor Networks - Wide Area Monitoring Systems (WAMS) - Energy Management System (EMU)-Phasor Measurement Units (PMUs)-GIS and Google Mapping tools - Advanced Metering infrastructure (AMI) drivers and benefits - AMI protocols, standards and initiatives - AMI needs in the smart grid - SCADA - RTU - Distribution System Modeling - Intelligent Electronic Devices(IED) - Fault Detection, Isolation and Restoration - Self Healing Systems - Monitoring & Protection- IEC 61968- 9 **9**

SMART GRID PATHWAYS TO DESIGN AND CASE STUDIES

Introduction to Smart Grid Pathway Design - Barriers and Solutions to Smart Grid Development - Automation at Generation, Transmission, Distribution and End User Level. Demonstration Projects - Advanced Metering - Case Study for Renewable Energy Resource Integration: Smart city - Description of Smart Grid Activity - Approach for Smart Grid Application - Benchmarking - Smart grid for world's largest Power systems- Development targets interconnection with USA- Case study on south Korean smart grid Test bed on Jeju Island. **9**

TOTAL : 45

TEXT BOOKS

1. *Bernd M. Buchholz Zbigniew Styczynski, "Smart Grids Fundamentals and Technologies in Electricity Networks", Springer Berlin Heidelberg, Mar.2020*
2. *James Momoh, "Smart Grid - Fundamentals of Design and Analysis", IEEE Press, John Wiley & Sons, INC., New Jersey, 2012.*
3. *Janaka.E.Kanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu and Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons Ltd., West Sussex, 2012.*

REFERENCE BOOKS:

1. *ErsanKabalci, Yasin Kabalci, "From Smart Grid to Internet of Energy", 1st edition Elsevier Science,2019*
2. *Stephen F. Bush, "Smart Grid : Communication - Enabled Intelligence for the Electric Power Grid", Wiley - IEEE Press, 2014*
3. *Ali Keyhani, "Design of Smart Power Grid Renewable Energy System", IEEE Press, John Wiley & Sons, INC, New Jersey, 2011*
4. *Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", Taylor and Francis Group, CRC Press, 2013*
5. *K S Manoj,"Smart Grid, Concepts To Design", Notion press India, 2020*

19EEE19 - ENERGY AUDIT IN THERMAL AND ELECTRICAL UTILITIES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Preaudit the energy*

CO2 *: Analyse the possibility of energy savings*

CO3 *: Analyze the methods of energy savings*

CO4 *: Design the solutions*

CO5 *: Identify and perform appropriate energy management*

Energy Efficiency in Thermal Utilities -I

- Fuels and Combustion: Introduction to fuels, properties of fuel oil, coal and gas, storage, handling and preparation of fuels, principles of combustion, combustion of oil, coal, and gas.
- Boilers: Types, combustion in boilers, performance evaluation, analysis of losses, feedwater treatment, blowdown, energy conservation opportunities..
- Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery.
- Insulation and Refractories: Insulation-types and application, the economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss.
- FBC boilers: Introduction, mechanism of fluidized bed combustion, advantages, types of FBC boilers, operational features, Retrofitting FBC system to conventional boilers, saving potential. **9**

Energy Efficiency in Thermal Utilities -II

- Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate, and flash steam recovery system, identifying opportunities for energy savings
- Cogeneration: Definition, need, application, advantages, classification and saving potentials.
- Waste Heat Recovery: Classification, advantages, and applications, commercially viable waste heat recovery devices, saving potential.
- Energy Management & Audit: Definition, need and types of an energy audit. Energy management (audit) approach-understanding energy costs, benchmarking, energy performance, matching energy use to the requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.
- Material and Energy balance: Facility as an energy system, methods for preparing process flow, material, and energy balance diagrams. **9**

Energy Efficiency in Electrical Utilities

- Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.

- Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy-saving opportunities with energy-efficient motors.
- Energy-Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy-efficient motors, soft starters with energy savers, variable speed drives, energy-efficient transformers, electronic ballasts, occupancy sensors, energy-efficient lighting controls.

9

Energy Efficiency in Thermo Electric Utilities - I

- Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities
- HVAC and Refrigeration System: Vapor compression refrigeration cycle, refrigerants, the coefficient of performance, capacity, and factors affecting Refrigeration and Air conditioning system performance and savings opportunities.
- Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system, saving potentially
- Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities.
- Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. **9**

Energy Efficiency in Thermo Electric Utilities - II

- Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy-saving opportunities assessment of cooling towers.
- Lighting System: Light source, choice of lighting, luminance requirements, and energy conservation avenues.
- Diesel Generating system: Factors affecting the selection, energy performance assessment of diesel conservation avenues **9**

TOTAL : 45

Energy Performance Assessment for Equipment and Utility Systems

Open Book examination on the following energy performance assessments for equipment and utility systems:

- Boilers, Furnaces
- Cogeneration, Turbines (gas, steam)
- Heat Exchangers
- Electric Motors, Variable Speed Drives
- Fans and Blowers, Water Pumps, Compressors
- HVAC systems
- Lighting Systems
- Performing Financial Analysis.
- Applications of Non-conventional & Renewable Energy Sources (NRES)
- Waste minimization and resource conservation

TEXT BOOKS

1. *Mehmet Kano?lu, Yunus A. Çengel, "Energy efficiency and management for engineers", McGraw-Hill Education, 2020*
2. *Stephen A. Roosa, Steve Doty, Wayne C. Turner, "Energy Management Handbook", 9th edition, River Publishers, Taylore and Francis Group, 2020*
3. *Energy Efficiency in Thermal Utilities, Bureau of Energy Efficiency (BEE), Guide books*
4. *Energy Efficiency in Electrical Utilities, Bureau of Energy Efficiency (BEE), Guide books*

REFERENCE BOOKS

1. *Rajiv Shankar, "Energy Auditing in Electrical Utilities", Viva Books, 2017*
2. *Wayne C. Turner," Energy Management Handbook", Eighth Edition, 2012*
3. *Stephen A. Roosa, Steve Doty, "Energy Management Handbook", 2018*
4. *General Aspects of Energy Management and Energy Audit, Bureau of Energy Efficiency (BEE), Guide* books
5. Energy Performance Assistance for Equipment and Utility Systems, Bureau of Energy Efficiency (BEE), Guide books

19EEE29 - AUTOMATION, RENEWABLE ENERGY AND FPGA LABORATORY

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Apply an industrial IoT to access the data via industrial IoT*

CO2 *: Develop a controller for a plant/actuator using PCS7*

CO3 *: Design combinational and sequential logical relations to be implemented in FPGA based on applications*

CO4 *: Design a controller in FPGA to control electric drives*

CO5 *: Illustrate the basic concept of renewable energy generated by solar, wind, battery and super capacitor-based power generation.*

LIST OF EXPERIMENTS

Automation Lab

1. Access of Analog and Digital I/Os via Industrial IoT 2040 using Python, C/C++ compiler
2. Interfacing of IoT 2040 Gateway with Android Application.
3. Hardware configuration of PCS7 - combinational logics.
4. Design logic for traffic light controller using PCS7
5. Design a level process with PID controller for a real time plant
6. Study of Distributed Control System architecture and ES/OS Configuration of AS410 CPU in PCS7.
7. RF Communication and control of two end Nodes
8. Application server and End device Communication
9. Real time Data Monitoring and Device Control
10. Smart meter interfacing using LoRa
11. IoT based 1 phase pwm inverter

FPGA PROGRAMMING LAB

(Language: Verilog | Software: Xilinx | FPGA Board: Spartan 3E, Spartan 6)

1. Combinational circuits - Adders, encoders and decoders
2. Sequential circuits - counters and shift registers
3. Wallace Multiplier
4. 4-bit ALU
5. Programming an UART Module using FPGA
6. Analog input measurement using FPGA and data transfer to real time controller
7. PWM Generator for power electronic converters
8. Quadrature Encoder Interfacing Module
9. Speed control of Single Phase Induction Motor using FPGA
10. Speed control of Three Phase Induction Motor using FPGA
11. Speed control of DC Motor using FPGA
12. FPGA and IoT based static over current relay with test set-up

RENEWABLE ENERGY LAB

1. Characteristics of PV panel
2. Maximum power tracking of PV panel
3. Load test on Active front end PWM rectifier
4. Load test on Solar based DC-DC boost converter
5. Charging and Discharging Characteristics of bidirectional buck-boost converter for a super capacitor.
6. Study of transmission line simulator
7. Study of DC micro grid.

19EEE40 - DEEP LEARNING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

***CO1** : Apply Mathematical foundations in deep learning*

***CO2** : Examine the performance measure of algorithms*

***CO3** : Analyze machine learning algorithms.*

***CO4** : Formulate Deep learning algorithms*

***CO5** : Identify appropriate networks in real life applications*

MATHEMATICAL FOUNDATIONS

Linear Algebra : Vectors, Matrices and Tensors - Linear Dependence and Span - Norms - Eigen Decomposition - Singular Value decomposition - Principal Component Analysis

Probability and Information Theory : Population and Sample - Measures of Central Tendency - Measures of Deviation - Measures of Shape - Correlation Analysis- Probability Distributions - Baye's Rule - Linear regression - Logistic Regression **9**

MACHINE LEARNING BASICS

Learning Algorithms - Capacity, over fitting and Under fitting - Hyper parameters and Validation Sets - Estimators , Bias and Variance - Supervised and Unsupervised Learning Algorithms **9**

DEEP NETWORKS

Deep feed forward networks - Gradient Based Learning - Back Propagation - Regularization - Dataset Augmentation - Multitask Learning - Early stopping - Difficulty of training deep neural networks, Greedy layer wise training - Bagging - Optimization strategies **9**

CONVOLUTIONAL AND RECURRENT NETWORKS

Convolution Neural Networks: Convolution - Pooling - Variants - Structured output - Data types- Unsupervised features

Recurrent Neural Networks: Back propagation through time- Long Short Term Memory- Gated Recurrent Units - Bidirectional LSTMs - Bidirectional RNNs **9**

RECENT TRENDS AND APPLICATIONS

Recent trends: Variational Auto encoders - Generative Adversarial Networks - Multi-task Deep Learning - Multi-view Deep Learning

Applications: Vision, NLP, Speech **9**

TOTAL : 45

TEXT BOOKS

1. *Ian Good fellow and Yoshua Bengio and Aaron Courville ,"Deep Learning", MIT Press, 2016.*
2. *Josh Patterson, " Deep Learning: A Practitioner's Approach, O'Reilly Media:, 2017*

REFERENCE BOOK

1. *François Chollet, "Deep Learning with Python", Manning Publications, 2021*

19EEL75 - PROFESSIONAL COMPETENCY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Demonstrate knowledge in the program domain.*

CO2 *: Develop the problem solving skill by analyzing the given criteria*

CO3 *: Present views cogently and precisely*

CO4 *: Exhibit professional etiquette suitable for career progression.*

CO5 *: Prepare the students to face the competitive examinations and interview*

TITLES TO BE COVERED

1. Electric circuits
2. Electromagnetic fields
3. Electrical Machines
4. Electrical and Electronic Measurements
5. Analog Electronics
6. Digital Electronics
7. Control Systems
8. Power Electronics
9. Power Systems
10. Signals and Systems

19EE76 - PROJECT WORK PHASE I

L	T	P	C
0	0	6	3

ASSESSMENT : VIVA - VOCE

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Interpret the electrical, electronics and other engineering concepts and principles related to the project work*

CO2 *: Demonstrate the technical skills to provide feasible solutions for real - life problems relevant to the society*

CO3 *: Enhance the management skills to achieve the project goal by working as a team and also improve technical writing skills.*

CO4 *: Apply engineering ethical principles in societal and environmental contexts and to realize the importance of project management tools, estimation and costing*

CO5 *: Analyze, estimate and manage a project within a stipulated project time line and communicate effectively on complex engineering problems*

19EE81 - PROJECT WORK PHASE II

L	T	P	C
0	0	10	5

ASSESSMENT : VIVA - VOCE

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Demonstrate the technical skills to provide feasible solutions for real - life problems relevant to the society*

CO2 *: Enhance the management skills to achieve the project goal by working as a team and also improve technical writing skills.*

CO3 *: Apply engineering ethical principles in societal and environmental contexts and to realize the importance of project management tools, estimation and costing*

CO4 *: Analyze, estimate and manage a project within a stipulated project time line and communicate effectively on complex engineering activities*

CO5 *: To develop a product as a solution for complex engineering problems and a need for sustainable development*

19ECOC16 - COMMUNICATION SKILLS FOR ENGINEERS

Introduction to Communication : Need for effective communication, Functions of Communication and Induction to the students, Communication Cycle, Levels of communication; Flow of communication; Communication networks; General and Technical Communication.

Non-verbal Communication and Body Language : Forms of Non-verbal communication; Kinesics; Proxemics; Chronemics and Effective use of body language.

Presentation Skills : 4Ps (Planning, Preparation, Practice, Presentation), Outlining; Effective use of A/V aids and Modes of Delivery

Listening Skills : Hearing Vs listening, process of listening, types, Barriers to Listening, Qualities of a Good Listener and Active Vs Passive Listening

Speaking Skills : Introducing yourself, Describing a person, place, situation and event, Giving instruction, Making inquiries - at a bank, post-office, air-port, hospital, reservation counter and role play

Writing Skills : Basics of Writing, Paragraph Writing, Precise Writing, Memos, Advertisements, Paraphrasing and Summarizing.

Letter Writing : Informal Letter, (Formal) Business Letters: Essential and Occasional Parts of a letter, layout, Characteristic and Letter of Inquiry, Complaint and Adjustments, orders and replies of it

Report Writing : Format, Structure and Types, Technical Reports, Description and Proposal

Reading Skills : Skimming and Scanning, Intensive and Extensive Reading, Poor habits of reading and The SQ3R Method

Grammar and Vocabulary : Tenses, Determiners, prepositions, conjunctions, Model Auxiliaries, concord, active and passive voice, Homonyms, Homophones, Acronyms.

REFERENCES

1. *Muralikrishna C., Sunita Mishra "Communication Skills for Engineers" 2nd edition, Pearson, New Delhi 2010*
2. *Vyas Manish A., Yogesh L. Patel, "Tasks for the English Classroom", MacMillan, New Delhi, 2012.*
3. *Michael vince, 'Advanced Language Practice', Macmillan Education, Oxford,2003*
4. *Iris, "English for Materials Science and Engineering", Springer Fachmedien Wiesbaden GmbH 2011*
5. *Lougheed Lin, "Business Correspondence: A Guide to Everyday Writing', Longman, Pearson Education, Inc,2003*

19ECOC17 - ENTREPRENEURSHIP AND MANAGEMENT

ENTREPRENEUR : Definition, Functions of an Entrepreneur, Types of Entrepreneur, Concept of Entrepreneurship -Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

MANAGEMENT : Introduction -Meaning -nature and characteristics of Management, Scope and functional areas of Management -Management as a Science, Art or Profession Management & Administration -Roles of Management, Levels of Management, Development of Management Thought- Early Management Approaches-Modern Management Approaches.

PLANNING : Nature, importance and purpose of planning process -Objectives -Types of plans (Meaning only) -Decision making -Importance of planning -steps in planning & planning premises -Hierarchy of plans.

ORGANISING AND STAFFING : Nature and purpose of organization -Principles of organization Types of organization - Departmentation -Committees - Centralisation Vs Decentralisation of authority and responsibility -Span of control -MBO and MBE Nature and importance of Staffing Process of Selection & Recruitment.

DIRECTING & CONTROLLING : Meaning and nature of directing -Leadership styles, Motivation Theories, Communication - Meaning and importance - Coordination, meaning and importance and Techniques of Co -ordination. Meaning and steps in controlling -Essentials of a sound control system Methods of establishing control.

REFERENCES

1. *P. C. Tripathi, P. N. Reddy, "Principles of Management", Tata McGraw Hill, 4th Edition, 2010.*
2. *Vasant Desai, "Dynamics of Entrepreneurial Development & Management" Himalaya Publishing House, 2010.*
3. *Donald F.Kuratko, "Entrepreneurship: Theory, Process, Practice", South-Western College Publishing, 2019.*
4. *Prasanna Chandra, "Projects- Planning, Analysis, Financing, Implementation and review", Tata McGraw Hill, 2012.*
5. *Manjunath V.S., "Entrepreneurship & Management", Pearson Education, 2010.*

19ECOC22 - HMS FOUNDATION COURSE ON MOBILE APP DEVELOPMENT

Introduction to Android Basics **(4)**

- First App development, Activities and Life cycle , Permissions
- UI Layout, UI Controls
- Services
- Broadcast receiver, Notification
- Database

Huawei Basic Mobile Services **(3)**

- Account Kit
- Location Kit
- Map Kit + Site Kit
- HMS Tool Kit - Cloud debugging
- Scan Kit
- Push Kit
- ML Kit
- In-App Messaging

Huawei Advanced Mobile Services **(3)**

- Ads Kit
- Analytics Kit
- Awareness Kit
- Audio Kit
- Game Service

AppGallery Connect & App Release **(5)**

- Imake Kit
- Crash SDK
- HMS+GMS Solutions
- HMS Toolkit - Cloud Testing
- A/B Testing
- App Release

TOTAL : 15 HOURS

WEB URLs :

https://developer.huawei.com/consumer/en/training/course/video/101620715873000160

19ECOC23 - BASEBAND COMMUNICATION - SIGNAL GENERATION AND ANALYSIS

Understanding of Baseband Terminology **(5 HOURS)**

- Understanding of time domain and frequency domain measurement units used in the Industry.
- Understanding Single ended and Differential signaling schemes
- Understanding Analog and Digital signals
- Time period, Frequency, Bandwidth, Symbol rate, Amplitude, Phase, Peak-to-peak, RMS, duty cycle, bits/symbol, Power Spectral density
- Understanding baseband modulation and demodulation

Understanding blocks of Baseband Communication **(8 HOURS)**

- Understanding of ADC & DAC blocks
- Understanding filters
- Understanding of IF processing
- Understanding Synchronization and equalization
- Understanding Inter symbol Interference
- Understanding Channel - Channel capacity, bandwidth, Channel coding
- Understanding signal processing techniques like mapping & de-mapping, encoding & decoding, Code correction, Pulse Shaping and Windowing

Baseband communication: practical session **(7 HOURS)**

- Generating and analyzing various baseband signals like Sine, Triangular, Ramp, Pulse
- Generating and analyzing analog modulated signals like AM, FM, PM
- Generating and analyzing digital modulated signals like ASK, FSK, PSK, PWM
- Generating and analyzing higher order IQ modulated signals like QPSK, 8PSK etc.

19ECOC24 - RF MEASUREMENTS LABORATORY

List of Experiments using ME1020 Hardware Kit : **(15 Hours)**

- Vector network analysis - understanding s-parameter measurements
- Vector network analysis - calibration and shifting of reference planes through port extension
- Vector network analysis of RF Filter - transmission, reflection, impedance on Smith Chart
- Vector network analysis of Amplifier - gain, isolation, gain compression, AM-PM conversion
- Vector network & Spectrum analysis of RF Divider/Combiner - insertion loss, return loss
- Spectrum analysis - understanding Spectrum Analyzer settings
- Spectrum analysis of Frequency Synthesizer and Mixer - harmonics, intermodulation, isolation
- Analyzing Amplifier using Spectrum Analyzer- gain, compression, harmonics and isolation
- Measurement and troubleshooting of RF Transceiver

19CSE01 - DATA SCIENCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Provide with the knowledge and expertise to become a proficient data scientist.*

CO2 *: Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.*

CO3 *: Produce Python code to statistically analyze a dataset.*

CO4 *: Critically evaluate data visualizations based on their design and use for communicating stories from data.*

INTRODUCTION

Data science- Benefits and uses of data science and big data- Facets of data- The data science process- The big data ecosystem and data science. **(9)**

STATISTICAL INFERENCE AND THE DATA SCIENCE PROCESS

Statistical Thinking in the Age of Big Data - Exploratory Data Analysis- The Data Science Process- Overview of the data science process- Defining research goals and creating- Retrieving data - Cleansing, integrating, and transforming data - Exploratory data analysis- Build the models - Presenting findings and building applications. **(9)**

LEARNING ALGORITHMS AND MODELS

Need for machine learning in data science - The modeling process- Types of machine learning - Semi-supervised learning- Three Basic Algorithms - Linear Regression -k- Nearest Neighbors (k-NN) -k-means. **(9)**

DATA VISUALIZATION (Matplotlib / Seaborn)

Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density- Customizing Plot Legends Customizing Color bars - Multiple Subplots Text and Annotation Customizing. Ticks Customizing- Matplotlib: Configurations and Stylesheets - Three - Dimensional Plotting in Matplotlib - Geographic Data with Base map Visualization with Seaborn. **(9)**

APPLICATIONS AND RECENT TRENDS

Social network analysis- Social Network Analysis at Morning Analytics- Terminology from Social Networks- Data Leakage-case study- Avoid Leakage- Evaluating Models. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly, First Edition, 2013. (UNIT II,UNIT III ,UNIT V).*
2. *Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science" Manning Publications, 2016 (UNIT I, II, III)*
3. *Jake VanderPlas ,"Python Data Science Handbook Essential Tools for Working with Data, 2016 (UNIT IV)*

URL REFERENCE

https://colab.research.google.com/github/jakevdp/PythonDataScienceHandbook/blob/master/notebooks/04.00-Introduction-To-Matplotlib.ipynb

19CIOC01 - C++ PROGRAMMING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Be able to explain the difference between object-oriented programming and procedural programming.*

CO2 : *Be able to program using C++ features such as objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, exception handling, etc.*

CO3 : *Be able to build C++ classes using appropriate encapsulation and design principles.*

TRAINING BASED ON THE FOLLOWING CONCEPTS

C++ Overview - Classes and Encapsulation- Member Functions- Instantiating and Using Classes- Constructors and Destructors- Overview of Inheritance- Defining Base and Derived Classes-Types of Inheritance- Overview of Polymorphism and Abstract Classes-Exceptions- Inheritance and Exceptions- Exception Hierarchies.

REFERENCES

1. *E.Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 7th Edition, 2018.*
2. *Bjarne Stroustrup, "The C++ Programming Language", Addison Wesly , 4th edition, 2013.*

19CIOC03 - APPLICATIONS OF PROBABILITY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To understand the generic structure of probabilistic models and their basic properties.*

CO2 *: Ability to understand and apply the discrete random variables to model real world problems and analyse their characteristics.*

CO3 *: To gain an understanding of the continuous random variables and the application of it to model real world problems.*

CO4 *: Ability to quantify the relationship between two random variables using covariance and correlation.*

TRAINING BASED ON THE FOLLOWING CONCEPTS:

SAMPLE SPACE AND PROBABILITY

Sets: Set Operations - The Algebra of Sets - Probabilistic Models: Sample Spaces and Events - Sequential Models - Probability Laws - Discrete Models - Continuous Models - Conditional Probability - Total Probability Theorem and Bayes' Rule - Independence - Counting - Case study.

DISCRETE RANDOM VARIABLES

Basic Concepts - Probability Mass Functions: The Bernoulli Random Variable - The Binomial Random Variable - The Geometric Random variable - The Poisson Random Variable - Functions of Random Variables - Expectation, Mean and Variance - Case study.

GENERAL RANDOM VARIABLES

Continuous Random Variables and Probability Density Functions (PDF): Exponential Random Variable - Cumulative Distribution Functions (CDF): The Geometric and Exponential CDFs - Normal Random Variables - The Continuous Bayes' Rule - covariance and correlation - Case study.

REFERENCES

1. *Dimitri P. Bertsekas and John N. Tsitsiklis, "Introduction to Probability", Athena Scientific, Second Edition, 2008. ISBN: 978-1886529236.*
2. *Veerarajan T, "Probability Statistics and Random Process," McGraw Hill Education, Third Edition, 2017. ISBN: 978-007066925.*
3. *Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, "An Introduction to Probability and Statistics", Wiley India, Second Edition, 2008. ISBN: 978-8126519262.*

19CIOC04 - USER INTERFACE DESIGN

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

The Students should be able to:

CO1 *: Design the User Interface for mobile and Web Applications*

CO2 *: Create the visual elements and define Interactivity to the UI elements*

CO3 *: Add movement between screens*

INTRODUCTION

The User Interface-Introduction, Overview, The importance of user interface - The importance of Good design, Characteristics of graphical and web user interfaces-wireframing.

TOOLS FOR UI DESIGN

Wireframing Tools- Adobe XD -Figma- Pencil Project -Invisionstudio.

REFERENCES

1. *Wilbert O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition, 2002*
2. *Web References - Open Source Tools for UI Design*

19CIOC06 - COMPREHENSIVE EXAM TRAINING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To prepare and equip the students for various competitive exams*

CO2 *: To relearn and refresh the core concepts in the domains like Data Structures, Digital Design, Database Management Systems, Programming, Computer Architecture, Operating Systems and Automata Theory.*

TRAINING BASED ON THE FOLLOWING CONCEPTS:

C PROGRAMMING

Programming in C, Recursion, Arrays, Structures and Pointers.

DATA STRUCTURES AND ALGORITHMS

Linked Lists, Stacks, Queues, Trees, Graphs, Sorting and Searching.

DIGITAL DESIGN

Boolean algebra, Combinational and Sequential circuits, Minimization, Number representations, Fixed and floating point computer arithmetic.

DATABASE MANAGEMENT SYSTEMS

ER-model, Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, Normal forms, B+ tree indexing, Transactions and concurrency control.

COMPUTER ARCHITECTURE

Machine instructions and Addressing modes, ALU, Data-path and Control unit, Instruction pipelining, Pipeline hazards, Memory hierarchy: cache, main memory and secondary storage, I/O interface: interrupt and DMA mode.

OPERATING SYSTEMS

System calls, Processes, Threads, Deadlock, CPU and Disk scheduling, Memory management and Vrtual memory.

FORMAL LANGUAGES AND AUTOMATA THEORY

Regular Expressions and Finite Automata, Context-Free Grammars and Push-Down Automata, Contex-Free Languages, Pumping lemma, Turing machines.

19CI53 - EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Describe the features of Embedded system*

CO2 *: Understand the architecture of ARM Processor*

CO3 *: Develop simple Assembly Language Programs*

CO4 *: Understand about Exceptions and interrupts*

CO5 *: Design and develop embedded applications*

INTRODUCTION TO EMBEDDED SYSTEM

Characteristics of Embedded system - Challenges in Embedded System - Embedded System Design Process - CPU Power Consumption.-Components for embedded programs - Models of programs - Performance analysis and optimization of program size - Power analysis and optimization. **(10)**

ARM PROCESSOR

Architecture overview - Registers - Special Registers - Operation mode - Stack memory operations - Reset sequence- 5 Stage pipeline organization - Arm instruction execution. **(8)**

ARM ASSEMBLY LANGUAGE PROGRAMMING

Data Processing Instructions-Data Transfer Instructions- Control flow Instructions - Writing Simple ALP - Memory Map - Bit Band Operations -Unaligned transfers - Exclusive access - Endian mode - Memory protection unit Overview - Power Management. **(9)**

EXCEPTION AND INTERRUPTS

Advanced Microcontroller Bus architecture - reset types and reset signals-Exception types-vector tables - Fault exceptions - Nested Vector Interrupt Controller overview- Basic interrupt configuration - Software interrupt - SYSTICK timer - Interrupt behavior : Sequence interrupt latency - Faults related to interrupts. **(9)**

DEVELOPMENT AND TESTING

Host and target machines - Tool chain for building Embedded software - In-Circuit Emulator - Logic analyzer - Debugging : JTAG Boundary scan test architecture , Core sight - Applications: Alarm Clock, Audio Player. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman, Third Edition, 2012.*
2. *Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Second Edition, Newnes, (Elsevier), 2010.*

REFERENCE

1. *Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.*

19ITL52 - EMBEDDED SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Develop Simple Assembly Language Program*

CO2 *: Develop Embedded C programs*

CO3 *: Develop applications based on IOT and Sensors*

LIST OF EXPERIMENTS

1. Basics of Assembly Language Programming
2. Peripheral Interfacing:
   Seven Segment Display
   Matrix Keyboard
   LCD Display
   Buzzer
3. Sensor based application development
4. Programming Robots
5. Internet of Things based applications
6. Digital circuit development using FPGA
7. PIC Microcontroller based application

19HOC51 - EMPLOYABILITY AND PERSONALITY DEVELOPMENT SKILLS - I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Solve objective questions on Syllogisms, Data Interpretation, Critical Reasoning, Theme Detection, Sentence Completion and Business Vocabulary*

CO2 *: Develop appropriate responses for business phone calls and negotiate effectively.*

CO3 *: Speak with appropriate body language for a technical speaking task.*

CO4 *: Project the appropriate grooming and the right etiquettes, for interview and group discussion task.*

VERBAL APTITUDE

Syllogisms-Paragraph Comprehension -Data Interpretation -Critical Reasoning/Theme Detection - Grammar -Sentence Completion Filler - Business Vocabulary- Foreign phrases used in English **(3)**

PROFESSIONAL COMMUNICATION

Telephonic Conversation Skills - Telephonic Interview -Etiquettes - Professional, Dining & Telephone - Employability skills - Importance and Employability level of present Y and Z Generation - Interpersonal Skills - Negotiation Skills - Types, Expressions used in formal and informal negotiations, Stages of Negotiation - Time Management - Pareto principle, Prioritizing tasks, Barriers to time management **(7)**

THE ART OF SPEAKING

Types of Speaking - Barriers to Speaking - Presentation on a Technical Topic - Speaking on Current Trends in the Industry **(5)**

NON-VERBAL COMMUNICATION

Interview Skills -Non Verbal Communication - Smiling, Posture, Handshake, Tone of Voice and Eye Contact - GD tips & techniques and Mock GD- Body Language - Grooming. **(5)**

TOTAL : 20

REFERENCES

1. *Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.*
2. *Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.*
3. *John Hayes. Interpersonal Skills at Work. Second Edition, Routledge Publication, 2005*

19HOC61 - EMPLOYABILITY AND PERSONALITY DEVELOPMENT SKILLS - II

L	T	P	C
0	0	2	1

ASSESSMENT :PRACTICAL

COURSE OUTCOMES

CO1 *: Exhibit Corporate Etiquettes with assertiveness and personal effectiveness.*

CO2 *: Build teams and solve problems at workplace.*

CO3 *: Manage conflicts in a professional manner*

CO4 *: Simulate an actual Job Interview scenario to prepare a candidate for a real Interview*

CORPORATE ETIQUETTE

Corporate Etiquette: Dos and Don'ts, - Conversational dos and don'ts - Creating elusive first impression- Assertiveness-Personal Effectiveness **(4)**

LEADERSHIP AND TEAM MANAGEMENT

Leadership Skills - Understanding Traits and Styles - Team Building: Bonding, Development and Delegation - Adaptability and Work Ethics - Handling Team Dynamics- Giving and Receiving Feedback- Problem Solving Skills **(5)**

STRESS AND CONFLICT MANAGEMENT

Emotional Intelligence: Recognition, Understanding and Managing - Stress Management: Techniques and Benefits - Conflict Management: Introduction - Handling Conflicts - Conflicts settlement **(6)**

GROUP DISCUSSION AND INTERVIEW SKILLS

Mock GD - Interview Skills - Answering challenging questions - Common Interview Questions **(5)**

TOTAL : 20

REFERENCES

1 *Barun K Mitra., Personality Development and Soft Skills. Second Edition, Oxford University Press, 2016*

2 *N.Krishnaswamy & Lalitha Krishnaswamy - Mastering Communication Skills and Soft Skills, New Delhi, Bloomsburry, 2015*

3 *Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success,Canada: Wiley & Sons, 2006.*

19CI61 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Illustrate real world problems from the perspective of intelligent agents to achieve problem oriented goal.*

CO2 *: Apply various informed search strategies in optimal decision making.*

CO3 *: Employ first order logic for building knowledge base to infer reasoning using knowledge Engineering.*

CO4 *: Describe representation of uncertain knowledge, Bayesian Networks and Temporal models.*

CO5 *: Describe several learning algorithms to improve the performance of intelligent agents.*

INTRODUCTION

Foundation of AI - Agents and Environments- Concept of Rationality - Nature of Environments - Structure of Agents-Problem-Solving Agents and examples-Uninformed Search Strategies-Searching with Partial Information. **(8)**

SEARCH TECHNIQUES

Search Strategies: A* Search -Heuristic Functions -Local Search Algorithms and Optimization Problems -Constraint Satisfaction Problems -Backtracking Search for CSPs - Local Search for Constraint Satisfaction Problems - Structure of Problems - Games-Optimal Decisions in Games - Alpha-Beta Pruning. **(8)**

KNOWLEDGE AND REASONING

Logic -Propositional Logic - Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic - Propositional vs. First-Order Inference - Forward Chaining -Backward Chaining -Resolution **(8)**

UNCERTAIN KNOWLEDGE AND REASONING

Acting under uncertainty - Bayes' rule and Its use - Representing Knowledge in an Uncertain Domain -The Semantics of Bayesian Networks - Exact Inference in Bayesian Network - Approximate Inference in Bayesian Networks - Hidden Markov Models - Kalman Filters. **(9)**

LEARNING

Forms of Learning - Learning Decision Trees-Artificial Neural Networks-Ensemble Learning-Logical Formulation of Learning-Knowledge in Learning - Explanation -Based Learning -Learning Using Relevance Information -Inductive Logic Programming - Statistical Learning -Learning with Complete Data -EM Algorithm- Passive Reinforcement Learning-Active Reinforcement Learning **(12)**

TOTAL : 45

TEXT BOOK

1. *Stuart J Russell and Peter Norvig, "Artificial Intelligence- A Modern Approach", Pearson Education Series, Third Edition, 2015.*

REFERENCES

1. *Deepak Khemani, "A First Course in Artificial Intelligence", Mc Graw Hill Education, First Edition, 2013.*
2. *Dan W. Patterson "Introduction to AI and ES", Pearson Education, First Edition, 2007*
3. *Patrick Henry Winston, "Artificial Intelligence", Addison Wesley publishers, Third Edition, 1992.*
4. *Elaine Rich, Kevin Knight and Shivashankar, "Artificial Intelligence", McGraw Hill, Third Edition, 2009*

19ITL63 - DATA ANALYTICS AND ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Apply suitable Data pre-processing to prepare data for Machine learning*

CO2 *: Develop machine learning models for Data inference and prediction*

CO3 *: Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.*

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Data Pre-Processing
2. Classification Algorithms
3. Clustering algorithms
4. Association Rule Mining
5. Chatbot Application
6. A* Algorithms
7. Local Search Algorithms
8. Adversarial Search
9. Inference models using Prolog

19ITE05 - CYBER SECURITY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the security issues in networks and computer systems to secure IT infrastructure.*

CO2 *: Describe cyber attacks related to cloud and web based systems.*

CO3 *: Diagnose and investigate cyber security crimes in mobile and wireless devices.*

CO4 *: Analyze the tools and methods in information technology used to commit cybercrimes.*

CO5 *: Analyze and Evaluate cyber security requirement of organization*

INTRODUCTION TO CYBERCRIME

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.**(9)**

CYBER OFFENSES

How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cyber crime, Attack Vector, Cloud Computing. **(9)**

CYBERCRIME: MOBILE AND WIRELESS DEVICES

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies as an n Measures in Mobile Computing Era, Laptops. **(9)**

TOOLS AND METHODS USED IN CYBERCRIME

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow. **(9)**

CYBER SECURITY: ORGANIZATIONAL IMPLICATIONS

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risk s and Perils for Organizations, Social Computing and the associated challenges for Organizations. **(9)**

TOTAL : 45

TEXT BOOK

1. *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.*

REFERENCES

1. *Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.*
2. *Introduction to Cyber Security, Chwan Hwa(john) Wu,J.David Irwin, CRC Press*

19CIE07 - ENTREPRENEURSHIP SKILL DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Develop an entrepreneurial mindset by learning key skills such as creative thinking, innovations and funding for business*

CO2 *: Formulate a business plan*

CO3 *: Assess the strengths and weaknesses of business plan*

CO4 *: Prepare a business plan for selecting a product*

LAUNCHING ENTREPRENEURIAL VENTURES

Creativity, Innovations, Methods to Initiate Ventures, Legal Challenges, Search for Entrepreneurial Capital **(8)**

BUSINESS PLAN FOR NEW VENTURES

Meaning and Objectives of a Business Plan, Advantages and cost of preparing a Business Plan, Elements, Critical Assessment **(9)**

Strategic Perspectives - Strategic Growth, Need for Strategic Planning, Understanding the growth stage, Unique managerial Concerns of growing enterprise, Valuation Concerns **(10)**

Entrepreneurship - Indian Perspective: Historical Perspective, Global Indian Entrepreneurs, Institutions, Modern Entrepreneurs **(9)**

Project Work - Students have to prepare a detailed business plan selecting product(s), Presentation of such business plans and submission after necessary corrections suggested by subject faculty. **(9)**

TOTAL : 45

TEXT BOOK

1. *Robert D Hisrich, Michael P Peters & Dean Shepherd, "Entrepreneurship", Tata McGraw Hill, 2013*

REFERENCES

1. *Thomas W.Zimmerer, Norman M.Scarborough, "Essentials of Entrepreneurship and Small Business Management", Prentice Hall of India, 2009*
2. *G.S.Sudha, "Management and Entrepreneurship Development", Indus Valley Publication, 2009*

19CS62 - MACHINE LEARNING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe and give examples of supervised and unsupervised learning methods.*

CO2 : *Discuss probability theory, make rational decisions to minimize risk and learn association rules from data.*

CO3 : *Ability to choose a subset of important features and understand feature extraction methods that form fewer new features from original data.*

CO4 : *Use decision trees for classification,describe learning algorithms to build the decision trees and gain an understanding of ensemble methods.*

CO5 : *Ability to understand the back-propagation algorithm to train a multi layer perceptron for different applications.*

CO6 : *Ability to understand the basics of Q learning in reinforcement learning.*

INTRODUCTION

Machine Learning - Machine Learning Applications - Learning Associations - Classification - Regression - Unsupervised Learning - Reinforcement Learning - Supervised Learning: Learning a Class from Examples - Vapnik - Chervonenkis (VC) Dimension - Probably Approximately Correct (PAC) Learning - Noise - Learning Multiple Classes - Regression - Model Selection and Generalization - Dimensions of a Supervised Machine Learning Algorithm **(7)**

BAYESIAN DECISION THEORY

Classification - Losses and Risks - Discriminant Functions - Association Rules - Parametric Methods: Introduction - Maximum Likelihood Estimation - Evaluating an Estimator: Bias and Variance - The Bayes' Estimator - Parametric Classification - Regression **(9)**

DIMENSIONALITY REDUCTION

Introduction - Subset Selection - Principal Components Analysis - Factor Analysis- singular value decomposition and matrix factorization-Multidimensional Scaling - Linear Discriminant Analysis- Isomap **(7)**

DECISION-TREE LEARNING AND ENSEMBLE METHODS

Concept Learning - Concept learning Task - Concept Learning as search -Finding a maximally specific hypothesis - Version Spaces and Candidate elimination Algorithm -Inductive Bias Decision Tree Learning - Decision Tree representation -Problems for Decision Tree Learning -Hypothesis Search space - Inductive Bias in Decision Tree Learning - Issues in Decision Tree Learning. AdaBoost Algorithm-Bagging Algorithm-Random Tree Ensembles:Random Forest. **(8)**

MULTILAYER PERCEPTRON AND DEEP LEARNING

Introduction- The Perceptron - Training a Perceptron - Learning Boolean Functions - Multilayer Perceptrons - MLP as a Universal Approximator- Backpropagation Algorithm - Training Procedures: Improving convergence - Tuning the Network Size. Convolution Networks: The Convolution Operation-Pooling-Convolution and Pooling as an infinitely strong prior - Structured Outputs -Data Types -Efficient Convolution Algorithms **(9)**

REINFORCEMENT LEARNING

Introduction - learning task - Q learning - The Q function - Algorithm for Q learning -convergence - updating sequence -Non deterministic rewards and actions -Temporal difference learning . **(5)**

TOTAL: 45

19ITE15 - FULL STACK DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Develop a work plan including the requirements, work flow, delivery management and user experience*

CO2 *: Design the system considering various interactions and dependencies*

CO3 *: Demonstrate various testing methodologies required for the application*

CO4 *: Understand the working of the APIs required for Full Stack Development*

CO5 *: Understand the security threats and security policies in deploying Full stack application*

INTRODUCTION

Raise of Web, Mobile Web, HTML State, Application Vs Websites, Work plan : Identify the requirements, Define the work, Track the work, Kanban, Continuous Improvement, Prioritization & Estimation, Managing Bugs, Continuous Delivery, User Experience : Information Architecture, user experience right and Polish, Implementing user experience **(8)**

DESIGN SYSTEM

System Architecture, Identify user interactions, Handling Commonalities, Working with legacy and external dependencies, Component interactions, Applications Vs Modules, cross-functional requirements, caching, Designing of failure, Design Modules, Refactoring, tools, changing the architecture **(8)**

TESTING & ACCESSIBILITY

Test-Driven Development, Test Pyramid, Behavior-Driven Development, Three Amigos, Manual Testing, Visual Testing, Cross-Functional Testing, Accessible from the start, Working with Assistive Technologies, Dealing with Interactive UI, Testing for Accessibility, Avoiding Common Mistakes **(8)**

APIs AND STORING DATA

API Responsibilities, Designing REST API, Securing API, Event-Based APIs, Discovering APIs, Using APIs, Jenkins Pipeline flow, Types of Databases, SQL or NoSQL, store data, Access data from App, Manage the data, Protect the Data **(10)**

SECURITY AND DEPLOYMENT

Trust and Secrets, Responding to incidents, The Golden Rule, Threats, Security Checklists: Injection- Broken Authentication and Session Management- Cross-Site Scripting(XSS) -Insecure Misconfiguration-Sensitive Data Exposure- Missing Functional Level Access Control, Cross-site Request Forgery(CSRF), Two Factor App,Gitlab **(11)**

TOTAL : 45

TEXT BOOKS

1. *Chris Northwood, "The Full Stack Developer - Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APress, 2018.*
2. *David Choi, "Full-Stack React, TypeScript and Node", Packt, 2020.*

REFERENCES

1. *Steve Fulton and Jeff Fulton, " HTML5 Canvas", O'Reilly, 2013*
2. *Marijin Haverbeke, " Eloquent JavaScript - A Modern Introduction to Programming", No scratch Press, 2018*
3. *Addy Osamani, " Learning JavaScript Design Patterns", O'Reilly, 2012*

19ITE16 - VIRTUAL AND AUGMENTED REALITY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Outline the foundation of virtual reality components and Modeling.*

CO2 *: Knowledge in concepts of augmented reality and its design.*

CO3 *: Gain knowledge on the applications of VR and AR.*

VIRTUAL REALITY INTRODUCTION

Introduction to Virtual Reality (VR): Fundamental Concept - Types of VR Technologies-Components of Virtual Reality: Input Devices: Trackers, Navigation, and Gesture Interfaces - Output Devices: Graphics, Three-Dimensional Sound, and Haptic Displays-Computing Architectures for VR. **(9)**

VR MODELING

Geometric Modeling: Introduction - Virtual Object Shape - Object Visual Appearance, Kinematics Modeling: Homogeneous Transformation Matrices - Object Position- Transformation Invariants- Object Hierarchies - Viewing the Three - Dimensional World, Physical Modeling: Collision Detection - Surface Deformation - Force Computation - Force Smoothing and Mapping - Haptic Texturing - Behavior Modeling **(10)**

AUGMENTED REALITY

Introduction to Augmented Reality (AR), Difference between AR, VR and Mixed Reality(MR), The Relationship Between Augmented Reality and Other Technologies, Working of AR, AR Concepts- Ingredients of an Augmented Reality-Major Hardware Components for Augmented Reality Systems, Major Software Components For Augmented Reality Systems. **(9)**

AUGMENTED REALITY DESIGN

Content Creation: Creating Visual Content, Creating Audio Content, Creating Content For Other Senses (Touch, Taste, Smell), Representation And Perceptual Issues Interaction- Mobile Augmented Reality: Introduction-Advantages and Disadvantages-Architectures. **(9)**

VR and AR APPLICATIONS

VR Applications: Introduction - Engineering - Entertainment - Science - Training.

AR Applications: Augmented Reality Applications Areas-Medical, Retail, Tourism and construction, Collaborative Augmented Reality, Applying Augmented Reality to a Problem, Evaluating Augmented Reality Applications,Example Augmented Reality Applications. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley, India, 2nd Edition, 2003.*
2. *Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann Publication, 1st Edition, 2013.*

REFERENCES

1. *Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann Publication, 2009.*
2. *Steven M. LaValle , Virtual Reality, Cambridge University Press, 2016.*
3. *Jon Peddie, Augmented Reality-Where We Will All Live,Springer, 2017.*

19ITL64 - INTERNET TECHNOLOGY AND SOFTWARE ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : : PRACTICAL

COURSE OUTCOMES

CO1 *: Demonstrate an ability to develop web pages using CSS, Frames and filters.*

CO2 *: Develop dynamic web pages using CGI concepts.*

CO3 *: Design an interactive web applications using XML parser (DOM, SAX).*

CO4 *: Design E- Commerce Application using UML modelling.*

CO5 *: Write test cases for E-commerce applications and perform testing.*

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Web page designing.
2. Web page designing using CSS, Frames, Filters etc.,
3. Dynamic web page design using CGI.
4. Case studies like a trading system, a portal system, a reservation system etc., using Server Side Technologies
5. Applications using XML.
6. UML modelling for web sites
7. Software Testing using Selenium.

19CH51 - NUMERICAL METHODS IN CHEMICAL ENGINEERING

L	T	P	C
2	1	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students will be able

CO1 *: To solve systems of algebraic equation using various numerical schemes and to develop programming code using MATLAB and EXCEL.*

CO2 *: To Solve nonlinear algebraic equation using open and bracketing type numerical methods*

CO3 *: To practice numerical integration using trapezoidal, Simpsons techniques for chemical problems*

CO4 *: To solve single ODE and Simultaneous ODEs using various numerical schemes.*

CO5 *: To formulate and solve PDEs for real time chemical Engineering Problems.*

NUMERICAL METHODS FOR SINGLE ALGEBRAIC EQUATIONS

Introduction, Root finding methods for solution on non-linear algebraic equations: Bisection, Newton-Raphson and Secant methods, System of Non-linear Equations. Chemical Engineering problems involving solution of non-linear equations **(9)**

NUMERICAL METHODS FOR SIMULTANEOUS ALGEBRAIC EQUATIONS

Methods like Gauss elimination, LU decomposition and matrix inversion, Gauss-Seidel method, Chemical Engineering problems involving solution of linear algebraic equations. **(9)**

INTERPOLATION AND NUMERICAL INTEGRATION

Interpolation and Approximation, Newton's polynomials and Lagrange polynomials, spline interpolation, linear regression, polynomial regression, least square regression, Numerical integration: Trapezoidal rule, Simpson's rule, integration with unequal segments, Chemical engineering problems involving numerical differentiation and integration **(9)**

NUMERICAL METHODS FOR ODES

Ordinary Differential Equations: Euler method, Runge-Kutta method, Adaptive Runge-Kutta method, Initial and boundary value problems, Chemical engineering problems involving single, and a system of ODEs. **(9)**

NUMERICAL METHODS FOR PDES

Introduction to Partial Differential Equations: Characterization of PDEs, Laplace equation, Heat conduction/ diffusion equations, explicit, implicit, Crank-Nicholson method, Introduction to Finite element method. **(9)**

TEXT BOOKS

1. *Gupta, S. K., "Numerical Methods for Engineers, New Academic Science, 2012.*
2. *Pradeep Ahuja, "Intrduction to Numerical Methods in Chemical Engineering", 2nd Edition, PHI Learning Private Limited, 2019.*

REFERENCES

1. *S.C. Chapra & R.P. Canale, "Numerical Methods for Engineers with Personal Computer Applications", McGraw Hill Book Company, 1985.*
2. *R.L. Burden & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles, 2000.*
3. *Atkinson, K. E., "An Introduction to Numerical Analysis", John Wiley & Sons, 1978.*
4. *Press, W. H. et al., "Numerical Recipes in C: The Art of Scientific Computing, 3rd Edition, Cambridge University Press, 2007.*

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Cos	Program Outcomes/Program Specific Outcomes (Pos/PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3			1	1							1	
CO2	3	1			1	1							2	1
CO3	3	3	1		2	2							3	2
CO4	1	2	1		1	1							1	1
CO5	3	3	1	1	2	1							3	1

(1: Slight, 2: Moderate 3: Substantial)

19CHL57 - MECHANICAL OPERATIONS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, students will be able to

CO1 *: Apply the concepts of mechanical operations in physical separation processes.*

CO2 *: Perform the sieve analysis using various size reduction equipment's.*

CO3 *: Operate and estimate the performance characteristic parameters for solid fluid and solid-solid separation equipment's.*

CO4 *: Conduct experiments to solve complex engineering problems effectively as an individual or team work.*

CO5 *: Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.*

LIST OF EXPERIMENTS

1. Determination of Critical Speed and Reduction Ratio of Ball Mill
2. Performance Studies on Jaw Crusher
3. Estimation of Separation Efficiency of Froth Floatation Cell
4. Determination of Specific Cake and Filter Medium Resistance of slurry using Plate and Frame Filter Press
5. Performance Studies on Roll Crusher
6. Estimation of area of Thickener for a Batch Sedimentation Unit
7. Determination of Effectiveness of Screen
8. Determination of Specific Cake Resistance of Slurry and Compressibility Factor of Leaf Filter under Constant Pressure Filtration
9. Estimation of Separation Efficiency of Cyclone Separator
10. Performance Studies on Hammer Mill
11. Determination of Specific Cake Resistance of Slurries Using a Continuous Rotary Vacuum drum filter press
12. Estimation of separation efficiency of Air Classifier
13. Study the Wall Effect on the Terminal Settling Velocity of a Sphere
14. Performance studies on mixing apparatus
15. Performance studies on solid transportation equipment

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Cos	Program Outcomes/Program Specific Outcomes (Pos/PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	3					2	1	3	
CO2	2	3	1	2	1	2					2	1	3	
CO3	3	2	2	2	2	2	1		2	2	1	2	3	
CO4	3	2	2	2	1	2	1	1	3		2	3	2	3
CO5			2				2	3	3		1	2	1	2

(1: Slight, 2: Moderate 3: Substantial)

19INT51 - INTERNSHIP-I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, the students are able to

CO1 *: Analyze the basic principles and knowledge of chemical engineering which has been applied in the production of various products in industries.*

CO2 *: Conduct lab scale experiments through the experience gained from the large scale industries.*

CO3 *: Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.*

- Students are instructed to complete six to eight weeks of internship in any Chemical Process Industry or Nationalized Academic Institution.
- A written report and an oral presentation should be given after successful completion of internship.

19INT61 - INTERNSHIP-II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, the students will be able to

CO1 *: Analyze the basic principles and knowledge of chemical engineering which has been applied in the production of various products in industries.*

CO2 *: Conduct lab scale experiments through the experience gained from the large scale industries.*

CO3 *: Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.*

- Students are instructed to complete six to eight weeks of internship in any Chemical Process Industry or Nationalized Academic Institution.
- A written report and an oral presentation should be given after successful completion of internship.

19HOC51 - EMPLOYABILITY AND PERSONALITY DEVELOPMENT SKILLS - I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Solve objective questions on Syllogisms, Data Interpretation, Critical Reasoning, Theme Detection, Sentence Completion and Business Vocabulary*

CO2 *: Develop appropriate responses for business phone calls and negotiate effectively.*

CO3 *: Speak with appropriate body language for a technical speaking task.*

CO4 *: Project the appropriate grooming and the right etiquettes, for interview and group discussion task.*

VERBAL APTITUDE

Syllogisms-Paragraph Comprehension -Data Interpretation -Critical Reasoning/Theme Detection - Grammar -Sentence Completion Filler - Business Vocabulary- Foreign phrases used in English **(3)**

PROFESSIONAL COMMUNICATION

Telephonic Conversation Skills - Telephonic Interview -Etiquettes - Professional, Dining & Telephone - Employability skills - Importance and Employability level of present Y and Z Generation - Interpersonal Skills - Negotiation Skills - Types, Expressions used in formal and informal negotiations, Stages of Negotiation - Time Management - Pareto principle, Prioritizing tasks, Barriers to time management. **(7)**

THE ART OF SPEAKING

Types of Speaking - Barriers to Speaking - Presentation on a Technical Topic - Speaking on Current Trends in the Industry. **(5)**

NON-VERBAL COMMUNICATION

Interview Skills - Non-Verbal Communication - Smiling, Posture, Handshake, Tone of Voice and Eye Contact - GD tips & techniques and Mock GD- Body Language - Grooming. **(5)**

REFERENCES

1. *Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.*
2. *Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.*
3. *John Hayes. Interpersonal Skills at Work. Second Edition. Routledge publication. 2005*

19HOC61 - EMPLOYABILITY AND PERSONALITY DEVELOPMENT SKILLS - II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Exhibit Corporate Etiquettes with assertiveness and personal effectiveness.*

CO2 *: Build teams and solve problems at workplace.*

CO3 *: Manage conflicts in a professional manner*

CO4 *: Simulate an actual Job Interview scenario to prepare a candidate for a real Interview*

CORPORATE ETIQUETTE

Corporate Etiquette: Dos and Don'ts, - Conversational dos and don'ts - Creating elusive first impression- Assertiveness-Personal Effectiveness **(4)**

LEADERSHIP AND TEAM MANAGEMENT

Leadership Skills - Understanding Traits and Styles - Team Building: Bonding, Development and Delegation - Adaptability and Work Ethics - Handling Team Dynamics- Giving and Receiving Feedback- Problem Solving Skills. **(5)**

STRESS AND CONFLICT MANAGEMENT

Emotional Intelligence: Recognition, Understanding and Managing - Stress Management: Techniques and Benefits - Conflict Management: Introduction - Handling Conflicts - Conflicts settlement **(6)**

GROUP DISCUSSION AND INTERVIEW SKILLS

Mock GD - Interview Skills - Answering challenging questions - Common Interview Questions **(5)**

REFERENCES

1. *Barun K Mitra., Personality Development and Soft Skills. Second Edition. Oxford University Press. 2016*
2. *N.Krishnaswamy & Lalitha Krishnaswamy - Mastering Communication Skills and Soft Skills. New Delhi. Bloomsburry. 2015*
3. *Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.*

17MDC49 - MANAGERIAL COMMUNICATION SKILLS

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Conceive appropriate verbal responses from the learners to a given social situation, using the guidelines to effective speaking skills and body language.*
- *Generate trouble shooting solutions to develop team building and interpersonal skills with case studies that focus on body language and empathy.*
- *Develop appropriate responses for business phone calls and formulate effective resolutions to professional conflicts that arise out of cross cultural communication gaps in a given managerial context.*
- *Compose appropriate written responses to professional problems faced by a team at the workplace arising out of ineffective communication skills.*

INTRODUCTION

Introduction - Code and Content - Stimulus and Response: Source - The Encoding Process - The Channel - The Decoding Process - The Receiver - Speaking Skills - Effective Speaking Guidelines - Communicating Soft Skills: A Self-assessment - Closing Tips **(6)**

SOFT SKILLS

Introduction to Soft Skills - Lessons from the Three Case Studies - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft Skills: Time Management - Attitude - Responsibility - Ethics, Integrity, Values and Trust - Self-confidence and Courage - Consistency and Predictability - Teamwork and Interpersonal Skills - Communication and Networking - Empathy and Listening Skills - Problem Solving, Troubleshooting and Speed reading - Leadership - Body Language **(7)**

TELEPHONING SKILLS & NEGOTATIONS

Preparing to make a telephone call - Receiving calls - Taking and leaving messages - Asking for and giving repetition - The secretarial barrier - Cross-cultural communication on the telephone - Setting up appointments - Changing arrangements - Ending a call - Cross-cultural communication on the telephone - Problem-solving on the telephone - Complaints - Negotiations: Types of negotiation - Preparation for a negotiation - Making an opening statement - Bargaining and making concessions - Accepting and confirming - Summarizing and looking ahead - Types of negotiator - Dealing with conflict - Rejecting - Ending the negotiation **(10)**

WRITING SKILLS TO CREATE AN IMPRESSION

Introduction- Fifteen Principle to Increase Clarity in Communication - Edit-Edit-Edit: The Reader's Perspective - Clarity of Thought - Clarity of Text. **(7)**

Total : 30

REFERENCE BOOKS

1. *Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.*
2. *Krishna Mohan, Meera Banerji. "Developing Communication Skills" Mac Million Publishers, 2012.*
3. *Sai Lakshmi. B, "Poly Skills- A Course in Communication and Life Skills" Cambridge University Press, 2012.*

17MDC58 - PERSONALITY DEVELOPMENT

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Ascertain the various concepts of Self like the Physical Self - Energy Self - Intellectual Self - Mental Self - Blissful Self with respect to the Western(Occidental) and Eastern(Oriental) theories of the Self and Personality Development.*
- *Outline the significant effects of Self Confidence to build team confidence, given the foundation principles of Self Motivation and Confidence.*
- *Assess the various personalities and Attitudes and choose the best attitude for making bold decisions in personal and professional contexts.*
- *Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.*

PERSONALITY DEVELOPMENT

One's Personality Sends Out a Signal That Others Read - Same Person: Consciously Different Personalities can be Powerful - There isn't One Right Personality; It Differs by Role - Learning about Personality Development from the Three Cases - Personality Analysis - Freudian Analysis of Personality Development - Swami Vivekananda's Concept of Personality - Development: Physical Self - Energy Self - Intellectual Self - Mental Self - Blissful Self - Personality Begets. **(10)**

LEADERSHIP QUALITIES & INTERPERSONAL SKILLS:

Resolving Conflict - A Smiling Face - Appreciative Attitude - Assertive Nature - Communication Skills - Listening Skills - Developing Empathy - The Personality Attribute of Taking Bold Decisions - Personality Types and Leadership Qualities - Mapping the Different Personality Types - Personality Tests: Example of a Personality Test: Jung Typology Test - Personality Assessment **(10)**

ETIQUETTE

Social Etiquette - Corporate Etiquette - Personal Grooming - Using minimal Body Language - Leadership and Entrepreneurship : Corporate Training - Professionalism - Self awareness - Creativity skills - Cognitive Development - Assertiveness - Positive Thinking and Attitude. **(10)**

Total : 30

REFERENCE BOOKS

1. *Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.*
2. *Krishna Mohan, Meera Banerji. "Developing Communication Skills" Mac Million Publishers, 2012.*
3. *Sai Lakshmi. B, "Poly Skills- A Course in Communication and Life Skills" Cambridge University Press, 2012.*

17MDC95 - MINOR PROJECT - DECISION TOOL DEVELOPMENT

L	T	P	C
0	0	8	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Investigate the business problem in detail*
- *Identify the logical and ordered process to address all the critical elements of the business problem*
- *Analyze various alternatives and select the best alternative for the problem*
- *Develop the decision tool with the help of the analysis*

Effectiveness in managing the business decision making will ultimately determine the success of the company. But this is a problem for companies of all sizes particularly with the companies that are growing rapidly. At this point a clear mechanism for managing, communicating and confirming decision implementation is essential. Hence this minor project concentrates on developing a decision tool for the Chosen business process.

In this minor project students have to :

- Choose a business problem and develop a decision tool for to address the same.

17MDC71 - PROJECT WORK AND VIVA VOCE - I

L	T	P	C
18			

PRE-REQUISITES

Should have undergone all courses upto 6th Semester

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

17MDC101 - PROJECT WORK AND VIVA VOCE - II

L	T	P	C
			18

PRE-REQUISITES

Should have undergone all courses

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

21MDS12 – ALGEBRA AND APPLICATIONS

L	T	P	C
3	1	0	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Describe the knowledge gained on sequences and apply them in financial mathematics*
- *Describe the linear algebra concepts and apply them appropriately*
- *Apply the concepts of matrices, eigen values and eigen vectors in economics, population biology and computer graphics*
- *Apply difference equation ideas in data modelling*

SEQUENCES, SERIES AND ALGEBRAIC EQUATIONS
Convergence and divergence of infinite series-series of positive terms-comparison, ratio, root and Raabe's tests-alternating series-Leibnitz test Expansions and summations using Binominal-exponential and logarithmic series. Applications of series in financial mathematics: Simple and Compound Interest-Nominal and Effective Interest Rates-Continuous Compounding –Future Value and Present Value-Annuities- Ordinary Annuity: Future and Present Value, Annuity Payment, Principal Sum, Period and Interest Rate , Annuity Due, Deferred Annuity and Perpetuity. Roots of algebraic and transcendental equations using Graeffe's and Newton-Raphson method. Real World Applications of Newton Raphson Method: Finding the Break Even Point of a Firm and finding the interest rates of Annuities.

(12)

LINEAR ALGEBRA
Definition of vector spaces-linearly dependent and independent-subspaces-basis and dimension-of vector space-rank and nullityof linear transformation. Inner product, properties- Cauchy Schwarz-inequality, norm and its properties, introduction of orthogonalbasis and Gram-Schmidt orthogonalization process. (6)

MATRICES
Eigenvalues and eigenvectors-properties-Cayley-Hamilton theorem (without proof)-Eigendecomposition and Diagonalization- Cholesky Decomposition-Quadratic form reduction in threevariables-applications.

APPLICATIONS OF MATRICES
Matrix factorization techniques-special matrices-permutation matrix (non negative elements)-Hessenberg matrix-sparse matrixsparsematrix-band width-Linear system of equations-Gauss elimination-Gauss Jordan-Inverse of a matrix-Gauss-seidal-iterationmethod. Application of Linear systems: A homogeneous system in economics- non homogenous system by inversion-Applications of Matrices in Input-Output Analysis in Economics. Leslie’s Population Growth Model, Homogeneous Coordinates and their applications to Computer Graphics. (12)

INTERPOLATION AND DIFFERENCE EQUATIONS

21MDS13 - STATISTICAL METHODS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Achieve good skills in presentation and summarization of data using statistical tool*
- *Apply basic concepts in probability theory to data and derive useful measures for easy interpretation of the probability structure of data*
- *Describe the knowledge gained in sampling and various methods of sampling from population data*
- *Understand the meaning of association between two variables and use regression analysis in prediction.*

DATA TYPES AND SCALES
Structured and Unstructured Data-Cross-Sectional, TimeSeries, and Panel Data-Types of Data Measurement Scales: Nominal, Ordinal, Interval and Ratio Scale-Raw data and grouped data – Primary and secondary data – Methods of collection –Classification of data – Tabulation –frequency distribution- **Data visualization**: **Charts:** Scatter Plot, Bar Chart- Pie Chart, Coxcomb Chart- **Graphs:-**Histogram, Frequency Polygon and Curve, Ogive curves and histograms-Stem and Leaf plot. (7)

SUMMARY STATISTICS
MEASURES OF CENTRAL TENDENCY-Arithmetic Mean (AM) -weighted arithmetic mean, median, mode, Geometric Mean (GM) and Harmonic Mean (HM) - Merits, demerits and uses-Relationship between mean, median and mode-Relationship AM, GM and HM, computation of the measures for grouped and ungrouped data -Percentile, Decile and Quartile.
MEASURES OF DISPERSION-range, mean deviation and standard deviation – coefficient of variation and its use- Inter Quartile Range (IQR)-Outliers-Box Whisker Plot and its uses- Treemap– Measures of shape - Skewness and Kurtosis and their uses.

(8)

PROBABILITY
***[Review** of basic concepts of probability, addition theorem, conditional probability and multiplication theorem- random variables: discrete and continuous, probability mass function and probability density function and cumulative distribution function]*
Bayes's Theorem and its applications– Moments of a random variable-raw and central moments. Mathematical expectation-mean and variance – Inequalities: Markov, Chebyshev, Chernoff, Jensen and Cauchy-Schwarz -Important discrete distributions-Discrete Uniform Distribution, Binomial, Poisson, -The Poisson approximation to the Binomial- Continuous distributions: Continuous Uniform Distribution and Normal distribution, its properties and applications-The Normal approximation to the Binomial-Normal Probability Plot andQ-Q plot.

(15)

SAMPLING

Population and sample- sampling and its need –sampling vs complete enumeration –parameter and statistics-Probability sampling and –random sampling- simple random sampling, lottery method and random number table method- stratified random sampling-sampling distribution and standard error of a statistic. Bootstrap sampling.

(7)

CORRELATION AND REGRESSION

Standardisation of variables-Methods: Z-score, 0-1 scale(min-max scale), standard deviation method and range method-Definition of correlation - Scatter plot –Karl Pearson's correlation coefficient its properties– Definition of Regression – Simple regression-Regression of x on y and y on x - fitting regression equation by the method of least squares-properties of regression coefficients -Spearman's rank correlation coefficient-Multiple regression with two independent variables-Multiple and Partial correlation coefficients in three variables and their properties. (8)

TOTAL : 45

TEXT BOOKS

1. *U.Dinesh Kumar. Business Analytics, Wiley India Pvt. Ltd., 4435-36/7, Ansari Road, Daryaganj, New Delhi-110002, 2017.*
2. *Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Ninth Edition, Prentice Hall, Delhi, 2002.*

REFERENCE BOOKS

1. *Michael Baron, "Probability and Statistics for Computer Scientists", 2nd edition, CRC Press.*
2. *Gupta,S.C. – "Fundamentals of Statistics", 7th revised and enlarged edition, - Himalaya Publishing House, New Delhi, 2013.*
3. *Peter Bruce and Andrew Bruce. Practical Statistics for Data Scientists, O'Reilly Media, Inc., 1005 Gravenstein Highway North,Sebastopol, CA 95472, 2017.*
4. *Gun, A.M., Gupta, M.K. and B. Dasgupta, "Fundamentals of Statistics", Vol.1.World Press, Kolkatta, 2013.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**H**	**H**	**H**					
CO2	**H**	**H**	**H**	**H**					
CO3	**H**	**H**	**H**	**H**					
CO4	**H**	**H**	**H**	**H**					
CO5									

21MDS14 -PROBLEM SOLVING AND PROGRAMMING IN PYTHON

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Develop algorithmic solutions to simple computational problems*
- *Write and execute simple python programs*
- *Decompose python program into functions*
- *Represent compound data using Python lists, tuples, dictionaries*
- *Read and write data from/to files in Python programs*
- *Create GUI application*

ALGORITHMIC PROBLEM SOLVING

General problem - solving concepts - Problem solving concepts for computers – Algorithms - Flowchart - Pseudocode. Programming concepts - Structured programming concepts -Programming methodologies viz. top-down and bottom-up programming.

(8)

INTRODUCTION TO PYTHON

Python in real world - Installing Python-Running Python. Numbers-Strings and Variables.Lists – Tuples - Dictionaries, Set.

(10)

CODING STRUCTURE

Comment-Continuation-Comparing if., elif - Repeat with while-Iterating with for-Functions-Handle errors with try and except.

(10)

MODULES, PACKAGES, FILES

Modules - Importing modules - Creating a module-Packages. Working with file-file processing - Controlling I/O - Basic File/Directory management - Access and ownership - Manipulating file paths.

(10)

USER INTERFACE

Date and Time - Regular Expressions - Graphical User Interface. (7)

TOTAL: 45

TEXT BOOKS

1. *Maureen Sprankle, "Problem Solving and Programming Concepts", Seventh Edition. [Para 1].*
2. *Bill Lubanovic, "Introducing Python: Modern Computing in Simple Packages", First Edition, O'Reilly Media, 2014. [Para 2,3].*
3. *Martin C. Brown, "Python the Complete Reference", Paperback, 2018. [Para 4].*
4. *R. Nageswara Rao, "Core Python Programming", Paperback, 2018. [Para 5].*

REFERENCE BOOKS:

1. *John V Guttag, "Introduction to computation and programming using python", MIT Press, 3rd Edition, 2013.*
2. *Yashavant Kanetkar, "Let Us Python", 2019.*
3. *Code Quickly, "Learn Python Quickly: A Complete Beginner's Guide to Learning Python, Even If You're New to Programming (Crash Course with Hands-On Project)", Paperback, March 22, 2020.*
4. *Nichola Lacey, "Python by Example: Learning to Program in 150 Challenges", Cambridge University Press, 1st Edition, 2019.*
5. *Dr. Charles R. Severance, "Python for Everybody Exploring Data Using Python 3", 2016.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**L**	**L**	**H**	**H**	**M**			
CO2	**M**	**M**	**H**	**H**	**M**	**M**	**L**	**M**	
CO3	**H**	**M**	**M**	**H**	**M**	**M**	**M**	**M**	
CO4	**M**	**M**	**M**	**H**	**M**	**M**	**M**	**M**	
CO5	**H**	**M**	**M**	**H**	**M**	**M**	**M**	**M**	

21MDS15 -PRINCIPLES OF DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Ability to understand the elements of digital system abstractions such as digital representations of information, digital logic, and Boolean algebra*
- *Identify basic requirements for a design application*
- *Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, and gate count*
- *Create gate level implementations of sequential/ combinational logic function.*
- *Design and develop digital logic for real time applications.*

NUMBER SYSTEMS AND CODES

Introduction - Decimal, Binary, Octal and Hexadecimal base conversions-BCD (8421) code - Gray code and conversion- ASCII code – Error detecting and correcting codes: parity, CRC and Hamming code.

(9)

BINARY ARITHMETIC

Unsigned and signed numbers - 1's, 2's, 9's, 10's, 15's, 16's Complement representation - 1's and 2's Complement Binary subtraction - BCD addition - 9's and 10's BCD subtraction - Binary Multiplication and Division.

(9)

BOOLEAN ALGEBRA AND LOGIC GATES

Introduction - Basic theorems and postulates - Boolean function - Canonical and Standard forms - Minimization of Boolean expression - Karnaugh Map and Quine Mc-Cluskey Method - Basic logic gates - truth tables - Applications.

(9)

COMBINATIONAL AND SEQUENTIAL LOGICS

Introduction - Combinational logic: Half Adder and Full Adder, Half Subtractor and Full Subtractor - Encoder and Decoder – 4X1 Multiplexer and 1X4 Demultiplexer, Sequential logic: Latches and Flip Flops – Types of flipflops - Clocked RS,JK, T and D Flip-Flops.

(9)

COUNTERS AND REGISTERS

Introduction to Asynchronous and Synchronous counters - 4 bit Up counter – 4 bit Down counter - Mod n counter - Parallel / Serial In / Out Shift Registers - Ring Counter.

(9)

TOTAL : 45

TEXT BOOKS

1. *Anil K. Maini, "Digital Electronics Principles, Devices and Applications", John Wiley & Sons Ltd, 2007.*
2. *A.P.Godse,"Digital Electronics", Technical Publications, Pune, 2009.*

REFERENCE BOOKS

1. *Morris Mano.M., "Digital Logic and Computer Design", PHI, 2001.*
2. *Malvino PA and Leach BP, "Digital Principles and Applications", McGraw Hill Book Company, 5th Edition, 1994.*
3. *Thomas C Bartee, "Digital Computer Fundamentals", McGraw Hill Book Company, 6th Edition, 1997.*
4. *Thomas L Floyd, "Digital Fundamentals", UBS, 10th Edition, 2008.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**M**	**M**						**L**
CO2	**M**	**M**	**H**						
CO3	**H**	**M**		**L**					
CO4	**H**	**L**		**M**					
CO5	**H**	**H**		**M**			**L**		

21MDS16 - COMPUTING LABORATORY I

L	T	P	C
0	0	4	2

PRE-REQUISITES

21MDS12, 21MDS13

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

- *Solve problems in linear algebra using Scilab scripts and commands.*
- *Measures of central tendency and dispersion using MS-Excel's in built functions.*
- *Generate graphical and diagrammatic representation of statistical data using MS-Excel's tools.*
- *Bivariate data using MS-Excel's Data Analysis Tools.*
- *Write script files and analyze data using Scilab and MS-Excel's Data AnalysisPack.*
- *Compute annuities and solve input-output models and Leslie's population growth models.*

TOPICS TO BE COVERED

1. Scilab Fundamentals.
2. Algebraic operations on matrices Transpose of a matrix, Determinants, inverse of matrix.
3. Computation of annuities, present and future values using Excel
4. Solving System of linear equations and consistency.
5. Applications to Input-Output models
6. Row reduced echelon form and normal form.
7. Eigen values, Eigen vectors, Rank of a matrix.
8. Applications of Leslie population growth model
9. Solving algebraic and system of equations.
10. Estimating numerical values for given data by means of interpolation.
11. Perform data manipulation using excel.
12. Perform graphical and diagrammatic representation of statistical data, like bar diagram, pie, histogram and line diagram.
13. Construct the pivotal tables and apply statistical functions to calculate the descriptive statistics.
14. Practice the theory behind the descriptive statistics, like measures of central tendency, dispersion, skewness and kurtosis.
15. Apply and Implement the theory of probability in various applications.
16. Simple probability and random sampling.
17. Practicing the simple correlation and regression techniques.

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	M					
CO2	M	M	M	M					
CO3	M	M	M	M					
CO4	M	M	M	M					
CO5	H	M	H	H					

21MDS17 - PROGRAMMING LABORATORY IN PYTHON

L	T	P	C
0	0	4	2

PRE-REQUISITES
21MDS14

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

- *Write, test and debug simple python programs*
- *Implement Python programs with conditionals and loops*
- *Develop Python programs with functions*
- *Use Python lists, tuples, dictionaries for representing compound data.*
- *Read and write data from/to files in Python.*
- *Create GUI based applications*

CONCEPTS TO BE COVERED

1. Steps in problem solving –drawing flowchart using Raptor Tool
2. Introduction to Python, Demo on IDE, Keywords, Identifiers and I/O statements.
3. Simple programs in Python
4. Operations and Expressions in Python
5. Algorithmic approach 1: Sequential
6. Algorithmic approach 2: Selection (if,elif,if…else,nested if else)
7. Algorithmic approach 3: Iteration (while and for)
8. Strings and its Operations
9. List and its operations
10. Dictionaries: operations
11. Tuples and its operations
12. Functions, Recursions
13. Files and its operations with command line arguments.
14. Date and Time manipulation
15. Creating User Interface for applications

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	L	L	H	H	M			
CO2	M	M	H	H	M	M	L	M	
CO3	H	M	M	H	M	M	M	M	
CO4	M	M	M	H	M	M	M	M	
CO5	H	M	M	H	M	M	M	M	

21MDS18 - DIGITAL ELECTRONICS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
21MDS15

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

- *To emulate and understand the internal working of arithmetical, relational and logical circuits inside computer systems.*
- *To familiarize digital data processing and storage through combinational and sequential logic.*
- *To Demonstrate serial and parallel data operations using shift registers and counters.*
- *To comply data encryption and decryption methods using encoding and decoding.*
- *To implement low level to high level digital computer systems using combinational and sequential logic.*

CONCEPTS TO BE COVERED

1. Study of logic gates.
2. Study of Flip-Flops.
3. Design of binary counter & decade counter.
4. Construction of Half-adder & Full-adder.
5. Implementation of basic Logic gates using Universal gates.
6. Testing Left shift, Right shift and Parallel-In, Parallel-Out operation of the Shift registers.
7. Multiplexing and Demultiplexing.
8. Encoding and decoding.
9. Conversion of binary into gray and gray into binary.

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H		M	M					
CO2	M		M	L					
CO3	M		L	M					
CO4	M	L							L
CO5	H	M		L					

21MDS19 -ENGLISH FOR EMPLOYABILITY

L	T	P	C
0	0	2	1

PRE-REQUISITES
Consent of the Instructor

COURSE OUTCOMES

- *Given strictly timed objective questions on logical sequence of words, sequential order of things, comparison, and sentence correction, solve within the given time.*
- *For a given specific speaking task on topics like JAM, Describing an object, book review and extempore generate ideas and speak confidently.*
- *For a given social situation viz., Travel and Transport, complaining, giving instructions, advising and sympathizing, requesting and warning people, communicate effectively to peer using appropriate functional language.*

UNIT – 1

Ice Breakers - Just a Minute - Book Reviews - Describing an object – Extempore – Paraphrasing.

(6)

UNIT – II

Spoken English - Travel and Transport, Complaining - Giving Instructions, Advising and Sympathizing – Requesting and warning people

(4)

UNIT – III

Logical Sequence of Words- Exercises - Sequential Order of Things - Comparison Type Questions – Introduction and Exercises - Idioms and Phrases - Types and Exercises Vocabulary through Mythology - One word Substitutes, Word Power Exercises - Common Errors in English - Sentence Correction.

(7)

UNIT – IV

Activity based on newspaper articles - Vocabulary – Homophones and Homonyms - Reading Prose – Reading Comprehension Activity

(3)

UNIT – V

Professional Communication - Mock Group Discussion – Mock Interview – Telephoning Skills – Personality Development Activities.

(10)

TOTAL : 30

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1					H				
CO2					H				
CO3					H				
CO4									
CO5									

21MDSLE01 - PROFESSIONAL ENGLISH

PRE-REQUISITES
Consent of the Instructor

L	T	P	C
2	0	0	2

ASSESSMENT: THEORY

COURSE OUTCOMES

- *Apply the rules of grammar namely Active and Passive voice, Direct and Indirect speech, Purpose and Function, Articles and Prepositions, Conjunction, Conditional sentences and use suitable patterns in a given sentence or passage.*
- *Construct appropriate responses to greet, transfer, place the caller on hold, enquires, callbacks, unintentional disconnects, interruptions, using suitable language and telephoning etiquettes. Given a business communication scenario construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator.*
- *Given a communication context, specify the type and barriers to listening, provide solutions and justify. For a given passage note the important points and summarize it.*
- *Given a business communication scenario, compose a Business Letters, Memo, Emails, Reports, Technical Proposals, Instructions and Recommendation and checklist using appropriate language and format. For a given job requirement, prepare a job application letter with resume.*
- *For a given HR topic, generate valid points for and against the topic and present them with appropriate group behavior. For any job requirement, plan and prepare for a 20min HR mock interview.*

FOCUS ON LANGUAGE: ENGLISH GRAMMAR & VOCABULARY

One Word Substitutes – Homophones – Homonyms – Eponyms – Direct Indirect Speech – Active Passive Voice – Conditional Sentences – Adverbs – Conjunctions – Prepositions – Articles – Relative Clause – Pronouns – Cause and Effect Expressions – Purpose and Function – Modals (6)

BUSINESS ENGLISH

Telephoning Skills: Understanding Telephone communication – Telephonic Conversations and Etiquettes - Handling Calls – Leaving a Message – Making Requests –Asking for and Giving Information – Giving Instructions - Negotiations: Types of Negotiation –Six Basic Steps of Negotiations – Informal and formal Negotiations

(4)

READING

Summarizing – SQ3R Reading Technique – Note Making: Outline/Linear Method- Sentence Method – Schematic/Mapping Method – Understanding Discourse Coherence – Cloze Comprehension – Critical Reading: Creative and Critical Thinking- Reading proverbs, online advice forum (4)

WRITING

Letter Writing – Business Letters – Cover Letters – Resumes – Memos – Emails – Reports – Technical Proposals – Instructions & Recommendations – Technical Description – Checklist - Writing a paragraph – Writing a description of a person's past present and future, recent experiences, movie review, list of roles – Writing a job application letter, Advice column list - Writing a guide book introduction – Writing about people response to a survey

(6)

LISTENING

Stress and Intonation -Types of Listening – Barriers of Effective Listening – Listening for Generic Content and Specific Information - Listening & Note Taking – Intensive Listening - Listening to Descriptions - Listening to predicaments, call in radio show and excuses

(4)

SPEAKING

Group Communication: Forms of Group Communication – Using Body Language in Group – Discussions – Group Discussions - Organizational GD – GD as a Part of Selection Process – Meetings – Conferences – Symposia & Seminars **–** Interviews: Objectives of Interviews – Types of Interviews – Job Interviews – Media Interviews – Press Conference - Describing abilities and Skills, acceptable and prohibited behaviour in different situations, Personality Traits, Countries, a predicament, Recent past events and experiences, movies and books – Giving Advice and suggestions- Making polite requests – Making invitations and excuses- Speculating about past and future events. (6)

TOTAL : 30

TEXT BOOKS

1. *Jack C Richerds, "Interchange - 2", CUP, Fourth Edition, Chennai, 2015.*
2. *Meenakshi Raman, Sangeeta Sharma, "Technical Communication – Principles and Practice", Oxford University Press, New Delhi, 2015, 2015.*

REFERENCE BOOKS

1. *Sudharshana N. P & Savitha C, "English for Technical Communication", CUP, 2016.*
2. *Sudharshana N. P & Savitha C, "English for Engineers", CUP, 2018.*
3. *Ronald Carter, Michael Mc Carthy. "Cambridge Grammar of English" Cambridge University Press, 2011.*
4. *Michael Mc Carthy and Felicity O'Dell, "English Vocabulary in Use", Cambridge University Press, 2012.*
5. *Mark Ibbotson. "Cambridge English for Engineering" Cambridge University Press, 2012.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1					**H**				
CO2					**H**	**L**			
CO3					**H**	**M**			
CO4					**H**	**M**			
CO5					**H**	**H**			

21MDS21 – CALCULUS AND APPLICATIONS

L	T	P	C
3	1	0	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *To incorporate the essentials of differential calculus and its applications.*
- *To provide various applications of integral calculus in business and economics.*
- *To describe the concepts of ordinary and partial differential equations, Fourier Series and methods of solving them.*
- *To provide good knowledge in experimental data analysis.*

DIFFERENTIAL CALCULUS

Definition of limit and derivative of a function. Applications to marginal analysis in Business and Economics-Approximations by increments- Relative Rate of Change and Elasticity of Demand-Maxima and Minima of function of single variables –Applications to Optimization of area and perimeter, Relation between Average Cost and Marginal Cost, Maximizing Revenue and Profit and Inventory Control. Functions of Several Variables-Partial Derivatives- Homogeneous functions and Euler's Theorem-Optimization of functions of two variables-Constrained Optimization using Lagrange Multipliers- Significance of Lagrange Multiplier--Optimisation of functions of several variables using Hessian matrix. (12)

INTEGRAL CALCULUS

Integration as a process of Summation and geometrical meaning-Applications-Beta and Gamma Functions- Application of single integrals- Area between two curves and finding the Net Excess Profit-Application to study Lorenz Curves in Economics –Computing Gini Index-Average Value of a function using integration and its interpretations-Useful life of a machine-Future and Present Value of an Income Flow- -Consumer Willingness to Spend-Consumers' and Producer's Surplus –- Double and triple integrals- Changing the order of integration -Applications of Double and triple integrals – Area and Volume. (10)

ORDINARY DIFFERENTIAL EQUATIONS

Formation of differential equations-geometrical interpretation of ODE- Higher order differential equations with constant coefficients- Euler Cauchy type-Applications in micro economics**.**

(5)

PARTIAL DIFFERENTIAL EQUATIONS:

Basic Concepts and Solutions of first order Equations-Linear Partial Differential Equations of Second Order with constant coefficients- Classifications-Hyperbolic, Parabolic and Elliptic – Solutions-**Fourier Series:** Dirichlet's conditions-Full range series-Half range series-Complex form of series-Parseval's identity -Harmonic analysis.

(9)

EXPERIMENTAL DATA ANALYSIS

Curve fitting: Least Square Method. **Interpolation:** Newton's method - Lagrange's method. **Numerical Differentiation:** Application to Maxima and Minima of functions. **Numerical Integration:** Trapezoidal rule- Simpson's $1/3^{rd}$ rule. Applications to area, volume and linear motion. **Numerical Solutions of Ordinary Differential Equations**: Taylor's Series – RungeKutta Fourth order methods – Milne's Predictor – Corrector Method. (9)

THEORY : 45
TUTORIAL : 15
TOTAL : 60

TEXT BOOKS

1. *L.D.Hoffman and G.L.Bradley, Calculus for Business, Economics and the Social and Life Sciences, 10th Edition, McGraw Hill, Higher Education, 2010.*
2. *Mehta B.C, and G.M.K. Madani, Mathematics for Economists, Sultan Chand & Sons, New Delhi, 2006.*
3. *Shepley L.Ross. Differential Equations. John Wiley and Sons, Third Edition, 2004.*
4. *Sankara Rao.K. Numerical Methods for Scientists and Engineers, Prentice Hal of India, New Delhi, 2001.*

REFERENCE BOOKS

1. *Thomas & Finney, " Calculus", Pearson education, 9th Edition, 2006.*
2. *Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons Asia Private Limited., 2008.*
3. *Grewal, B.S., "Higher Engineering Mathematics", 4th Edition, Khanna Publishers, 2007.*
4. *Wylie C. R, Barret L. C, "Advanced Engineering Mathematics", 6th Edition, McGraw Hill, New York, 1995.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**L**		**M**				**L**	**L**
CO2	**H**	**L**		**M**				**L**	**L**
CO3	**H**	**L**		**M**				**L**	**L**
CO4	**H**	**L**		**M**				**L**	**L**

21MDS22 - PROBABILITY DISTRIBUTIONS AND APPLICATIONS

Contact Hours

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Apply various discrete and continuous probability distributions to data and also situations where they can be applied*
- *Apply moment generating functions in understanding various properties of random variables*
- *Become familiar with various methods in statistical inference and he can independently apply many statistical tests to make inferences on the properties of both discrete and continuous types of data.*
- *Describe the concepts of Bayesian inference.*

PROBABILITY DISTRIBUTIONS-DISCRETE

Geometric distribution-its memory less property, negative binomial distribution, Hyper-geometric distributions-The Binomial Approximation to the Hyper-geometric distribution, multinomial distribution. **Continuous**: exponential distribution and its memory-less property, gamma, Beta, Chi-square log normal distributions and Weibull distributions –applications and their properties.

(9)

FUNCTIONS OF RANDOM VARIABLES

Moments and Moment Generating functions –properties-MGF of important distributions-Transformations of Variables (using Jacobians) and finding their distributions -method of direct transformation and method of moment generating functions- Joint and Marginal Probability mass functions(for discrete) and density functions(for continuous) for two and more than two random variables. Conditional probability distributions-conditional mean and variance-Covariance of random variables-Statistically independent random variables-mean and variance of linear combination of random variables. (9)

ESTIMATION

Estimation of parameters using method of moments-Maximum Likelihood Point Estimation(MLE) – Properties of estimators-Unbiasedness, minimum variance, efficiency and sufficiency -Mean Square Error-Asymptotic properties-consistency-Fisher Information and Cramer-Rao's Inequality – Interval Estimation –Interpretation-Confidence interval for mean when variance is i) known and ii) unknown and determination of sample size-Concept of a Large-Sample Confidence Interval-Prediction Intervals. (9)

SAMPLING AND TESTS OF HYPOTHESIS

Population and sample –Sampling distribution of a statistic-Derivation of sampling distribution of mean and S^2- t-distribution and F-distribution-Central limit theorems- Test of significance – Basic

concepts – null hypothesis – alternative hypothesis – level of significance – Standard error and its importance – steps in testing-One and two tailed tests-The use of p-values for Decision making – Large sample tests and Small sample tests for : Single sample: Testing on a single mean with variance known and variance unknown-Two samples-tests on means –One sample test on a single proportion-two sample tests of two proportions-Goodness of Fit tests, One and two sample tests concerning variances-Tests of independence for categorical data, tests for homogeneity-testing of correlation coefficient and regression coefficients. (9)

BAYESIAN ESTIMATION

Bayesian Inferences-Prior and posterior distributions-Point Estimation Using the Posterior Distribution- Bayesian Interval Estimation-Bayes Estimates using Decision Theory framework: Bayes estimate under squared error loss function and absolute error loss function.

(9)

TOTAL : 45

TEXT BOOKS

1. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability & Statistics for Engineers & Scientists, Ninth Edition, Prentice Hall, Delhi, 2002.*
2. *Michael Baron, "Probability and Statistics for Computer Scientists", 2nd edition, CRC Press, 2014.*

REFERENCE BOOKS

1. *U.Dinesh Kumar. Business Analytics. Wiley India Pvt. Ltd., 4435-36/7, Ansari Road, Daryaganj, New Delhi-110002, 2017.*
2. *Sheldon Ross. Probability and Statistics for Engineers and Scientists, Elsevier Academic Press, 2009.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**L**	**L**	**L**					
CO2	**H**	**L**	**L**	**L**					
CO3	**H**	**H**	**H**	**H**			**M**	**M**	**M**
CO4	**H**	**H**	**H**	**H**			**M**	**M**	**M**
CO5	**H**	**M**	**M**	**M**			**L**	**L**	**L**

21MDS23 - DATA STRUCTURES AND ALGORITHMS I

PRE-REQUISITES

21MDS14

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

- *Emphasize the importance of data structures in developing and implementing efficient algorithms.*
- *Describe how the basic data structures are represented in memory and used by algorithm.*
- *Understand the linear data structures such as stacks, queues and their applications.*
- *Assess how the choice of data structures and algorithm design methods impacts the performance of programs.*
- *Design and implement sorting and searching algorithms.*

BASIC CONCEPTS

Definition of an Algorithm -Basic Steps in Development of an Algorithm - Algorithm analysis – Functions used- Asymptotic Analysis - Analyzing Recursive Algorithms - Designing Recursive Algorithms. (9)

ARRAYS

Low-Level Arrays - Dynamic Arrays and Amortization - Efficiency of Python's Sequence Types - Using Array-Based Sequences - Multidimensional Data Sets. (9)

STACKS AND QUEUES

Stacks - The Stack Abstract Data Type - Simple Array-Based Stack Implementation - Reversing Data Using a Stack - Matching Parentheses and HTML Tags.
Queues - The Queue Abstract Data Type - Array-Based Queue Implementation - Using an Array Circularly - Double-Ended Queues. (9)

LINKEDLISTS

Singly Linked Lists - Circularly Linked Lists - Doubly Linked Lists - The Positional List ADT - Sorting a Positional List - Link-Based vs. Array-Based Sequences. (9)

SORTING

Introduction -Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort.

SEARCH STRATEGIES

Linear Search-Binary Search. (9)

TOTAL : 45

TEXT BOOK

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser , *"Data Structures and Algorithms in Python", Wiley publications, 2013.*

REFERENCE BOOKS

1. *Rance D. Necaise, "Data Structures and Algorithms using Python ",Wiley publications, 2013.*
2. *Ellis Horowitz & SartajSahani, "Fundamentals of Data Structures", Galgotia Publications, 1994.*
3. *Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivert, Clifford Stein "Introduction to Algorithms", Second Edition, Prentice Hall of India, Publications, New Delhi, 2007.*

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		**M**		**L**	**M**				
CO2		**H**	**M**	**L**					
CO3	**M**		**M**	**L**					
CO4				**H**					**L**
CO5	**M**	**M**	**M**	**L**					

21MDS24 – OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT :THEORY

COURSE OUTCOMES

- *To describe Object Oriented Programming concepts and basic characteristics of Java*
- *To depict the principles of packages, exception handling and String handling*
- *To design and develop applications using inheritance and interfaces*
- *To develop data structure concepts using collections*
- *To develop a java application with threads and build simple Graphical User Interfaces*

INTRODUCTION

Introduction to object oriented programming Paradigm- Introduction – Evolution of Higher Level Languages – Complexity of softwares and their Attributes - object oriented programming Paradigm - Introduction to Java Language – Evolution – Salient Features – Java, Internet and World Wide Web – The Java Environment The Java Language Preliminaries (7)

FUNDAMENTALS, OBJECTS AND CLASSES

Fundamental Programming Structures in Java – Objects and Classes – Object Construction – Packages - String Handling – String Constructors, String Length, Character Extractions, String Comparison, Searching, Modifying and Joining Strings, String Buffer (7)

EXCEPTIONS, ASSERTIONS AND LOGGING

Exceptions : Dealing with errors, Catching Exceptions , Using Assertions, try, catch, throw, throws and finally (7)

INHERITANCE

Classes, superclasses and subclasses – Object : The cosmic superclass – Generic Array List – Object Wrappers and Autoboxing – Method with a variable number of parameters – Enumeration Classes – Constructors – Method Overloading – Method overriding – Constructor overloading – Constructor overriding

Interfaces - Lambda Expressions and Inner Classes – Abstract class – final class, method and variable. (10)

COLLECTIONS

The Java Collections Framework, Interfaces in the Collections Framework, Concrete Collections, Maps, Views and Wrappers, Converting between collections and Arrays (7)

CONCURRENCY and EVENT DRIVEN PROGRAMMING

Concurrency: Threads – Thread States – Thread Properties – Synchronization Database Connectivity: JDBC, Introduction to Servlet and Java Server Page. (7)

TOTAL : 45

TEXT BOOKS

1. Object Oriented Programming with Java, By M. T. Somashekara, D. S. Guru, K. S. Manjunatha , Prentice Hall India Pvt., Limited , June 2017 (Para – I).
2. Core Java Volume I—Fundamentals, Cay.S.Horstmann, 11th Edition, Pearson Education , 2018.
3. Herbert Schildt - Java: The Complete Reference, Eleventh Edition McGraw Hill Education, 2018.

(Para IV).

REFERENCE BOOKS

1. Effective Java, Joshua Bloch, Third Edition, Addison-Wesley Publications, 2018.
2. Herbert Schildt - Java: A Beginner's Guide, 8th Edition, McGraw Hill Education, 2018.
3. Core and Advanced Java, Black Book. Dreamtech Press, 2018.
4. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1				**M**					
CO2				**M**		**L**			
CO3	**M**			**M**		**L**			
CO4	**M**			**M**		**L**			
CO5	**M**			**M**		**L**			

21MDS25 - COMPUTING LABORATORY II

Contact Hours

L	T	P	C
0	0	4	2

PRE-REQUISITES

21MDS21, 21MDS22

ASSESSMENT: PRACTICALS

COURSE OUTCOMES

- *Solve problems using R*
- *Understand properties of probability distributions and to perform statistical tests using MS-Excel, R*
- *Perform numerical methods using command in R*
- *Perform Hypothesis testing using MS-Excel and commands in R*

1. Basic commands in R for matrix operations, plotting of functions data storage and retrieval
2. Developing script files in R
3. Probability Distributions using MS-Excel and R
   Using functions in MS-Excel and R to calculate the probabilities and inverse probabilities and cumulative distribution functions for
   i) Binomial, Poisson, Normal,
   ii) Geometric, Negative Binomial and Hypergeometric distributions
   iii) exponential, gamma, beta and
   iv) normal and lognormal distributions
   v) t, F, Chi-square distributions
4. **Hypothesis testing Using MS-Excel's Data Analysis Pack and R**
   i) Testing Single mean, difference between two means large samples- Z test
   ii) Testing Single mean, difference between two means small samples- t- test
   iii) Single proportion, Difference between two proportions
   iv) Chi-square for i) goodness of fit and ii) independence of attributes
   v) Equality of Variances
5. **Numerical methods using R**
   i) Numerical differentiation:
   ii) Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule
   iii) Curve fitting: Linear, quadratic, polynomial and exponential
   iv) Numerical solution of ordinary differential equations using Runge-Kutta 4^{th} order method

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	M					
CO2	M	H	H	M					
CO3	H	M	L	L					

21MDS26 - DATA STRUCTURES AND ALGORITHMS LABORATORY I

Contact Hours

L	T	P	C
0	0	4	2

PRE-REQUISITES

21MDS17, 21MDS23

ASSESSMENT: PRACTICALS

COURSE OUTCOMES

- *Selection and application of suitable data structures in implementing practical problems.*
- *Demonstrate the abstract properties of various data structures such as stacks, queues and linked list.*
- *Trace and code recursive methods and compare with iterative methods*
- *Apply sorting algorithms that suit the given problem statement.*
- *Demonstrate understanding of linear and binary search algorithms*

APPLICATIONS OF THE FOLLOWING DATA STRUCTURE CONSTRUCTS

1. Sparse and dense Matrix operations using arrays.
2. Stacks using array representation.
3. Evaluate a given postfix expression using stacks.
4. Conversion of infix expression to postfix expression and evaluation.
5. Queues, circular queue and double ended queue using array representation.
6. Linked Lists: Singly linked, doubly linked and Circular lists and applications.
7. Linked Stacks.
8. Linked Queues.
9. Expression Processing.
10. Sorting algorithms-Insertion sort, Merge sort, Quick sort, Heap sort, Radixsort.
11. Searching algorithms-Linear search, Binary search.

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**H**	**M**	**H**	**H**					
CO2	**M**	**H**	**M**	**M**					
CO3		**H**	**M**						
CO4			**M**	**M**					
CO5	**L**	**M**							

21MDS27 – OBJECT ORIENTED PROGRAMMING LABORATORY

Contact Hours

L	T	P	C
0	0	4	2

PRE-REQUISITES

21MDS24

ASSESSMENT : PRACTICALS

COURSE OUTCOMES

- *Given software requirements, design an object oriented software solution by discovering appropriate classes and objects and identifying attributes, behaviour and hierarchy among the classes.*
- *Write java programs by employing the object oriented constructs of inheritance and polymorphism for a given software requirement*
- *For a given software solution, organize the application programs into packages and prepare a deployable application*
- *Generate robust java applications for a given user requirements by employing applicable object oriented concepts and handling all possible exceptions*
- *Design and develop interactive three tier applications using Servlets, JSP and JDBC for the given user specifications*

CONCEPTS TO BE COVERED

1. Design use case models and class models using UML notations
2. Creating Classes and Objects using different types of functions
3. Programs using Constructor and Destructor
4. Count the number of objects created for a class using static member function
5. Write programs using Inheritance
6. Write programs to implement Polymorphism
7. Create programs to implement Runtime Polymorphism using Abstract Class and Interface
8. Develop programs for the given scenario using Packages and implement suitable Exception handling mechanisms.
9. Devise problems to implement Multithreading concepts
10. Write programs to choose and implement appropriate Collections for the given scenario
11. Develop a web application using JSP as front end, servlets as controllers and connect it with a database using JDBC connectivity.

Course Outcomes(CO)	Programme Outcomes (PO)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	M					L			
CO2	M					L			
CO3	M					L			
CO4	M,					L			
CO5	M					L			

21MDS28 – EMPLOYABILITY SKILLS

L	T	P	C
0	0	2	1

PRE-REQUISITES
Consent of the Instructor

COURSE OUTCOMES

- *Solve timed objective question on logical reasoning and verbal ability.*
- *Generate ideas and speak confidently, for a given specific speaking task on topics like describing a picture, movie reviews, storytelling, and extempore.*
- *Use appropriate functional expressions, for a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions.*
- *Produce language structures accurately and fluently, for a given 2 to5 minutes speaking activity like extempore and Debate. Prepare a power point presentation for 15 minutes, for a given technical topic.*
- *Specify appropriate responses and construct a summary for given short conversations and monologues for listening. Construct dialogues for a given social scenario, interpret the given graphic information and write creative paragraphs.*

UNIT – 1

Self Introduction - Barriers to Speaking and Listening - Introduction to Spoken English, Greetings, Thanking - Apologizing, Congratulating - Giving Directions, Shopping – Role Play. (6)

UNIT – II

Activity based on newspaper articles - Word Building - A picture and a few words activity - Current Events. (4)

UNIT – III

Alphabet test – Alphabet Order, Alphabet Series - Letter Word Problem, Word Formation and Scramble - Series Completion –Para Jumbles- Synonyms and Antonyms- Types and Exercises- Sentence Completion –Types and Exercises. (8)

UNIT – IV

Reading Comprehension- Skimming and Scanning - Reading Prose – Bacon's Essays (Speaking Activity based on the essays) - Story Building- Extempore - Movie Reviews. (4)

UNIT – V

Speech Sounds - Word Vocabulary - Reading Comprehension - Listening Practice- I -Dialogue

Writing - Conversational Exercise – I - Focus on Language - Creative Writing - Conversational Exercise – II - Listening Practice – II. (8)

TOTAL : 30

Course Outcomes(CO)	**Programme Outcomes (PO)**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1					**H**				
CO2					**H**	**L**			
CO3					**H**	**M**			
CO4					**H**	**M**			
CO5					**H**				**L**

Year- 4 (2020-21)			
Sl.No	**Name of the programme**	**Name of the Course**	**Course Code**
Civil Engineering			
1	BE Civil Engineering	Calculus and Differential Equations	19FYM13
2	BE Civil Engineering	Physics for Communication Engineers	19FYP14
3	BE Civil Engineering	Electrical Engineering and Instrumentation	19EC11
4	BE Civil Engineering	Digital Electronics	19EC31
5	BE Civil Engineering	Analog Electronics	19EC32
6	BE Civil Engineering	Computer Architecture and Organization	19EC34
7	BE Civil Engineering	Communication Skills for Engineers – I	19HOC31
Electrical and Electronics Engineering			
8	B.E.Electrical and Electronics Engineering	Communication skills for engineers I	19HOC31
9	B.E.Electrical and Electronics Engineering	Communication skills for engineers II	19HOC41
Electronics and Communication Engineering			
10	B.E.Electronics and Communication Engineering	Basics of Python	19ECOC01
Information Technology			
11	B.Tech Information Technology	R Programming	19CIOC02
12	B.Tech Information Technology	Open-Source Tools for Network Analysis	19CIOC06
13	B.Tech Information Technology	Aptitude Training	19ITOC01

Sl.No	Name of the programme	Name of the Course	Course Code
14	B.Tech Information Technology	Data Visualization Tools	19ITOC02
15	B.Tech Information Technology	Data Science Tools	19ITOC03
16	B.Tech Information Technology	Cloud Computing Applications	19ITOC04
17	B.Tech Information Technology	Software Testing Tool	19ITOC06
Chemical Engineering			
18	B.Tech. Chemical Engineering	Computer Laboratory (Programming for Problem Solving)	19CHL36
19	B.Tech. Chemical Engineering	Communication Skills for Engineers-I	19HOC31
20	B.Tech. Chemical Engineering	Biology for Chemical Engineers	19CH41
21	B.Tech. Chemical Engineering	Communication Skills for Engineers-II	19HOC41
Sotware Systems			
22	MSC Sotware Systems	Structured Systems Analysis and Design	20MSS13
23	MSC Sotware Systems	Probability and Statistics – II	20MSS32
24	MSC Sotware Systems	Blockchain Technologies Laboratory	20MSSL03
25	MSC Sotware Systems	Virtual and Augmented Reality Laboratory	20MSSL13
26	MSC Sotware Systems	Information Retrieval	20MSSE06
Decision and Computing Sciences			
27	MSc Decision and Computing Sciences	Advanced Data Structures Laboratory	17MDCEL3
Master of Computer Applications			
28	Master of Computer Applications	Mathematical Foundations of Computer Applications	20MCA11

Sl.No	Name of the programme	Name of the Course	Course Code
29	Master of Computer Applications	Data Structures and Algorithms	20MCA12
30	Master of Computer Applications	Operating System Principles	20MCA14
31	Master of Computer Applications	Data Structures Laboratory	20MCA16
32	Master of Computer Applications	Database Management Systems Laboratory	20MCA17
33	Master of Computer Applications	Advanced Java Programming	20MCA22
34	Master of Computer Applications	Virtualization and Cloud Computing	20MCA23
35	Master of Computer Applications	Advanced Programming Laboratory	20MCA26
36	Master of Computer Applications	Professional English	20MCA27
37	Master of Computer Applications	Mini Project	20MCA28
38	Master of Computer Applications	Cryptography and Network Security	20MCA31
39	Master of Computer Applications	Cryptography and Network Security Laboratory	20MCA33
40	Master of Computer Applications	Machine Learning Laboratory 0 0 4 2 FC	20MCA34
41	Master of Computer Applications	Inplant Training	20MCAIT01
42	Master of Computer Applications	Project work and viva voce	20MCA41
43	Master of Computer Applications	Recent Trends in Web Technology	20MCAOC01
44	Master of Computer Applications	Basics of Data Structures	20MCAB11
45	Master of Computer Applications	Programming in C	20MCAB12
46	Master of Computer Applications	Computer Hardware and Organization	20MCAB13
47	Master of Computer Applications	Basics of Internet	20MCAB21

Sl.No	Name of the programme	Name of the Course	Course Code
48	Master of Computer Applications	Object Oriented Programming in C++	20MCAB23
49	Master of Computer Applications	Graphics and Multimedia	20MCAE101
50	Master of Computer Applications	Advanced Database Management Systems	20MCAE102
51	Master of Computer Applications	Distributed Systems	20MCAE103
52	Master of Computer Applications	Grid and Cluster Computing 3 0 0 3 PE	20MCAE104
53	Master of Computer Applications	Software Metrics and Measurement	20MCAE106
54	Master of Computer Applications	Agile Methods for Software Development	20MCAE107
55	Master of Computer Applications	Software Architecture and Design Patterns	20MCAE108
56	Master of Computer Applications	Data Analytics	20MCAE201
57	Master of Computer Applications	Intelligent Information Retrieval	20MCAE202
58	Master of Computer Applications	Big Data Technologies	20MCAE203
59	Master of Computer Applications	Internetworking Protocols and Management	20MCAE302
60	Master of Computer Applications	Mobile Computing	20MCAE303
61	Master of Computer Applications	Organizational Behaviour	20MCAE401
62	Master of Computer Applications	Principles of Management	20MCAE402
63	Master of Computer Applications	Accounting and Financial Management	20MCAE403
64	Master of Computer Applications	E-Commerce	20MCAE404
65	Master of Computer Applications	Decision Making	20MCAE405

Sl.No	Name of the programme	Name of the Course	Course Code
66	Master of Computer Applications	Entrepreneurship Development	20MCAE406
67	Master of Computer Applications	Principles of Environmental Science	20MCAE407
68	Master of Computer Applications	Mobile Application Development Laboratory	20MCAEL01
69	Master of Computer Applications	Graphics and Multimedia Laboratory	20MCAEL02
70	Master of Computer Applications	Internet of Things Laboratory	20MCAEL03
71	Master of Computer Applications	Data Analytics Laboratory	20MCAEL04
72	Master of Computer Applications	Data Mining Laboratory	20MCAEL05
Artificial Intelligence & Machine Learning			
73	M.Sc. (Artificial Intelligence & Machine Learning)	Artificial Intelligence	19MAM31
74	M.Sc. (Artificial Intelligence & Machine Learning)	Theory of Computing	19MAM32
75	M.Sc. (Artificial Intelligence & Machine Learning)	Predictive Analytics	19MAM34
76	M.Sc. (Artificial Intelligence & Machine Learning)	Human Computer Interaction	19MAM35
77	M.Sc. (Artificial Intelligence & Machine Learning)	Artificial Intelligence Lab	19MAM36
78	M.Sc. (Artificial Intelligence & Machine Learning)	Database Management Systems Lab	19MAM37
80	M.Sc. (Artificial Intelligence & Machine Learning)	Predictive Analytics Lab	19MAM38
81	M.Sc. (Artificial Intelligence & Machine Learning)	Operations Research	19MAM41
82	M.Sc. (Artificial Intelligence & Machine Learning)	Machine Learning	19MAM42
83	M.Sc. (Artificial Intelligence & Machine Learning)	Data Communications and Networking	19MAM44
84	M.Sc. (Artificial Intelligence & Machine Learning)	Operating Systems	19MAM45
85	M.Sc. (Artificial Intelligence & Machine Learning)	Machine Learning Lab	19MAM46

Sl.No	Name of the programme	Name of the Course	Course Code
86	M.Sc. (Artificial Intelligence & Machine Learning)	Design and Analysis of Algorithms Lab	19MAM47
87	M.Sc. (Artificial Intelligence & Machine Learning)	Network Programming Lab	19MAM48
88	M.Sc. (Artificial Intelligence & Machine Learning)	Econometrics and Machine Learning in Finance	19MAMOC01

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University)

DEPARTMENT OF CIVIL ENGINEERING

B.E. CIVIL ENGINEERING-FULL TIME

(III TO VIII SEMESTER)

Curriculum from the Academic Year 2019 - 2020 and onwards

SUBJECTS OF STUDY

Semester III

Course Code	Course Name	L	T	P	C	Category
19CEM31	Differential Equations and Boundary Value Problems	3	1	0	4	BSC
19CE31	Mechanics of Solids	3	1	0	4	ES
19CE32	Engineering Geology	3	0	0	3	PC
19CE33	Mechanics of Fluids	3	0	0	3	PC
19CE34	Surveying	3	0	0	3	PC
19CE35	Water Supply Engineering	3	0	0	3	PC
19HSS01	Science of Creativity and Professional Ethics	1	0	0	1	HSC
19CEL36	Strength of Materials Laboratory	0	0	2	1	PC
19CEL37	Survey Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19HOC31	**Communication Skills for Engineers I***	**0**	**0**	**2**	**1**	**EEC**
	TOTAL CREDITS				**25**	

Semester IV

Course Code	Course Name	L	T	P	C	Category
19CE41	Construction Technology	3	0	0	3	PC
19CE42	Strength of Materials	3	1	0	4	PC
19CE43	Transportation Engineering	3	0	0	3	PC
19CE44	Applied Hydraulics and Hydraulic Machinery	3	0	0	3	PC
19CE45	Waste Water Engineering	3	0	0	3	PC
19CE46	Professional Practices and Ethics	3	0	0	3	BSC
19CEL47	Hydraulics Laboratory	0	0	2	1	PC
19CEL48	Environmental Engineering Laboratory	0	0	2	1	PC
	One Credit Course	1	0	0	1	EEC
19HOC41	**Communication Skills for Engineers II***	**0**	**0**	**2**	**1**	**EEC**
	TOTAL CREDITS				**23**	
	* Not to be counted for GPA. Pass is required					

19ECOC01 - BASICS OF PYTHON

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 *: Explain basic concepts and illustrate data types, operators, and I/O functions for writing Python Programming*

CO2 *: Write Python programs using conditional statements and list and interpret results*

INTRODUCTION

Conceptual introduction, topics in computer science, algorithms,modern computer systems, hardware architecture, data representation in computers, software and operating system,installing Python: basic syntax, interactive shell, editing, saving, and running a script,The concept of data types; variables, assignments, immutable variables,numerical types, arithmetic operators and expressions, comments in the program, understanding error messages. **(7)**

CONTROL STATEMENTS AND LIST

Conditions, boolean logic, logical operators, ranges Control statements: if-else, loops (for, while) String manipulations: subscript operator, indexing, slicing a stringstrings and number system: converting strings to numbers and vice versa , Binary, octal, hexadecimal numbersLists, tuples, and dictionaries basic list operators, replacing, inserting, removing an element- searching and sorting lists Dictionary literals, adding and removing keys, accessing and replacing values-Traversing dictionaries-Case Study. **(8)**

TOTAL : 15

TEXT BOOK

Fundamentals of Python, First Programs Author, Kenneth Lambert Publisher, Course Technology, Cengage Learning, 2012 ISBN-13: 978-1-111-82270-5.

EEC COURSES

19HOC31 - COMMUNICATION SKILLS FOR ENGINEERS - I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Gain confidence, enhance Personality and develop positive attitude in their work and life.*

CO2 *: Effectively communicate and present opinions using appropriate functional expressions for a given situation*

CO3 *: Compose Emails, Reports for a given business scenario using appropriate sentence construction and in the prescribed format.*

CO4 *: Generate ideas and speak on a given topic in a competitive scenario like Debate, Group Discussion, and Public Speaking.*

PERSONALITY DEVELOPMENT

Motivation and Self Confidence, SCOT Analysis - Personality Development - What is Personality, Developing Positive Attitude towards work and life, Building Relationship with others - Personality Development - Paradigms of Human Interaction, Fear Management. **4**

VERBAL COMMUNICATION

English Conversation - Asking and Giving Opinions - English Conversation -Thanking People, Asking and Giving Suggestions - English Conversation - Asking for Direction, Agreeing and Disagreeing - Role Play-Business. **5**

BUSINESS COMMUNICATION

Email Writing - Format, Etiquettes and Tips - Report Writing -Introduction, elements and tips - Drafting a report - Error Identification - Rules, Common Mistakes and Exercises - Sentence Completion Filler (fill in the blanks using apt words). **5**

PUBLIC SPEAKING

How to start and sustain a conversation - Debate - Extempore - Group Discussion - Importance and Process - Public Speaking - Introduction, Tips - Drafting a Public Speech - Interview - Types, Dos and Don'ts - Mock Press. **6**

TOTAL : 20

REFERENCES

1. *https://nptel.ac.in/content/storage2/courses/109104030/references/references.pdf (online resource)*
2. *John Seelay, Oxford Guide to Effective Writing and Speaking, 2nd Edition, Kindle Edition by Oxford University Press, 2007.*
3. *Sabina Pillai, Agna Fernandez, Soft Skills and Employability Skills -Published by Cambridge University Press, 2017.*

19HOC41 - COMMUNICATION SKILLS FOR ENGINEERS - II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 *: Solve objective questions on analogy, Statement and Argument, Statement and Conclusion, Data Sufficiency and Sentence improvement within a given time.*

CO2 *: Construct grammatically correct sentences*

CO3 *: Speak confidently to describe a process, present information on the specified topic and disseminate information in a professional manner.*

SELF EVALUATION

Self believe and self Esteem - Activities based on Current Events **2**

VERBAL AND LOGICAL RESONING

Analogy - Introduction, Types and Exercises - Statement and Argument - Statement and Conclusion - Data Sufficiency - Sentence Improvement - Critical Reasoning/Theme Detection **5**

GRAMMAR

Basic Grammar- Subject Verb Agreement - One word substitute - Preposition- Cause and Effect -Basic level questions and Moderate level questions **4**

PRESENTATION TECHNIQUES

Describing a Process - Presentation Skills - Introduction, Planning and Preparation - Presentation on a Topic - Group Discussion - Dos and Don'ts - Functional Expressions used in Group Discussion - Interview Skills - Ideal Grooming for an interview, Preparing for the Interview. **9**

TOTAL : 20

REFERENCES

1. *Sanjay Kumar, PushpLata, Communication Skills 2nd Edition, published by Oxford University Press, New Delhi, India, 2015.*
2. *Anthony Manning, Chris Sowton and Craig Thaine, Cambridge Academic English, published by Cambridge University Press, U P, India, 2012.*

BASIC SCIENCE COURSES (BSC)

Course Code	Course Name	L	T	P	C	Semester
19FYM14	Matrices and Calculus	3	1	0	4	I
19FYP13	Engineering Physics	3	0	0	3	I
19FYC11	Engineering Chemistry	3	0	0	3	I
19PL11	Physics Laboratory-I	0	0	2	0.5	I
19CL11	Chemistry Laboratory-I	0	0	2	0.5	I
19MEL12	Engineering Practices Laboratory	0	0	2	1	I
19FYM24	Fourier Series and Partial Differential Equation	3	1	0	4	II
19PL21	Physics Laboratory-II	0	0	2	0.5	II
19CL21	Chemistry Laboratory-II	0	0	2	0.5	II
19CIM31	Linear Algebra, Complex Variables and Transform Techniques	3	1	0	4	III

ENGINEERING SCIENCE COURSES (ESC)

Course Code	Course Name	L	T	P	C	Semester
19CSL12	Python Programming	1	0	4	3	I
19FYP24	Introduction to Electronic Devices	3	0	0	3	II
19CS21	C Programming	3	1	0	4	II
19CSL11	C Programming Laboratory	0	0	4	2	II
19MEL11	Engineering Graphics	1	0	4	3	II
19CI32	Digital Design	3	0	0	3	III
19CIL34	Digital Design Laboratory	0	0	3	1.5	III

PROFESSIONAL CORE COURSES (PCC)

Course Code	Course Name	L	T	P	C	Semester
19CI31	Data Structures and Algorithms - I	3	1	0	4	III
19CS31	Discrete Mathematics	2	0	0	2	III
19CI33	Object Oriented Programming and Java	3	0	0	3	III
19CIL35	Object Oriented Programming Laboratory	0	0	3	1.5	III
19CI41	Data Structures and Algorithms- II	3	0	0	3	IV
19CI42	Database Management Systems	3	0	0	3	IV
19CI43	Computer Architecture	3	0	0	3	IV
19CI44	Operating Systems	3	0	0	3	IV
19CI45	Software Engineering	2	1	0	3	IV
19CS41	Formal Languages and Automata Theory	2	0	0	2	IV
19CIL46	Database Management Systems Laboratory	0	0	3	1.5	IV
19CIL47	Data Structures and Algorithms Laboratory	0	0	3	1.5	IV
19CI51	Computer Networks	3	0	0	3	V

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Course Code	Course Name	L	T	P	C	Semester
19FYEL11	Employability Skills	0	0	2	1	I
19FYEL21	English for Employability	0	0	2	1	II
19HOC31	Communication Skills for Engineers - I	1	0	0	1	III
19HOC41	Communication Skills for Engineers -II	1	0	0	1	IV
19HOC51	Employability and Personality Development Skills-I	0	0	2	1	V
19IT65	Mini Project	0	0	3	-	V
19INT51	Internship-I	0	0	0	1	V
19IT65	Mini Project	0	0	3	3	VI
19HOC61	Employability and Personality Development Skills-II	0	0	2	1	VI
19INT61	Internship-II	0	0	0	1	VI
19IT75	Project Phase-I	0	0	6	3	VII
19IT81	Project Phase-II	0	0	10	5	VIII

ONE CREDIT COURSES (OCC)

1. DEPARTMENT BASED

Course Code	Course Name	L	T	P	C
19CIOC01	C++ Programming	0	0	2	1
19CIOC02	R Programming	0	0	2	1
19CIOC03	Applications of Probability	0	0	2	1
19CIOC04	User Interface Design	0	0	2	1
19CIOC05	Open-Source Tools for Network Analysis	0	0	2	1
19CIOC06	Comprehensive Exam Training	0	0	2	1
19ITOC01	Aptitude Training	0	0	2	1

2. INDUSTRY BASED

Course Code	Course Name	L	T	P	C
19ITOC02	Data Visualization Tools	0	0	2	1
19ITOC03	Data Science Tools	0	0	2	1
19ITOC04	Cloud Computing Applications	0	0	2	1
19ITOC05	Agile Software Development	0	0	2	1
19ITOC06	Software Testing Tool	0	0	2	1

3. NPTEL Offered (4 weeks courses not part of the curriculum)

4. Institute Based

19CIOC01 - C++ PROGRAMMING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Be able to explain the difference between object-oriented programming and procedural programming.*

CO2 *: Be able to program using C++ features such as objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, exception handling, etc.*

CO3 *: Be able to build C++ classes using appropriate encapsulation and design principles.*

TOPICS TO BE COVERED

C++ Overview - Classes and Encapsulation- Member Functions- Instantiating and Using Classes- Constructors and Destructors- Overview of Inheritance- Defining Base and Derived Classes-Types of Inheritance-Overview of Polymorphism and Abstract Classes-Exceptions- Inheritance and Exceptions- Exception Hierarchies.

REFERENCES

1. *E.Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 7th Edition, 2018.*
2. *Bjarne Stroustrup, "The C++ Programming Language", Addison Wesly , 4th Edition, 2013.*

19CIOC02 - R PROGRAMMING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To explore and understand the usage of R Libraries.*

CO2 *: To understand and use Data Frames, Statistical Methods and Data Visualization.*

INTRODUCTION

Introducing to R - R Data Structures - Help functions in R - Vectors - Scalars - Declarations - recycling - Common Vector operations - Using all and any - Vectorized operations - NA and NULL values - Filtering - Vectorised if-then else - Vector Equality - Vector Element

MATRICES, ARRAYS AND LISTS

Creating matrices - Matrix operations - Applying Functions to Matrix Rows and Columns - Adding and deleting rows and columns - Vector/Matrix Distinction - Avoiding Dimension Reduction - Higher Dimensional arrays - lists - Creating lists - General list operations - Accessing list components and values - applying functions to lists - recursive lists.

DATA FRAMES

Creating Data Frames - Matrix-like operations in frames - Merging Data Frames - Applying functions to Data frames - Factors and Tables - factors and levels - Common functions used with factors - Working with tables - Other factors and table related functions - Control statements - Arithmetic and Boolean operators and values - Default values for arguments - Returning Boolean values - functions are objects - Environment and Scope issues - Writing Upstairs - Recursion - Replacement functions - Tools for composing function code - Math and Simulations in R.

STATISTICAL GRAPHS

Box Plot, Histograms, Scatter Plotter, Line chart, Bar Chart, Heat maps, Histograms.

DATA EXPLORATION AND VISUALIZATION

Using the ggplot2 package to visualize data -Applying themes from ggthemes to refine and customize charts and graphs - Building data graphics for dynamic reporting.

REFERENCES

1. *Hadley Wickham and Garrett Grolemund, "R for Data Science", O'Reilly, 2017.*
2. *Tilman M. Davies, "The Book of R : A first cover in Programming and Statistics", No Starch Press, 2016.*

19CIOC03 - APPLICATIONS OF PROBABILITY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To understand the generic structure of probabilistic models and their basic properties.*

CO2 *: Ability to understand and apply the discrete random variables to model real world problems and analyze their characteristics.*

CO3 *: To gain an understanding of the continuous random variables and the application of it to model real world problems.*

CO4 *: Ability to quantify the relationship between two random variables using covariance and correlation.*

SAMPLE SPACE AND PROBABILITY

Sets: Set Operations - The Algebra of Sets - Probabilistic Models: Sample Spaces and Events - Sequential Models - Probability Laws - Discrete Models - Continuous Models - Conditional Probability - Total Probability Theorem and Bayes' Rule - Independence - Counting - Case study.

DISCRETE RANDOM VARIABLES

Basic Concepts - Probability Mass Functions: The Bernoulli Random Variable - The Binomial Random Variable - The Geometric Random variable - The Poisson Random Variable - Functions of Random Variables - Expectation, Mean and Variance - Case study.

GENERAL RANDOM VARIABLES

Continuous Random Variables and Probability Density Functions (PDF): Exponential Random Variable - Cumulative Distribution Functions (CDF): The Geometric and Exponential CDFs - Normal Random Variables - The Continuous Bayes' Rule - COVARIANCE AND CORRELATION - Case study.

REFERENCES

1. *Dimitri P. Bertsekas and John N. Tsitsiklis, "Introduction to Probability", Athena Scientific, Second Edition, 2008. ISBN: 978-1886529236.*
2. *Veerarajan T, "Probability Statistics and Random Process," McGraw Hill Education, Third Edition, 2017. ISBN: 978-007066925.*
3. *Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, "An Introduction to Probability and Statistics", Wiley India, Second Edition, 2008. ISBN: 978-8126519262.*

19CIOC04 - USER INTERFACE DESIGN

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

The Students should be able to:

CO1 *: Design the User Interface for mobile and Web Applications*

CO2 *: Create the visual elements and define Interactivity to the UI elements*

CO3 *: Add movement between screens*

INTRODUCTION

The User Interface-Introduction, Overview, The importance of user interface - The importance of Good design, Characteristics of graphical and web user interfaces-wireframing.

TOOLS FOR UI DESIGN

Wireframing Tools- Adobe XD -Figma- Pencil Project -Invisionstudio.

REFERENCES

1. *Wilbert O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition 2002*
2. *Web References - Open Source Tools for UI Design*

19CIOC05 - OPEN-SOURCE TOOLS FOR NETWORK ANALYSIS

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To understand the working principle of Network analysis tools.*

CO2 *: Analyze packet /file transmission between networks using Wireshark, Nmap and Cisco tools.*

TOPICS TO BE COVERED

Wireshark- Introduction to Wireshark- Features of Wireshark- Packet Capture and Protocol Analysis- IP Address, TCP/UDP Port Filters- Packet Sniffing Usernames, Passwords, and Web Pages

Nmap- Nmap Introduction and Installation- Scanning Techniques- Discovery Options

Cisco Packet Tracer- Introduction and Installation- packet tracing on switches and Routers

CASE STUDY

1. Layer 2- packet Analysis
2. Discovering Packet based attacks
3. Identifying the packet data and assign dynamic IP in Switches and Routers.

19CIOC06 - COMPREHENSIVE EXAM TRAINING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To prepare and equip the students for various competitive exams*

CO2 *: To relearn and refresh the core concepts in the domains like Data Structures, Digital Design, Database Management Systems, Programming, Computer Architecture, Operating Systems and Automata Theory.*

C PROGRAMMING

Programming in C, Recursion, Arrays, Structures and Pointers.

DATA STRUCTURES AND ALGORITHMS

Linked Lists, Stacks, Queues, Trees, Graphs, Sorting and Searching.

DIGITAL DESIGN

Boolean algebra, Combinational and Sequential circuits, Minimization, Number representations, Fixed and floating point computer arithmetic.

DATABASE MANAGEMENT SYSTEMS

ER-model, Relational model: relational algebra, tuple calculus, SQL, Integrity constraints, Normal forms, B+ tree indexing, Transactions and concurrency control.

COMPUTER ARCHITECTURE

Machine instructions and Addressing modes, ALU, Data-path and Control unit, Instruction pipelining, Pipeline hazards, Memory hierarchy: cache, main memory and secondary storage, I/O interface: interrupt and DMA mode.

OPERATING SYSTEMS

System calls, Processes, Threads, Deadlock, CPU and Disk scheduling, Memory management and Vrtual memory.

FORMAL LANGUAGES AND AUTOMATA THEORY

Regular Expressions and Finite Automata, Context-Free Grammars and Push-Down Automata, Contex-Free Languages, Pumping lemma, Turing machines.

19ITOC01 - APTITUDE TRAINING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO 1 *: To enhance problem solving skills on quantitative aptitude*

CO 2 *: Understand and practice logical reasoning*

CO 3 *: Practice problems based on reasoning ability*

QUANTITATIVE APTITUDE

Number System- Average- Partnership- Permutation And Combination- Problem On Ages- Probability- Time And Work- Time, Speed and Distance- Pipes And Cistern- Ratio And Proportion- Percentage Block-Train-Profit and Loss-Simple and Compound Interest

LOGICAL REASONING

Puzzles- Blood Relation- Sequence & Series- Direction Sense- Statement & Conclusion-Seating Arrangement-Data sufficiency -Einstein Riddles

REASONING ABILITY

Figural and Factual Analysis-Coding-decoding-Statements Based Logical Questions-Questions on Word Pattern-Letter Series related Questions-Data interpretation: Tabulation -Bar Graphs -Pie Chart -Line Graphs

19HOC31 - COMMUNICATION SKILLS FOR ENGINEERS - I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Gain confidence, enhance Personality and develop positive attitude in their work and life.*

CO2 *: Effectively communicate and present opinions using appropriate functional expressions for a given situation.*

CO3 *: Compose Emails, Reports for a given business scenario using appropriate sentence construction and in the prescribed format.*

CO4 *: Generate ideas and speak on a given topic in a competitive scenario like Debate, Group Discussion, and Public Speaking.*

PERSONALITY DEVELOPMENT

Motivation and Self Confidence, SCOT Analysis - Personality Development - What is Personality, Developing Positive Attitude towards work and life, Building Relationship with others - Personality Development - Paradigms of Human Interaction, Fear Management. **(4)**

VERBAL COMMUNICATION

English Conversation - Asking and Giving Opinions - English Conversation -Thanking People, Asking and Giving Suggestions - English Conversation - Asking for Direction, Agreeing and Disagreeing - Role Play-Business. **(5)**

BUSINESS COMMUNICATION

Email Writing - Format, Etiquettes and Tips - Report Writing -Introduction, elements and tips - Drafting a report - Error Identification - Rules, Common Mistakes and Exercises - Sentence Completion Filler (fill in the blanks using apt words). **(5)**

PUBLIC SPEAKING

How to start and sustain a conversation - Debate - Extempore - Group Discussion - Importance and Process - Public Speaking - Introduction, Tips - Drafting a Public Speech - Interview - Types, Dos and Don'ts - Mock Press. **(6)**

TOTAL : 20

REFERENCES

1. *https://nptel.ac.in/content/storage2/courses/109104030/references/references.pdf (online resource)*
2. *John Seelay, Oxford Guide to Effective Writing and Speaking, 2nd Edition, Kindle Edition by Oxford University Press, 2007.*
3. *Sabina Pillai, Agna Fernandez, Soft Skills and Employability Skills - Published by Cambridge University Press, 2017.*

19HOC41 - COMMUNICATION SKILLS FOR ENGINEERS - II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Solve objective questions on analogy, Statement and Argument, Statement and Conclusion, Data Sufficiency and Sentence improvement within a given time.*

CO2 *: Construct grammatically correct sentences.*

CO3 *: Speak confidently to describe a process, present information on the specified topic and disseminate information in a* professional manner.

SELF EVALUATION

Self belief and self Esteem - Activities based on Current Events **(2)**

VERBAL AND LOGICAL REASONING

Analogy - Introduction, Types and Exercises - Statement and Argument - Statement and Conclusion - Data Sufficiency - Sentence Improvement - Critical Reasoning / Theme Detection **(5)**

GRAMMAR

Basic Grammar- Subject Verb Agreement - One word substitute - Preposition- Cause and Effect - Basic level questions and Moderate level questions. **(4)**

PRESENTATION TECHNIQUES

Describing a Process - Presentation Skills - Introduction, Planning and Preparation - Presentation on a Topic - Group Discussion - Dos and Don'ts - Functional Expressions used in Group Discussion - Interview Skills - Ideal Grooming for an interview, Preparing for the Interview **(9)**

TOTAL : 20

REFERENCES

1. *Sanjay Kumar, Pushp Lata, Communication Skills Second Edition, published by Oxford University Press, New Delhi, India, 2015.*
2. *Anthony Manning, Chris Sowton and Craig Thaine, Cambridge Academic English, published by Cambridge University Press, U P, India, 2012.*

19CHL36 - COMPUTERS LABORATROY
(PROGRAMMING FOR PROBLEM SOLVING)

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, students will be able to

CO1 *: Describe the basics of C Programming and understand the problem-solving aspect*

CO2 *: To write algorithms and to draw flowcharts for solving problems*

CO3 *: Develop C programs with simple expressions for problem solving*

CO4 *: Use arrays, pointers, strings and structures to formulate algorithms and programs*

CO5 *: Design and develop solutions to real world problems using C.*

LIST OF EXPERIMENTS

Write a C-Program using

1. Operators and expressions
2. Decision Statements
3. Switch operations
4. Basic Loop operations
5. Advanced loops
6. Array
7. Functions
8. Structure

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Cos	Program Outcomes/Program Specific Outcomes (Pos/PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3												1
CO3	3													
CO4														
CO5		3			2									

(1: Slight, 2: Moderate 3: Substantial)

19HOC31 - COMMUNICATION SKILLS FOR ENGINEERS - I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Gain confidence, enhance Personality and develop positive attitude in their work and life.*

CO2 *: Effectively communicate and present opinions using appropriate functional expressions for a given situation.*

CO3 *: Compose Emails, Reports for a given business scenario using appropriate sentence construction and in the prescribed format.*

CO4 *: Generate ideas and speak on a given topic in a competitive scenario like Debate, Group Discussion, and Public Speaking.*

PERSONALITY DEVELOPMENT

Motivation and Self Confidence, SCOT Analysis - Personality Development - What is Personality, Developing Positive Attitude towards work and life, Building Relationship with others - Personality Development - Paradigms of Human Interaction, Fear Management. **(4)**

VERBAL COMMUNICATION

English Conversation - Asking and Giving Opinions - English Conversation -Thanking People, Asking and Giving Suggestions - English Conversation - Asking for Direction, Agreeing and Disagreeing - Role Play-Business. **(5)**

BUSINESS COMMUNICATION

Email Writing - Format, Etiquettes and Tips - Report Writing -Introduction, elements and tips - Drafting a report - Error Identification - Rules, Common Mistakes and Exercises - Sentence Completion Filler (fill in the blanks using apt words). **(5)**

PUBLIC SPEAKING

How to start and sustain a conversation - Debate - Extempore - Group Discussion - Importance and Process - Public Speaking - Introduction, Tips - Drafting a Public Speech - Interview - Types, Dos and Don'ts - Mock Press. **(6)**

REFERENCES

1. *https://nptel.ac.in/content/storage2/courses/109104030/references/references.pdf (online resource)*
2. *John Seelay, Oxford Guide to Effective Writing and Speaking, 2nd Edition, Kindle Edition by Oxford University Press, 2007.*
3. *Sabina Pillai, Agna Fernandez, Soft Skills and Employability Skills - Published by Cambridge University Press, 2017.*

19CH41 - BIOLOGY FOR CHEMICAL ENGINEERS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students will be able to

CO1 *: Gain insight into the various levels of organization of life, their characteristics and basic needs in the ecosystems.*

CO2 *: Explain the major anabolic & catabolic pathways in carbohydrate, protein & lipid metabolism and understand the significance of high energy compounds.*

CO3 *: Understand the various types of genes, their functions and inheritance, analyze the mechanisms involved in protein synthesis and gene regulation.*

CO4 *: Gain knowledge on the structure and functions of basic cell types and their importance in cellular processes, relate the role of lipid bilayer membrane & proteins to transport of molecules and understand communication of cells through signalling pathways.*

CO5 *: Have knowledge on identification of microorganisms, their physiology, diversity, conservation, growth kinetics & culturing methods, understand microbial interactions and infections and strategies to manage them.*

BASICS

Diversity of life - Genetic diversity, Species diversity & Ecosystem diversity. Prokaryotic and Eukaryotic cells – Constituents and organelles present in prokaryotic and eukaryotic cells. Similarities and differences between prokaryotic and eukaryotic cells. Macromolecules present in cells. **(9)**

BIOCHEMISTRY METABOLISM

(Anabolism and Catabolism) Carbohydrate metabolism - Glycolysis and TCA cycle. Lipid metabolism - Beta oxidation of saturated fatty acids. Synthesis of saturated fatty acids. Protein metabolism - General breakdown of proteins - Deamination, Transamination & Urea cycle. Bioenergetics - Electron transport chain and Oxidative phosphorylation. **(9)**

GENETICS AND MOLECULAR BIOLOGY

Mendelian laws of inheritance. Structure and types of DNA and RNA. Basic features of prokaryotic and eukaryotic genome organization. DNA replication - Basic principles and mechanism of DNA replication - k model of DNA replication. Transcription - Synthesis of RNA and Post-transcriptional modifications. Translation - Genetic code - General features of the genetic code. Mechanism of protein synthesis and Post translational modifications. Regulation of gene expression - Operon concept with specific reference to lac operon. **(9)**

CELL BIOLOGY

Cytoskeleton -functions of microfilaments and microtubules. Membrane systems - Structure and organization of biological membranes. Fluid Mosaic Model. Membrane proteins. Transport of molecules across membranes -Transport of small molecules - Passive transport, Active transport (Sodium-Potassium pump) and Facilitated diffusion. Transport of large molecules - exocytosis and endocytosis. Cell division - Mitosis and Meiosis. Signal transduction - Intracellular and Intercellular signalling. Role of cyclic AMP. **(9)**

MICROBIOLOGY

Basics -Broad classification and Characteristics of microorganisms. Types of culture media. Identification of microbes - Simple staining and Differential staining. Growth kinetics and growth curve. Host-Microbe interaction - Major diseases caused by different microbes in plants, animals and humans. Microbial diversity - Conservation of biodiversity - in-situ and ex-situ conservation. Ecology - Types of Ecosystems. Ecological pyramids. Virology - Structure, mode of spread and clinical manifestations of Human Immunodeficiency virus. **(9)**

TOTAL: 45

REFERENCES

1. *Ananthanarayanan and Paniker's (2017). Textbook of Microbiology, 10th edition, Orient Longman Pvt. Ltd.,Hyderabad.*
2. *Verma, P.S. and Agarwal,V.K.(2008). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. 5thedition, New Age International Publishers, New Delhi.*
3. *Karp, G., Iwasa,J. & Marshall, W. (2015). Cell and Molecular Biology-Concepts and Experiments, 8th edition, John Wiley & Sons Inc., New York.*
4. *Murray,K.R., Bender,D.A., Botham,K.M., Kennelly, P.J., Rodwell.W.V. and Weil, P.A. (2018). Harper's Illustrated Biochemistry, 31st edition, The McGraw Hill Companies.*
5. *Nelson,D.L. and Cox, M.M. (2017). Lehninger Principles of Biochemistry, 17th edition, W.H. Freeman and Company, New York.*
6. *Bery, J.M.,Tymoezko,J.L. and Stryer,L. (2015). Biochemistry, 8th edition, W.H.Freeman and Company, NewYork.*

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Cos	Program Outcomes/Program Specific Outcomes (Pos/PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1	1							3	
CO2	2	3	2		1	2							2	
CO3	3	1				1							1	
CO4	2	2	2		1	1							3	1
CO5	1	2	2		1	1							2	1

(1: Slight, 2: Moderate 3: Substantial)

19HOC41 - COMMUNICATION SKILLS FOR ENGINEERS - II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Solve objective questions on analogy, Statement and Argument, Statement and Conclusion, Data Sufficiency and Sentence improvement within a given time.*

CO2 *: Construct grammatically correct sentences.*

CO3 *: Speak confidently to describe a process, present information on the specified topic and disseminate information in a professional manner.*

SELF EVALUATION

Self believe and self Esteem - Activities based on Current Events. **(2)**

VERBAL AND LOGICAL RESONING

Analogy - Introduction, Types and Exercises - Statement and Argument - Statement and Conclusion - Data Sufficiency - Sentence Improvement - Critical Reasoning / Theme Detection **(5)**

GRAMMAR

Basic Grammar- Subject Verb Agreement - One word substitute - Preposition- Cause and Effect - Basic level questions and Moderate level questions. **(4)**

PRESENTATION TECHNIQUES

Describing a Process - Presentation Skills - Introduction, Planning and Preparation - Presentation on a Topic - Group Discussion - Dos and Don'ts - Functional Expressions used in Group Discussion - Interview Skills - Ideal Grooming for an interview, Preparing for the Interview **(9)**

REFERENCES

1. *Sanjay Kumar, Pushp Lata, Communication Skills SECOND EDITION, published by Oxford University Press, New Delhi, India, 2015.*
2. *Anthony Manning, Chris Sowton and Craig Thaine, Cambridge Academic English, published by Cambridge University Press, U P, India, 2012.*

19CH51 - NUMERICAL METHODS IN CHEMICAL ENGINEERING

L	T	P	C
2	1	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of course, students will be able

CO1 *: To solve systems of algebraic equation using various numerical schemes and to develop programming code using MATLAB and EXCEL.*

CO2 *: To Solve nonlinear algebraic equation using open and bracketing type numerical methods*

CO3 *: To practice numerical integration using trapezoidal, Simpsons techniques for chemical problems*

CO4 *: To solve single ODE and Simultaneous ODEs using various numerical schemes.*

CO5 *: To formulate and solve PDEs for real time chemical Engineering Problems.*

NUMERICAL METHODS FOR SINGLE ALGEBRAIC EQUATIONS

Introduction, Root finding methods for solution on non-linear algebraic equations: Bisection, Newton-Raphson and Secant methods, System of Non-linear Equations. Chemical Engineering problems involving solution of non-linear equations **(9)**

NUMERICAL METHODS FOR SIMULTANEOUS ALGEBRAIC EQUATIONS

Methods like Gauss elimination, LU decomposition and matrix inversion, Gauss-Seidel method, Chemical Engineering problems involving solution of linear algebraic equations. **(9)**

INTERPOLATION AND NUMERICAL INTEGRATION

Interpolation and Approximation, Newton's polynomials and Lagrange polynomials, spline interpolation, linear regression, polynomial regression, least square regression, Numerical integration: Trapezoidal rule, Simpson's rule, integration with unequal segments, Chemical engineering problems involving numerical differentiation and integration **(9)**

NUMERICAL METHODS FOR ODES

Ordinary Differential Equations: Euler method, Runge-Kutta method, Adaptive Runge-Kutta method, Initial and boundary value problems, Chemical engineering problems involving single, and a system of ODEs. **(9)**

NUMERICAL METHODS FOR PDES

Introduction to Partial Differential Equations: Characterization of PDEs, Laplace equation, Heat conduction/ diffusion equations, explicit, implicit, Crank-Nicholson method, Introduction to Finite element method. **(9)**

TEXT BOOKS

1. *Gupta, S. K., "Numerical Methods for Engineers, New Academic Science, 2012.*
2. *Pradeep Ahuja, "Intrduction to Numerical Methods in Chemical Engineering", 2nd Edition, PHI Learning Private Limited, 2019.*

REFERENCES

1. *S.C. Chapra & R.P. Canale, "Numerical Methods for Engineers with Personal Computer Applications", McGraw Hill Book Company, 1985.*
2. *R.L. Burden & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles, 2000.*
3. *Atkinson, K. E., "An Introduction to Numerical Analysis", John Wiley & Sons, 1978.*
4. *Press, W. H. et al., "Numerical Recipes in C: The Art of Scientific Computing, 3rd Edition, Cambridge University Press, 2007.*

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Cos	Program Outcomes/Program Specific Outcomes (Pos/PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3			1	1							1	
CO2	3	1			1	1							2	1
CO3	3	3	1		2	2							3	2
CO4	1	2	1		1	1							1	1
CO5	3	3	1	1	2	1							3	1

(1: Slight, 2: Moderate 3: Substantial)

19CHL56 - ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon successful completion of course, students will be able to

CO1 *: To differentiate between wage employment, self-employment and entrepreneurship*

CO2 *: To appreciate and develop positive thinking and self-confidence for embarking on self-employment / entrepreneurship.*

CO3 *: To appreciate the importance of systematic planning in setting up and managing a business enterprise.*

PART I

MOTIVATION AND CONFIDENCE BUILDING

Positive thinking, shedding negative feelings, Experience Sharing by successful entrepreneurs, Motivational video clips, Scope for Self-employment. **(7)**

PART II

SELF EMPLOYMENT

Advantages over wage employment, Entrepreneurship Development, Need and importance of embarking on self-employment Advantages of self-employment, Assessing self to know entrepreneurial tendencies, Process of Entrepreneurship Development Importance of behavioural changes for entrepreneurship, Difference between Income Generating Activity, Self-Employment and Entrepreneurship, Characteristics of an entrepreneur - Dynamics of Entrepreneurship, Attitude and its impact on Entrepreneurship. **(8)**

TOTAL : 15

TEXT BOOKS

1. *Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship, Tata McGraw Hill, 10 th Edition.*

Mapping of Course Outcomes (Cos) with Program Outcomes (Pos)

Cos	Program Outcomes/Program Specific Outcomes (Pos/PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2	1					
CO2									2					
CO3								3	2					

(1: Slight, 2: Moderate 3: Substantial)

19INT51 - INTERNSHIP-I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, the students are able to

CO1 *: Analyze the basic principles and knowledge of chemical engineering which has been applied in the production of various products in industries.*

CO2 *: Conduct lab scale experiments through the experience gained from the large scale industries.*

CO3 *: Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.*

- Students are instructed to complete six to eight weeks of internship in any Chemical Process Industry or Nationalized Academic Institution.
- A written report and an oral presentation should be given after successful completion of internship.

19HOC51 - EMPLOYABILITY AND PERSONALITY DEVELOPMENT SKILLS - I

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Solve objective questions on Syllogisms, Data Interpretation, Critical Reasoning, Theme Detection, Sentence Completion and Business Vocabulary*

CO2 *: Develop appropriate responses for business phone calls and negotiate effectively.*

CO3 *: Speak with appropriate body language for a technical speaking task.*

CO4 *: Project the appropriate grooming and the right etiquettes, for interview and group discussion task.*

VERBAL APTITUDE

Syllogisms-Paragraph Comprehension -Data Interpretation -Critical Reasoning/Theme Detection - Grammar -Sentence Completion Filler - Business Vocabulary- Foreign phrases used in English **(3)**

PROFESSIONAL COMMUNICATION

Telephonic Conversation Skills - Telephonic Interview -Etiquettes - Professional, Dining & Telephone - Employability skills - Importance and Employability level of present Y and Z Generation - Interpersonal Skills - Negotiation Skills - Types, Expressions used in formal and informal negotiations, Stages of Negotiation - Time Management - Pareto principle, Prioritizing tasks, Barriers to time management. **(7)**

THE ART OF SPEAKING

Types of Speaking - Barriers to Speaking - Presentation on a Technical Topic - Speaking on Current Trends in the Industry. **(5)**

NON-VERBAL COMMUNICATION

Interview Skills - Non-Verbal Communication - Smiling, Posture, Handshake, Tone of Voice and Eye Contact - GD tips & techniques and Mock GD- Body Language - Grooming. **(5)**

REFERENCES

1. *Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.*
2. *Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.*
3. *John Hayes. Interpersonal Skills at Work. Second Edition. Routledge publication. 2005*

19INT61 - INTERNSHIP-II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, the students will be able to

CO1 *: Analyze the basic principles and knowledge of chemical engineering which has been applied in the production of various products in industries.*

CO2 *: Conduct lab scale experiments through the experience gained from the large scale industries.*

CO3 *: Perform as a leader with good ethical principles to meet societal needs in the field of chemical engineering.*

- Students are instructed to complete six to eight weeks of internship in any Chemical Process Industry or Nationalized Academic Institution.
- A written report and an oral presentation should be given after successful completion of internship.

19HOC61 - EMPLOYABILITY AND PERSONALITY DEVELOPMENT SKILLS - II

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Students will be able to

CO1 *: Exhibit Corporate Etiquettes with assertiveness and personal effectiveness.*

CO2 *: Build teams and solve problems at workplace.*

CO3 *: Manage conflicts in a professional manner*

CO4 *: Simulate an actual Job Interview scenario to prepare a candidate for a real Interview*

CORPORATE ETIQUETTE

Corporate Etiquette: Dos and Don'ts, - Conversational dos and don'ts - Creating elusive first impression- Assertiveness-Personal Effectiveness **(4)**

LEADERSHIP AND TEAM MANAGEMENT

Leadership Skills - Understanding Traits and Styles - Team Building: Bonding, Development and Delegation - Adaptability and Work Ethics - Handling Team Dynamics- Giving and Receiving Feedback- Problem Solving Skills. **(5)**

STRESS AND CONFLICT MANAGEMENT

Emotional Intelligence: Recognition, Understanding and Managing - Stress Management: Techniques and Benefits - Conflict Management: Introduction - Handling Conflicts - Conflicts settlement **(6)**

GROUP DISCUSSION AND INTERVIEW SKILLS

Mock GD - Interview Skills - Answering challenging questions - Common Interview Questions **(5)**

REFERENCES

1. *Barun K Mitra., Personality Development and Soft Skills. Second Edition. Oxford University Press. 2016*
2. *N.Krishnaswamy & Lalitha Krishnaswamy - Mastering Communication Skills and Soft Skills. New Delhi. Bloomsburry. 2015*
3. *Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.*

20MSS13 - STRUCTURED SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand and articulate the role of system analyst in modern organizations and how the analyst functions in each phase of the system development life cycle.*

CO2 : *Identify the right requirements gathering tool to represent the information in quantitative manner.*

CO3 : *Choose the appropriate design methods for inputs and outputs for effective user interaction with the information systems.*

CO4 : *Solve a wide range of problems related to analysis, design and construction of information systems.*

CO5 : *Apply suitable procedures to ensure the correctness of data so as to build and operate quality information systems.*

SYSTEMS ANALYSIS FUNDAMENTALS

Need for systems Analysis and Design - Roles of a System Analyst(consultant, supporting expert, agent of change, system Analyst) - The Systems Development Life Cycle - Developing Open Source Software - Organizations as Systems - Project initiation, feasibility, managing Time and Activities, Project Scheduling using Gantt charts and PERT diagram. **(9)**

INFORMATION REQUIREMENTS ANALYSIS

Information gathering using interactive methods: Interviewing, using questionnaires. Information gathering using unobtrusive methods: sampling, investigation analysing quantitative documents - case study and group project for interactive method and unobtrusive methods. **(9)**

THE ANAYSIS PROCESS

Using Data Flow Diagrams - analysing systems using data dictionaries -process specification format - structured English - decision tables - decision trees. Diagramming using Microsoft Visio. **(9)**

THE ESSENTIALS OF DESIGN

Designing effective output: output design objectives - relating output content to output method - designing output for displays - designing a website - Designing Apps for smartphones and tablets.

Designing effective input: Good forms design - good display and web forms design - website design. Databases (only fundamental)- data concepts : data and metadata, files, relational database- steps in retrieving and presenting data. **(9)**

HUMAN-COMPUTER INTERACTION AND DESIGNING ACCURATE DATA ENTRY PROCEDURE

Understanding Human - Computer Interaction - usability - Types of User Interfaces - Designing Interfaces for smartphone and Tablets - Designing accurate data entry procedures : Effective coding - effective and efficient data capture - ensuring data quality through input validation. **(9)**

TOTAL : 45

TEXT BOOK

1. *Kendall & Kendall, "Systems Analysis and Design", Eastern Economy Edition, PHI, Ninth Edition, 2014.*

REFERENCE BOOKS

1. *Joseph. S.Valacich, Joey. F. George, Jeffrey A. Hoffes , "Essentials of Systems Analysis and Design", Eastern Economy Edition, PHI, Fourth Edition, 2009.*
2. *Whitten and Bentley, "System Analysis and Design Methods", Tata McGraw Hill, Seventh Edition, 2015.*
3. *Alan Dennis, Barabara Haley wixom, Roberta M.Roth, "System Analysis and Design", Wiley Student Edition, Fourth Edition, 2014.*

20MSS32 - PROBABILITY AND STATISTICS - II

L	T	P	C
3	1	0	4

PRE-REQUISITES

20MSS21

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Apply moment generating function and transformation of variables to determine the probability distributions of transformed variables.*

CO2 : *Gain good knowledge in estimation of parameters of probability distributions using classical and Bayesian approaches.*

CO3 : *Formulate and compute multiple linear regression models and intercept it.*

CO4 : *Develop skill to analyze data from statistical experiments using appropriate Statistical Design of Experiments.*

CO5 : *Gain knowledge in computing reliability of systems for life testing and construct Control Charts.*

FUNCTIONS OF RANDOM VARIABLES

Moments and Moment Generating Functions (MGF)- definition- Properties - MGFs of important distributions-Theorems on MGFs-Transformations of Variables and finding their distributions -method of direct transformation and method of moment generating functions. **(8)**

ESTIMATION

Estimation of parameters using method of moments-Maximum Likelihood Point Estimation(MLE)-Properties of estimators-Unbiasedness, minimum variance, efficiency and sufficiency-Mean Square Error-Asymptotic properties-consistency-Fisher Information and Cramer-Rao's Inequality - Interval Estimation-Confidence interval for the mean of single sample -Bayesian Concepts-Subjective Probability- Conditional Perspective-Bayesian Inferences-Prior and posterior distributions- Point Estimation using the posterior Distribution- Bayesian Interval Estimation-Bayes Estimates using Decision Theory framework: Bayes estimate under squared error loss function and absolute error loss function. **(13)**

MULTIPLE REGRESSION ANALYSIS (MLR)

Variables in Multivariate Data-Mean Vector, Covariance and Correlation Matrices and their properties - Estimation of missing values. Multiple Linear Regression Equation and Polynomial Regression Models- Estimation of the coefficients using method of least squares-Linear Regression using Matrices-Properties of Least Squares-Inferences in Multiple Linear Regression: ANOVA and testing the partial regression coefficients- Interpretation of R2-Standardized Regression Coefficient and its interpretation-Inclusion of categorical or indicator variables in MLR -Multi-collinearity problem-Stepwise Regression. **(8)**

APPLIED STATISTICS:DESIGNS OF EXPERIMENTS

Analysis of Variance (ANOVA) technique-Design of experiments - basic concepts - treatment - experimental unit -experimental error - basic principle - replication, randomization and local control- One way Analysis of Variance : Completely Randomized Design- Randomized blocks design - description - layout - analysis-Latin Square Design-description-layout-analysis. **(8)**

APPLIED STATISTICS: RELIABILITY AND QUALITY CONTROL

Concepts of reliability-hazard functions-Reliability of series and parallel systems- Control Charts-Nature of Control Limits-Purpose of Control Charts-Control Charts for Variables (and R charts)-Control Charts for Attributes(p, c and np charts)-CUSUM charts. **(8)**

TOTAL : 60

TEXT BOOKS

1. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Inc., 7th Edition, Delhi, India, 2002. [Para 1, 2,4,5]*
2. *Alvin C.Rencher. "Methods of Multivariate Analysis", 2nd Edition, Wiley Inter-science, 2002 [Para 3]*

REFERENCE BOOKS

1. *Michael Baron, "Probability and Statistics for Computer Scientists", 2nd Edition, CRC Press, 2014.*
2. *Meyer, Paul L., "Introductory Probability and Statistical Applications", Addision Wesley, 2nd Edition, 1970.*
3. *S. C .Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 10th Revised Edition, New Delhi, 2002.*
4. *S.C. Gupta ,"Fundamentals of Statistics", 7th and Enlarged Edition, Himalaya Publishing, Delhi, 2014.*

20MSS36 - PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Write, test, and debug simple Python programs.*

CO2 *: Implement Python programs with conditionals and loops.*

CO3 *: Use functions for structuring Python programs.*

CO4 *: Represent compound data using Python lists, tuples, and dictionaries.*

CO5 *: Read and write data from/to files in Python and data exploration.*

CONCEPTS TO BE COVERED

1. Python installation, python interface and python IDE.
2. Python constructs
   a. Jump/branching
   b. Loops
   c. Functions
   d. Variables and their scope
   e. Modules
   f. Operators and expressions
3. Importing/exporting data in python
4. Exceptions handling in python
5. Collections and dictionaries
6. Object oriented programming in python
7. Working with files in python
8. Data exploration in python
   a. Working with data in python
   b. Data modelling using machine learning techniques

20MSS83 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the basic concepts, methods, techniques, tools, components and functions of intelligent agents.*

CO2 : *Given a search problem, analyze and formalize the problem, select the appropriate search method, and develop the algorithm for it.*

CO3 : *Apply AI techniques to real-world problems to develop intelligent systems.*

CO4 : *Design and implement logical reasoning agents.*

CO5 : *Describe and implement the major approaches to classical planning.*

INTRODUCTION

Artificial Intelligence: Introduction - Risks and Benefits - Intelligent Agents: Agents and Environments-The concept of Rationality-The Nature of Environments-The Structure of Agents. **(9)**

PROBLEM-SOLVING AGENTS

Solving problems by searching - Sample problems - Searching Algorithms - Uninformed Search Strategies-Informed Search Strategies-Heuristic Functions. Beyond Classical Search: Local search algorithms and optimization problems-Local Search in continuous spaces-Searching with non deterministic actions-Searching with partial observations - online search agents and unknown environments. **(12)**

ADVERSARIAL SEARCH AGENTS

Games-Optimal Decisions in games-Alpha-Beta Pruning-Imperfect Real-Time Decisions-Stochastic games-Partially Observable Games-State-of-the-art Game Problems. **(6)**

LOGICAL AGENTS

Knowledge Based Agents-The Wumpus world-Logic -Propositional Logic - Proposition theorem Proving - Effective propositional model checking-Agents Based on propositional logic. First-Order Logic:-Syntax and Semantics of First-Order Logic-Using First-Order Logic-Knowledge Engineering in First-Order Logic. **(12)**

PLANNING AGENTS

Classical Planning-Algorithms for planning - Heuristics for Planning - Hierarchical Planning - Planning and acting in Non deterministic Domains - Analysis of Planning Approaches. **(6)**

TOTAL : 45

TEXT BOOK

1. *Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.*

REFERENCE BOOKS

1. *Dan W. Patterson, "Introduction to AI and Expert Systems", Pearson Education, 2007.*
2. *Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", 3rd Edition, McGraw Hill, 2017 .*
3. *Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Edition, 1992.*

20MSS85 - ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Design and implement heuristic search procedures.*

CO2 *: Develop constraint satisfaction problem solution.*

CO3 *: Design and implement solutions for classical Artificial Intelligence problems.*

CO4 *: Design and implement knowledge based system.*

CO5 *: Use the various Artificial Intelligence tools.*

CONCEPTS TO BE COVERED

1. Implementing state space search algorithms for solving puzzle problems.
   A* Search
   Hill-climbing Search
2. Implementation of MiniMax Search Procedure with alpha beta pruning for finding the solutions of games.
3. Implementation of Constraint Satisfaction Problem for solving Crypt-arithmetic.
4. Develop a knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice.
5. Implementation of Unification algorithm by considering Resolution concept
6. Designing a Chatbot application.
7. Solve the classical Water Jug problem.
8. Solve the classical Monkey Banana problem.
9. Solve the classical Blocks World problem.
10. Development of programs for simulation of computer games like: Tic-Tac-Toe, N-queens Problems, traveling salesman problem, Chess, etc
11. Implementation of operation of Vacuum-Cleaning agent using appropriate search algorithm.
12. Create a knowledge base in PROLOG/LISP that consists of facts, rules and queries in following domains
    a. Medicine
    b. Agriculture
    c. Finance
13. Develop an Expert System for any specialized domain of choice.

MOOCs

1. *https://www.class-central.com/mooc/445/edx-cs188-1x-artificial-intelligence*
2. *https://www.class-central.com/mooc/7923/nptel-ai-constraint-satisfaction*

20MSSE06 - INFORMATION RETRIEVAL

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Explain basic concepts and techniques in Information Retrieval.*

CO2 : *Apply the information retrieval models.*

CO3 : *Evaluate an information retrieval system based on the relevance of the documents it retrieves.*

CO4 : *Compare the relative performances of different IR systems on benchmark document collections and queries.*

CO5 : *Elucidate the issues involved in providing an IR service on a web scale.*

Introduction : Information Retrieval - Information Retrieval system - Electronic text formats - Open source IR systems. Boolean Retrieval Model: Information Retrieval problem - vocabulary and postings lists - Dictionaries and tolerant retrieval - Index construction - Index compression. **(9)**

Ranked Retrieval Models: Methods for Scoring Documents - weighting the importance of a term in a Document - Vector space Model for scoring. Computing scores: Efficient scoring and Ranking - Components of an IR System - Vector Space scoring and Query operator interaction. Evaluation in information retrieval:Standard test collections - Evaluation of unranked retrieval sets - Evaluation of ranked retrieval results - Assessing relevance - System quality and user utility. **(9)**

Enhancing the Retrieval: Relevance Feedback and pseudo relevance feedback - Global methods for query reformation. Probabilistic Information Retrieval: The Probability Ranking Principle - The Binary Independence Model - An appraisal and some extensions. Language Models for Information Retrieval: Language Models - The query likelihood model - Comparison of Language Modeling with other approaches. **(9)**

Machine Learning Techniques in Information Retrieval: Text Classification and Naive Bayes-Vector Space Classification - SVM and ML on Documents. **(9)**

Structured Data Retrieval: XML Concepts - Challenges - A Vector Space Model - Evaluation - Text centric and data-centric XML retrieval.Web Search : Basics - Web crawling and indexes - Link analysis. **(9)**

TEXTBOOKS

1. *John Davies, "Information Retrieval: Searching in the 21st Century", Wiley, 2009. (Para-1)*
2. *C. Manning, P. Raghavan and H. Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2009. (Para 2-5)*

REFERENCE BOOKS

1. *Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormac, "Information Retrieval - Implementing and Evaluating Search Engines", The MIT Press, 2016.*
2. *Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval", Second Edition, ACM Press Books, 2011.*

20MSSE08 - PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES

20MSS12, 20MSS21, 20MSS32

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the forecasting, discrimination, classification, shrinkage and clustering techniques.*

CO2 : *Classify objects into different groups using discriminant function, logistic regression equation and cluster analysis techniques and analyze time series data for forecasting.*

CO3 : *Apply principal component and factor analysis techniques for dimensionality reduction.*

CO4 : *Estimation of time series forecasting, logistic regression, principal component analysis,* factor analysis and k-means techniques.

Time Series Forecasting : Introduction to Forecasting-Time Series Data and Components of Time-Series Data - Forecasting Techniques and Forecasting Accuracy-Moving Average Method-Single Exponential Smoothing(ES) - Double Exponential Smoothing-Holt's Method- Regressive Model for Forecasting -Auto-Regressive(AR) Models - Moving Average Process MA(q)) - Auto-Regressive Moving Average (ARMA) Process-Auto-Regressive Integrated Moving Average (ARIMA) Process -Power of Forecasting: Theil's Coefficient. **(12)**

Discrimination: Discriminant Function Analysis- Fisher's discriminant function -Fitting discriminant functions. **(6)**

Classification: Logistic Regression: Binary Logistic Regression - Estimation of Parameters in Logistic Regression - Interpretation of Logistic Regression Parameters - Logistic Regression Model Diagnostics - Classification Table, Sensitivity and Specificity - Optimal Cut-off Probability - Variable Selection in Logistic Regression - Application of Logistic Regression in Credit Rating. **(8)**

Principal Component Analysis and Factor Analysis: Data Reduction Techniques-Definition of Population Principal Components -Principal Components obtained by Standardized variables- Rules to retain number of Principal Components using Scree Plot.

Factor Analysis : Definitions-The Orthogonal Factor Model-Its Covariance Structure- Factor Loadings and Interpretations.Exploratory and Confirmatory Factor Analysis- Estimation of PCA and FA. **(10)**

Clustering: Introduction- Distance and Dissimilarity Measures used in Clustering- Quality and Optimal Number of Clusters-K-Means Clustering and Hierarchical Clustering Methods. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Dinesh Kumar U, " Business Analytics", Wiley, First Edition, 2017 (Para 1, Para3, Para 5)*
2. *Richard A.Johnsonand Dean W.Wichern, " Applied Multivariate Statistical Analysis", 6th Edition, Pearson Prentice Hall, 2007 (Para 2 and Para 4)*

REFERENCE BOOKS

1. *Joseph F. Hair Jr., William C. Black, Barry J.Babin and Rolph E.Anderson, "Multivariate Data Analysis", 7th Edition, Pearson, 2010.*
2. *G.James,D.Witten, T.Hastie and R.Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2015.*

20MSSE16 - VIRTUAL REALITY AND AUGMENTED REALITY

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Explain the understanding of fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR*

CO2 *: Explain the fundamental concepts relating to Virtual Reality such as presence, immersion, and engagement*

CO3 *: Understand the system of human vision and its implication on perception and rendering*

CO4 *: Apply the concepts learned when developing VR applications.*

CO5 *: Design VR systems*

INTRODUCTION

Virtual Reality - Modern VR Experiences- Hardware and Software for Virtual Reality - Geometry of virtual worlds.

Augmented Reality : Introduction - Working - Concepts related to Augmented Reality - Ingredients of an Augmented Reality Experience. **(9)**

PHYSIOLOGY OF HUMAN VISION

Behavior of Light - Lenses - Cameras and Displays From Cornea to Photoreceptors - From Photoreceptors to the Visual Cortex - Eye Movements - Implications for VR. **(9)**

PERCEPTION AND RENDERING

Visual Perception: Perception of Depth - Perception of Motions - Perception of Color - Combining sources of Information.

Visual Rendering: Ray Tracing and Shading Models - Rasterization - Correcting Optical Distortions- Improving Latency and Frame Rates - Immersive Photos and Videos. **(9)**

MOTION AND TRACKING

Motion : Velocities and Accelerations - The Vestibular System - Physics and Virtual World - Mismatched Motion and Vection

Tracking: Tracking 2D Orientation - Tracking 3D Orientation - Tracking Position and Orientation - Tracking Attached Bodies - 3D Scanning of Environments. **(9)**

INTERACTION AND EVALUATION

Physics of Sound - Physiology of Human Hearing - Auditory Perceptron - Auditory Rendering Evaluating VR Systems and Experiences: Perceptual Training - Recommendations for Developers - Comfort and VR Sickness - Experiments on Human Subjects. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.(Para -1).*
2. *Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2019.(Para 2-5).*

REFERENCE BOOKS

1. *William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann Publishers, 2002.*
2. *Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", Springer, 2005.*

20MSSL03 - BLOCKCHAIN TECHNOLOGIES LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : LABORATORY

COURSE OUTCOMES

CO1 *: Illustrate the role of cryptography in securing blockchain.*

CO2 *: Interact with a blockchain system by sending and reading transactions.*

CO3 *: Design, build, and deploy distributed applications.*

THE FOLLOWING ARE TO BE PRACTICED

1. Test the properties of cryptographic Hashing
2. Perform Using JavaScript
   a. Creating a Blockchain
   b. Implementing Proof of Work
   c. Miner rewards & generating transactions
   d. Signing transactions
3. Create a private Ethereum Blockchain.
4. Test the properties of Ethereum transactions and Cryptographic Hashing - the authenticity and security of Ethereum transactions (Using MetaMask)
5. Develop smart contracts for Ethereum Blockchain
6. Interacting with smart contracts via the web.

20MSSL13 - VIRTUAL REALITY AND AUGMENTED REALITY LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

20MSS12, 20MSS21,20MSS32

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Set up Unity for Virtual Environment.*

CO2 *: Create Scenes.*

CO3 *: Create game objects.*

CO4 *: Apply color, texture, Material for Game Objects.*

CO5 *: Design and develop VR environments.*

Tools : Unity / Three.js

TOPICS TO BE COVERED

1. Developing a scene.
2. Adding game objects such as a cube, plane and sphere, and applying transformations on the game objects.
3. Adding video and audio sources.
4. Changing the colour, material and texture of Game objects separately in a scene.
5. Apply rigid body component, material and Box collider to the game objects.
6. Create an immersive environment (living room/ battlefield/ tennis court) with static game objects.
7. Adding 3D game objects.
8. Include animation and interaction in the immersive environment.
9. Create a virtual environment for any use case.

17MDC71 - PROJECT WORK AND VIVA VOCE - I

L	T	P	C
18			

PRE-REQUISITES

Should have undergone all courses upto 6th Semester

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

19MAM31 - ARTIFICIAL INTELLIGENCE

PRE-REQUISITES

19MAM24

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Apply various heuristic search strategies in optimal decision making*

CO2 *: Understand uncertainty in real world situations.*

CO3 *: Employ first order logic for building a knowledge base and demonstrate reasoning on this.*

CO4 *: Express different planning strategies to deal with problems, describe and apply various knowledge representation techniques.*

CO5 *: Review knowledge based Artificial Intelligent systems and approaches.*

INTRODUCTION

Foundation of AI - Agents and Environments- Concept of Rationality - Nature of Environments - Structure of Agents. **(6)**

PROBLEM SOLVING

Problem-Solving Agents and examples - Uninformed and Informed Search Strategies - Heuristic Functions - Local Search Algorithms and Optimization Problems - Local search in Continuous spaces - Searching with Nondeterministic actions and Partial Observations. **(12)**

ADVERSARIAL SEARCH AND CONSTRAINT SATISFACTION PROBLEMS

Games - Optimal Decisions in Games - Alpha-Beta Pruning. Constraint Satisfaction Problems (CSP) - Backtracking Search for CSPs - Local Search for Constraint Satisfaction Problems - Structure of Problems. **(8)**

KNOWLEDGE AND REASONING

Knowledge based Agents - The Wumpus World - Logic - Propositional Logic- Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic - Unification and Lifting - Forward Chaining - Backward Chaining - Resolution - Knowledge Representation. **(12)**

PLANNING

Definition of classical planning - Algorithms for Planning as State-Space Search - Planning Graphs - Hierarchical Task Network Planning - Planning and Acting in Nondeterministic Domains - Multi agent Planning. **(7)**

TOTAL : 45

TEXT BOOK

1. *Stuart J Russell and Peter Norvig, "Artificial Intelligence- A Modern Approach", Pearson Education Series, Third Edition, 2010. (Chapters 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)*

REFERENCES

1. *Dan W.Patterson "Introduction to AI and ES", Pearson Education, First Edition, 2007*
2. *Nilis J Nilsson "AI A new Synthesis" Morgan Kaufmann publishers, 1998*

19MAM32 - THEORY OF COMPUTING

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Develop designs for different machine types: finite automata, pushdown automata.*

CO2 *: Illustrate the mechanism of Turing machine and state its applications*

CO3 *: Recognize partial recursive functions and its relationship to programs*

CO4 *: Design different types of grammars and develop grammars to produce specific solutions.*

CO5 *: Formulate methods to check the correctness of algorithms*

FINITE STATE MACHINES

Deterministic finite state machine, Non-deterministic finite state machine, Pumping lemma for Regular grammar. Applications of Finite State Machines. **(8)**

PUSH DOWN AUTOMATA

Deterministic push down automata. Recognizing context free grammars. Non deterministic push down automata and Ambiguous context free grammars. Applications of Push down Automata. **(8)**

TURING MACHINES AND COMPUTABILITY

Turing Machines, recognizing Context sensitive grammars. Types of Turing machines, Halting problem. Effective procedure for algorithm and computability. Applications of Turing Machine. **(9)**

FUNCTIONS

Basic functions and strategy set, Partial and Primitive recursive functions, Computability. McCarthy's formalism, Programs and Recursive functions. **(6)**

PRODUCTIONS

Production system, Acceptors and Generators, Markov algorithms. **(8)**

GRAMMARS

Rules, formalization, Ambiguity, Reduced Form, Derivation on Rule Tree, Chomsky hierarchy, Derivation graphs, Grammars and Compiler Design, Programming languages and Compilers, Sentential forms and Derivation trees, Parsing algorithms Stochastic grammars. **(8)**

COMPUTATION

Approaches for checking correctness, Partial total correctness, Proof methods. Floyd Hoare Manna Inductive assertion. Functional methods. **(8)**

TOTAL : 45

TEXT BOOKS

1. *EV Krishnamoorthy, "Introduction to Theory of Computation", East West Press,1983. (Sections 2 to 5)*
2. *KLP Mishra, N.Chandrashekar "Theory of Computer Science -Automata, Languages and Computation" Second Edition, PHI, 1998.*

REFERENCES

1. *John E Hopcroft, Jeffrey D Ullman,"Introduction to Automata theory languages and computation", Addision Wesley 2006.*
2. *Michael Sipser "Introduction to the theory of computation" PWS Publishing, 2006.*

19MAM33 - DATABASE MANAGEMENT SYSTEMS

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the purpose and architecture of database systems from the perspective of persistent storage of real world data.*

CO2 *: Analyze the problem statement, construct the Entity Relationship model and map it into relational model by applying normalization.*

CO3 *: Generate Relational Algebra, Relational Calculus and SQL statements to perform queries of real world applications*

CO4 *: Evaluate the indexing techniques and choose the suitable technique by analyzing the given application*

CO5 *: Determine the concurrency control and recovery mechanisms based on the criticality of the transaction*

INTRODUCTION

Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Architecture, Database Users and Administrators.

Relational Model : Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Language, Relational operations. **(10)**

DATABASE DESIGN

Database Design and the E-R Model, Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Extended E-R Features. Relational Database Design: Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory. **(11)**

INTRODUCTION TO SQL

Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database. Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

Advanced SQL:Accessing SQL from a Programming Language, Functions and Procedures, Triggers. Formal Relational Query Languages: The Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus. **(10)**

DATA STORAGE AND INDEXING

File Organization, Organization of Records in Files, Data-Dictionary Storage, Database Buffer. Indexing and Hashing: Basic Concepts, Ordered Indices, Overview of B+-Tree Index Index, Definition in SQL. **(7)**

TRANSACTION, CONCURRENCY CONTROL AND RECOVERY

Concept, Simple Transaction Model, Atomicity and Durability, Isolation, Serializability, Isolation and Atomicity, Isolation Levels. Lock-based Concurrency Control, Time Stamp based Concurrency Control, Failure Classification, Recovery and Atomicity. **(7)**

TOTAL : 45

TEXT BOOK

1. *Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2010.*

REFERENCES

1. *Ramez Elmasri, Shamkant B. Navathe Durvasula, V.L.N. Somayajulu, Shyam K. Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.*
2. *Christopher Allen, Simon Chatwin, Catherine A. Creary, "Introduction to Relational Databases and SQL Programming", Tata McGraw-Hill, 2003.*

19MAM34 - PREDICTIVE ANALYTICS

[redacted]

PRE-REQUISITES

19MAM13, 19MAM22

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Analyze time series data and apply it to forecast the future.*

CO2 *: Formulate and compute multiple linear regression model and understand its properties.*

CO3 *: Classify objects into different groups using discriminant function, logistic regression equation.*

CO4 *: Identify underlying factors in multivariate data sets using principal component analysis.*

CO5 *: Understand the terminology of factor analysis, factor rotation and interpret factor loadings using R programming.*

MULTIPLE REGRESSION ANALYSIS (MLR)

Variables in Multivariate Data-Mean Vector, Covariance and Correlation Matrices and their properties-Estimation of missing values. Multiple Linear Regression Equation and Polynomial Regression Models- Estimation of the coefficients using method of least squares-Linear Regression using Matrices-Properties of Least Squares-Inferences in Multiple Linear Regression: ANOVA and testing the partial regression coefficients- Interpretation of R2-Standardized Regression Coefficient and its interpretation-Inclusion of categorical or indicator variables in MLR -Multi-collinearity problem-Stepwise Regression. **(10)**

TIME SERIES FORECASTING

Regression Model for forecasting-Forecasting Time Series data with Seasonal Variation-Auto-Regressive(AR) Models- AR Model Identification: ACF and PACF, Moving Average -MA(q)) and ARMA(p,q) Models-Auto-Regressive Integrated Moving Average (ARIMA) Process-Dickey Fuller Test-Augmented Dickey-Fuller Test-Transforming Non Stationary Process to Stationary Process using Differencing-ARIMA(p,d,q) model building-Ljung-box test for Auto-Correlations-Power of Forecasting: Theil's Coefficient. **(12)**

DISCRIMINATION AND CLASSIFICATION

Discriminant Function Analysis- Fisher's discriminant function -Fitting discriminant functions using R and interpreting the results. Logistic Regression: Logistic Model-Definitions of Odds and Logit-Estimation of the logistic regression coefficients-Making Predictions-Multiple Logistic Regression-Fitting logistic regression equation using R and interpreting the results. **(9)**

PRINCIPAL COMPONENT ANALYSIS

Data Reduction Techniques-Definition of Population Principal Components -Principal Components obtained by Standardized variables -Rules to retain number of Principal Components using Scree Plot-Graphing the Principal Components-Testing the equal correlation structure-Geometric and Algebraic bases of Principal Components. **(7)**

FACTOR ANALYSIS

Factor Analysis -Definitions-The Orthogonal Factor Model-Its Covariance Structure- Estimation of loadings and communalities-Principal component method and Principal factor method-Factor Loadings and Interpretations- Rotation- Orthogonal and Oblique rotation-Exploratory and Confirmatory Factor Analysis- Estimation of PCA and FA using R. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Alvin C.Rencher, William F. Christensen "Methods of Multivariate Analysis", 3rd Edition, Wiley Inter-science, 2012*
2. *Dinesh Kumar U, " Business Analytics", Wiley, First Edition, 2017*
3. *Richard A.Johnsonand Dean W.Wichern, " Applied Multivariate Statistical Analysis", 6th Edition, Pearson Prentice Hall, 2007.*

REFERENCES

1. *R.E.Walpole, R.H.Myers,S.L.Myers and K.Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Prentice Hal, 2012.*
2. *Joseph F. Hair Jr., William C. Black, Barry J.Babin and Rolph E.Anderson, "Multivariate Data Analysis", 7th Edition, Pearson, 2010.*
3. *G.James,D.Witten, T.Hastie and R.Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2015.*

19MAM35 - HUMAN COMPUTER INTERACTION

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Learn the foundations of Human Computer Interaction (HCI)*

CO2 : *Be familiar with the design technologies for individuals and persons with disabilities*

CO3 : *Be familiar with models and theories of HCI*

CO4 : *Develop an understanding of the intricacies of mobile HCI*

CO5 : *Develop an understanding of the intricacies of web HCI*

FOUNDATIONS OF HCI

The Human: I/O channels - Memory - Reasoning and problem solving; The computer: Devices -Memory - processing and networks; Interaction: Models - frameworks - Ergonomics - styles -elements - interactivity- Paradigms. **(9)**

DESIGN & SOFTWARE PROCESS

Interactive Design basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in software process - software life cycle - usability engineering - Prototyping in practice - design rationale. Design rules - principles, standards, guidelines, rules. Evaluation Techniques - Universal Design. **(9)**

MODELS AND THEORIES

Cognitive models -Socio-Organizational issues and stakeholder requirements -Communication and collaboration models-Hypertext, Multimedia and WWW. **(9)**

MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. **(9)**

WEB INTERFACE DESIGN

Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Pearson Education, 2004. (Para I - III)*
2. *Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009. (Para IV)*
3. *Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009. (ParaV)*

REFERENCES

1. *Isaias, Pedro, Blashki, Katherine "Interactivity and the Future of Human Computer Interface", IGI Global, 2020.*

19MAM36 - ARTIFICIAL INTELLIGENCE LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Design and implement heuristic search procedures*

CO2 *: Develop solutions for constraint satisfaction problem*

CO3 *: Design and implement solutions for classical Artificial Intelligence problems*

CO4 *: Design and implement knowledge-based system*

CO5 *: Become familiar with use of Artificial Intelligence tools.*

CONCEPTS TO BE COVERED

1. Implementing state space search algorithms for solving puzzle problems.
   a. A* Search
   b. Hill-climbing Search.
2. Implementation of Min-Max Search Procedure with alpha beta pruning for finding the solutions of games.
3. Implementation of Constraint Satisfaction Problem for solving Crypt-arithmetic.
4. Implementation of Unification algorithm by considering Resolution concept.
5. Solve the classical Water Jug problem.
6. Solve the classical Monkey Banana problem.
7. Solve the classical Blocks World problem.
8. Develop a knowledge base system/ expert system consisting of facts and rules about some specialized knowledge domain of your choice.
9. Designing a Chatbot application
10. Development of programs for simulation of computer games like: Tic-Tac-Toe, N-queens Problems, travelling salesman problem, Chess, etc.

Softwares : Use of PROLOG, LISP, CLIPS or any open source framework

TOTAL : 60

19MMA37 - DATABASE MANAGEMENT SYSTEMS LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application.*

CO2 *: Formulate simple DML SQL queries to retrieve the required data for real world applications.*

CO3 *: Generate DML queries with Subqueries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications.*

CO4 *: Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors as required by OLTP applications.*

CO5 *: Develop a database project by constructing the ER model, creating Tables and generating SQL and PL/SQL blocks using RDBMS platform.*

CONCEPTS TO BE COVERED

1. Designing a database for an application and representing it through ER diagram and map it to ER Scheme.
2. Creating and managing tables
3. Basic SQL SELECT statements
4. Restricting and sorting data
5. Single row functions
6. Displaying data from multiple tables
7. Aggregating data using Group function - Group By
8. Subqueries
9. Views, Sequence, Index, Synonym
10. SET operators, Date and Time functions
11. PL / SQL Programs
12. Exception Handling, Cursors, Functions, Procedures, Package, Triggers

Softwares : MySQL/Oracle

TOTAL : 60

19MAM38 - PREDICTIVE ANALYTICS LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Use R software to analyze multivariate data using multiple linear regression, discriminant function, logistic regression equation models and cluster analysis tools.*

CO2 *: Using R software to analyze Time Series Models*

CO3 *: Identify underlying factors in multivariate data by applying factor analysis and principal component analysis models using R software packages.*

CO4 *: Use R software to retain the components and loading of the Principal Components.*

CO5 *: Use R to verify the data and to estimate the parameters of a factor model.*

CONCEPTS TO BE COVERED

1. Reading and plotting Multivariate Data-Matrix scatter plot and Scatter plot with the data points labeled by their group.
2. Calculating summary statistics for Multivariate Data-Means and variances per group, Between-groups Variance and within-groups variance for a variable.
3. Calculating Covariances, Correlations and Standardizing Multivariate data fitting Multiple Regression Equation using MS-Excel and interpreting the output.
4. Writing Script files in R for Fitting Multiple Regression Equation: Summary, extracting ? coefficients, Covariance matrix, standard errors, residuals and fitted values and plotting, Normal Probability Plot of residuals, Predictions-Compare the results using lm command.
5. Stepwise regression: forward, backward and stepwise.
6. Differencing a Time Series, selecting a Candidate ARIMA Model, Forecasting using ARIMA Model.
7. Fitting logistic regression equation: Prediction, goodness of fit and Plotting ROC Curve.
8. Discriminant function analysis and loadings for the discriminant functions.
9. Principal component Analysis : screen plot to decide on the number of components to retain and loadings for the PCs and Scatter Plots for PCs.
10. Factor Analysis using R

Software : R Studio

TOTAL : 60

19MAM41 - OPERATIONS RESEARCH

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Solve Linear Programming, Transportation and Assignment based problems.*

CO2 *: Discuss the elementary Inventory models, Price break models and Safety stock problems.*

CO3 *: Solve Job sequencing and replacement problems.*

CO4 *: Categorize the Queuing models.*

CO5 *: Analyze the network models using CPM and PERT.*

LINEAR PROGRAMMING

Linear programming problem - canonical and standard forms - formulation - graphical solution - simplex method-Big M method using artificial variables- Transportation model - Initial Basic Feasible Solution using Northwest Corner method, Matrix Minima method and Vogels approximation method - Optimal solution by Modified Distribution Method-Unbalanced Transportation problems and Degeneracy - Assignment model-Solution by using Hungarian method. **(12)**

SEQUENCING AND REPLACEMENT

Sequencing: Basic assumptions - Johnson's procedure for Sequencing of: i) n jobs on 2 machines ii) n jobs in 3 machines and iii) n jobs on m machines. Replacement: Need for replacement of equipments - failure mechanism of items - Replacement policy - Replacement of items that deteriorates gradually - Replacement of items that fail suddenly. **(7)**

INVENTORY

Need for the inventory - Costs involved in inventory - Concepts of average inventory, economic order quantity - Deterministic model: Fixed ordering quantity models - EOQ model with uniform demand, finite and infinite replacement with or without shortages -EOQ with one price break. Inventory control - Buffer stock - Determination of optimum buffer stock - EOQ system of ordering - Multi item order model - ABC analysis. **(9)**

QUEUING THEORY

Queuing system characteristics-Describing a queuing system by input pattern, service mechanism, queue discipline and customer behaviour- Steady, transient and explosive states in queuing systems-Designation of queue and symbols used in queuing models- M/M/1 (∞/FIFO) model-Steady State solutions-Finite Queue Length Model: (M/M/1) : (∞/FIFO). **(8)**

PERT and CPM NETWORKS

Activities and events-Rules for forming a Network- Critical Path Method(CPM) for computing project completion time- network - Time estimation in CPM-Project Cost Analysis- critical path -Crashing-Least cost schedule algorithm- PERT - Network - Difference between PERT and CPM-Time estimates in PERT- Critical Path estimation - Probability of meeting a scheduled date of completion of the project. **(9)**

TOTAL : 45

19MAM42 - MACHINE LEARNING

PRE-REQUISITES

19MAM13, 19MAM22

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Recognize fundamental issues and challenges of machine learning: data, model selection, model complexity, supervised and unsupervised learning.*

CO2 *: Apply Decision trees and Artificial Neural Networks for classification*

CO3 *: Distinguish the strength and weakness of Bayesian learning.*

CO4 *: Analyze and use Instance based learning and reinforcement learning in real time problems.*

CO5 *: Learn association rules and clustering methods and apply to derive insights from data.*

INTRODUCTION

Basics of Machine Learning-Examples of Machine Learning Applications-Designing a Learning System. **(3)**

CONCEPT LEARNING AND GENERAL TO SPECIFIC ORDERING

Concept Learning Task- Concept Learning as Search- Find-S- Version Space and Candidate Eliminate Algorithm-Inductive bias. **(5)**

DECISION TREE LEARNING

Decision tree representation, Decision tree Learning Algorithm- Inductive bias-Issues in Decision Tree learning. **(6)**

ARTIFICIAL NEURAL NETWORKS

Introduction- Neural Network Representations- Perceptron- Multi-layer Networks and Back Propagation Algorithm- Remarks onthe Back propagation Algorithm- Face Recognition Example.

EVALUATING HYPOTHESIS

Motivation, Estimating Hypothesis Accuracy, Basis of Sampling Theory- Difference in Error of Two Hypothesis- Comparing Learning Algorithms **(8)**

BAYESIAN LEARNING

Bayes Theorem - Bayes theorem and Concept Learning- Maximum Likelihood and Least Square Error Hypothesis- Bayes Optimal Classifier- Naive Bayes Classifier-Bayesian Belief Networks- EM Algorithm. **(8)**

INSTANCE BASED LEARNING

k-Nearest Neighbour Learning, locally weighted Regression- Radial Basis Functions- Case based Reasoning. Reinforcement Learning: The learning task - Non-deterministic Rewards and Actions - Relationship to Dynamic Programming. **(8)**

UNSUPERVISED LEARNING

Introduction-k-means Clustering-Hierarchical Clustering. Association Rules - Apriori Algorithm. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Tom M Mitchell, "Machine Learning", Indian Edition, McGraw Hill, 2013.*
2. *Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 3rd Edition, 2014. (First and Last Para).*
3. *Jaiwei Han, Micheline Kamber Data Mining-concepts and techniques, 2/e, Morgan Kaufmann Publishers, San Francisco, 2006. (Last Para)*

REFERENCES

1. *Bishop, C. Pattern Recognition and Machine Learning. Berlin: Springer-Verlag, 2006.*
2. *Stephen Marsland, Machine Learning: An Algorithmic Perspective, Chapman and Hall, 2014.*

19MAM43 - DESIGN AND ANALYSIS OF ALGORITHMS

PRE-REQUISITES

19MAM14, 19MAM24

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Able to apply divide and conquer, greedy methods in problem solving*

CO2 : *Able to use dynamic programming in real time problems and derive efficient solutions.*

CO3 : *Able to understand the concepts of backtracking and branch-bound techniques.*

CO4 : *Able to differentiate between NP, NP hard and NP Complete problems.*

CO5 : *Able to analyze the efficiency of different algorithm design techniques and their proper usage in application problems.*

INTRODUCTION

Fundamentals of algorithmic problem solving - Method of specifying an algorithm - proving the correctness - Analyzing an algorithm - Asymptotic Notations. **(5)**

DIVIDE AND CONQUER

General Method- Binary Search - Finding the Maximum and Minimum- Merge Sort - Quick Sort - Strassen's Matrix Multiplication. **(7)**

GREEDY METHOD

General Method - Knapsack Problem - Tree Vertex Splitting - Minimum-cost spanning trees- Single Source Shortest Paths.**(7)**

DYNAMIC PROGRAMMING

General Method - Multistage Graphs - All-Pairs Shortest Paths - Single Source Shortest Path - Traveling Salesperson Problem. **(7)**

BACK TRACKING

General Method - 8 Queens Problem - Sum of Subsets- Graph Coloring -Hamiltonian Cycles. **(7)**

BRANCH AND BOUND

General Method - 0/1 Knapsack Problem - Traveling Salesperson Problem. **(5)**

NP-HARD, NP-COMPLETE CLASSES

Basic concepts - Non-deterministic algorithms - Satisfiability Problem - NP-hard and NP-complete Problems. **(7)**

TOTAL : 45

TEXT BOOK

1. *Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamental of Computer Algorithms", Galgotia Publications, 1998.*

REFERENCES

1. *Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivert, Clifford Stein "Introduction to Algorithms", Second Edition, Prentice Hall of India, Publications, New Delhi, 2007.*
2. *Anany Levitin, "Introduction: The Design & Analysis of Algorithm", Pearson Education Inc., 2003.*
3. *Michael T.Goodrich, Roberto Tamassia, "Algorithm Design, Foundations, Analysis and Internet Examples", Wiley, 2011.*
4. *Jon Kleinberg and Eve Tardos, "Algorithm Design", Pearson Education, 2012.*

19MAM44 - DATA COMMUNICATIONS AND NETWORKING

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Enumerate the layers of the OSI model and TCP/IP and compare the models.*

CO2 *: Describe the relationship between data and signals, and distinguish among their types, behavior, properties, characterization, and transmission.*

CO3 *: Given an inter-network topology configuration, can demonstrate how a packet reaches the destination.*

CO4 *: Explain the services offered by each layer of TCP/IP protocol suite and the role of each protocol.*

CO5 *: Given an application, can explain the role of the protocols involved.*

INTRODUCTION

Data Communications - Networks - The Internet - Protocols and Standards - OSI Model - TCP/IP Protocol Suite - Addressing. **(9)**

PHYSICAL LAYER AND MEDIA

Data and Signals - Digital Transmission: Digital to Digital Conversion - Analog to Digital Conversion - Transmission Modes - Analog Transmission: Digital -to -Analog Conversion - Multiplexing Techniques. **(10)**

DATA LINK CONTROL

Framing - Flow and Error Control - Protocols - Noiseless Channels - Noisy Channels. Multiple Access: Random Access Protocols - Ethernet - IEEE 802.11. **(7)**

NETWORK LAYER

Switching - Packet switching at Network Layer - Network layer Services - Issues - IP Addresses - Delivery and Forwarding of Packets - Internet Protocol IPv4 - Address Resolution Protocol - Internet Control Message Protocol. **(9)**

HIGHER LAYERS

Transport Layer: Services - User Datagram Protocol: User Datagram - UDP services - Transmission Control Protocol: TCP services - Features - Segment - TCP connection Management.

Application Layer : DNS - Worldwide Web. **(10)**

TOTAL : 45

TEXT BOOKS

1. *Behrouz A Forouzan, "Data Communications and Networking", Tata McGrawHill, 5th Edition, 2017. (Para 1-III)*
2. *Behrouz A Forouzan, "TCP/ IP Protocol Suite", Tata McGraw Hill, 2010. (Para IV-V)*

REFERENCES

1. *Kevin Fall R and Richard Stevens W, "TCP/IP Illustrated, Volume 1: The Protocols", Addison-Wesley, 2011.*
2. *James F Kurose and Keith Ross, "Computer Networking: A Top-Down Approach", Pearson Addison-Wesley, 2012.*
3. *Douglas Comer, "Internetworking with TCP/IP", Prentice Hall, 2013.*
4. *William Stallings, "Data and Computer Communications", Pearson, 2013.*

19MAM45 - OPERATING SYSTEMS

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Demonstrate the structure of operating system, batch programming, system calls and virtual machines.*

CO2 *: Demonstration of Kernel Management specific to concurrent process for Inter Process Communication systems.*

CO3 *: Estimate system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first.*

CO4 *: Recognize memory allocation and deallocation for both static and dynamic storage.*

CO5 *: Design and develop a new simple File System using Disk and File System Management*

INTRODUCTION

Abstract view of an Operating system - Extended view of resource manager - Overview: Simple Batch system - Multi programmed batch systems - Time Sharing Systems - Parallel Systems - distributed systems - Real time systems - System structure: IO structure- memory- CPU-Kernels and microkernels - Dual-mode operation - operating - system services - system calls - Structure of Operating system- Various components of Operating system. **(9)**

PROCESS MANAGEMENT

Process Concepts - Process Creation - Process Termination - Process States - Process Description - Process Control - Relationship between process and threads - Thread State - Thread Scheduling- Thread Synchronization-Multithreading model - Concurrent Process -process synchronization: critical section problem - Mutual Exclusion - Dekker's algorithm -synchronization hardware - semaphore - classical problem of ynchronization - critical regions - monitors - atomic transaction - race condition. Deadlock characterization - handling deadlocks - prevention - avoidance - detection and recovery - combined approach. **(10)**

PROCESSOR MANAGEMENT

Basic Concepts - Scheduling Criteria - Pre-emptive versus non-preemptive scheduling - Scheduling algorithms: FIFO - Shortest job first, priority, round robin, multi-level queue - Multi level feedback queue - multiprocessor scheduling. **(9)**

MEMORY MANAGEMENT

Basic Concepts - Logical versus Physical address - Swapping - Fixed Partition and Dynamic Partition - Simple Paging - Multi Level Paging - Inverted Paging - Paging algorithms-Simple segmentation- Virtual Memory - Demand Paging - Thrashing-Working Set Model -Demand Segmentation. **(9)**

I/O AND FILE MANAGEMENT

I/O: hardware - Application I/O interface - Logical Structure of I/O Functions -I/O Buffering - Disk I/O - Disk Scheduling. File Management: File Concepts - Access methods - Directory Structure - File System Structure - Allocation methods - Free Space Management.

CASE STUDIES

Mobile Operating System-Cloud and IoT Operating Systems. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Abraham Silberschatz. A, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley, 2013.*
2. *William Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall, Ninth Edition, 2018.*

REFERENCES

1. *H.M.Dietel, "An Introduction to Operating Systems", Addison Wesley, 2nd Edition,2007.*
2. *Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Pvt. Ltd, 2008.*

19MAM46 - MACHINE LEARNING LAB

[redacted]

PRE-REQUISITES

19MAM18

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Able to prepare the data for machine learning using data pre-processing and dimension reduction techniques.*

CO2 *: Able to build regression and classification models using benchmark datasets and give insights.*

CO3 *: Able to evaluate the performance of models using different performance measures.*

CO4 *: Able to use clustering techniques to group data and analyse the clusters.*

CO5 *: Able to design and develop prediction systems by choosing appropriate machine learning algorithms on real-time datasets.*

CONCEPTS TO BE COVERED

1. Perform descriptive analysis on different types of datasets
2. Apply pre-processing techniques on the dataset.
3. Build Regression models to predict future values for datasets like rainfall, earthquake etc.
4. Build Classification models and infer the results
    a. Decision tree classifier
    b. Naïve Bayes Classifier
    c. k-Nearest Neighbor Classifier
5. Apply cross validation techniques and evaluate the models using various performance metrics
6. Implement Perceptron and Artificial Neural Network for simple problems
7. Implement the non-parametric Locally Weighted Regression algorithm to fit data points.
8. Clustering
    a. Implement K-Means Clustering
    b. Implement Hierarchical clustering
9. Use market basket dataset and mine association rules using Apriori algorithm.
10. Build a complete Machine Learning pipeline with data visualization capabilities for a given prediction problem.

Note: Benchmark datasets may be downloaded from UCI machine learning repository, Kaggle etc for each of the above problems.

TOTAL : 60

19MAM47 - DESIGN AND ANALYSIS OF ALGORITHMS LAB

[redacted]

PRE-REQUISITES

19MAM17, 19MAM27

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Ability to analyze the efficiency of different algorithm design techniques and their proper usage in application problems.*

CO2 *: Implementing string matching and network flow algorithms.*

CO3 *: Able to apply data structure concepts in any applications of the dynamic programming*

CO4 *: Implement the design technique of backtracking in application to analyze the types of problem solved using backtracking*

CO5 *: Skill to compare, contrast, and understand the choice of various design techniques to solve a given problem.*

CONCEPTS TO BE COVERED

1. Problem using closest pair algorithm
2. Prim's minimum cost spanning tree
3. Kruskal's minimum cost spanning tree using min heap data structure, union and find operation
4. Problem related to greedy methods
5. Applications of dynamic programming
6. Application of all pairs shortest path problem
7. Application of graph coloring using backtracking
8. Applications of branch and bound technique
9. String matching algorithms

TOTAL : 60

19MAM48 - NETWORK PROGRAMMING LAB

[redacted]

PRE-REQUISITES

19MAM14

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Understand key protocols that support communication.*

CO2 *: Develop and implement connection-oriented and connectionless communication using Socket API for a given set of requirements.*

CO3 *: Develop and implement concurrent and iterative servers and analyze their functionality.*

CO4 *: Apply advanced programming techniques such as Broadcasting and Multicasting.*

CO5 *: Develop and implement simple network applications using NS-2 API for a given set of requirements and demonstrate its working.*

CONCEPTS TO BE COVERED

1. Basic networking commands
2. TCP one-way communication
3. TCP two-way communication
4. UDP one-way communication
5. UDP two-way communication
6. Concurrent, Iterative Server Implementation
7. IP header setting by kernel and displaying IP header
8. IP header setting by user and displaying IP header
9. IP Checksum Computation
10. Ping Implementation
11. Broadcasting using UDP
12. Multicast Communication using UDP
13. Simulations / Developing networking applications

Software / Tools : Java, Any open source Network Simulation tool

TOTAL : 60

ONE CREDIT COURSES

19MAMOC01- ECONOMETRICS AND MACHINE LEARNING IN FINANCE

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the fundamentals of econometrics and financial markets.*

CO2 *: Select and implement linear regression, logistic regression and random forest models as per business requirement.*

CO3 *: Understand the techniques of fine tuning the model parameters to improve its performance.*

CO4 *: Apply machine learning models to financial data and derive insights.*

ECONOMETRICS

Review of Probability and Statistics-Fundamentals of Economics

Financial Institutions, Products and Markets-Introduction to Financial Institutions-Introduction to Financial Products and Markets **(5)**

MACHINE LEARNING IN FINANCE

Review of R programming language-Review of machine learning

Building a multiple linear regression model

Building a logistic regression model

Validating Regression Models - Performance Diagnostics

Building a regression model to forecast losses for a trading desk

Building a logistic regression model to assess the credit quality of the borrower

Building a model using KNN, K-means and Naive Bayes classifier and understanding the testing the performance of the models

Building Prudential Life Insurance Assessment using Multinomial Logit and Random Forest.

Discussing resources for having a career in model development, validation, quantitative research and data science. **(10)**

TOTAL : 15

20MCA11 - MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Apply the concept of system of linear equation to real time problems*

CO2 *: Understand basic statistical concepts and measures.*

CO3 *: Apply the concept of probability distribution and random variables to different problems and apply the principles of correlation and regression.*

CO4 *: Analyse and solve problems using sampling theory.*

CO5 *: Acquire sound knowledge of analysis in the time series and decision making through analysis of variance in the field of data analysis.*

LINEAR ALGEBRA

System of linear equations - Solution Sets of Linear Systems - Linear Independence - Linear transformation - Matrix of linear transformations **(8)**

MEASURES OF CENTRAL TENDENCY AND DISPERSION

Measures of Central Tendency : mean, median, mode, Geometric mean, Harmonic mean - Measures of Dispersion: Range, mean deviation, standard deviation and coefficient of variation - Skewness and Kurtosis. **(8)**

PROBABILITY

Probability Axioms - Conditional Probability - Laws of total probability - Baye's theorem. One Dimensional Random variables - Discrete case and Continuous case - Distributions: Binomial, Poisson and Normal Distributions. Mathematical expectation - Two dimensional random variables - Joint distributions - mean and variance - Correlation and Regression. **(10)**

SAMPLING THEORY

Population and sample - sampling and its need - parameter of statistics - Test of significance - standard error- level of significance - test of hypothesis - test of significance for small samples: student t-test , F-test and Chi-square test: Goodness of fit and Independence of attributes - test of significance for large samples: mean ,proportion and variance. **(9)**

TIME SERIES AND ANALYSIS OF VARIANCE

Component of time series - measurement of trend - moving average method - least square method for linear and exponential curves. Basic principles of experimental design - analysis of variance for one way classification - completely randomized design - Latin square design. **(10)**

TOTAL : 45

REFERENCES

1. *David C Lay, "Linear Algebra and Its Applications", 5th Edition, Pearson Education, 2015.*
2. *Gupta, S.C. and Prof. Kapoor, V.K., "Fundamental of Applied Statistics", Edition 4, reprint, S.Chand & Co., 2015.*
3. *Gilbert Strang, "Linear Algebra and Its Applications", Brooke/Cole Ltd., New Delhi, Fourth Revised Edition, 2012.*
4. *Veerarajan.T, "Fundamentals of Mathematical Statistics", 1st Edition, Yes Dee Publishing Pvt Ltd, 2017.*
5. *Michael Baron, "Probability and Statistics for Computer Scientists", 2nd Edition, CRC Press, 2014.*
6. *Richard I Levin and David S. Rubin, "Statistics for Management", 8th Edition, Pearson (2017).*

20MCA12 - DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

***CO1** : Choose and design data structures such as array, linked list, stack, queue, trees and graphs to effectively model information in a problem.*

***CO2** : Choose and apply operations like insertion, deletion, traversal and searching mechanism on various data structures relevant to a problem.*

***CO3** : Judge efficiency trade-offs between data structures.*

***CO4** : Apply standard algorithms for searching and sorting based on given problem.*

***CO5** : Apply algorithm analysis techniques to evaluate performance of an algorithm.*

BASIC CONCEPTS

System Life Cycle - Algorithm Specification - Data Abstraction - Primitive Data Structures - Iterative and Recursive algorithms - Performance Analysis - best case - worst case - average case complexities - Notations. **(5)**

ARRAYS

Array as an Abstract Data Type (ADT) - Polynomial ADT - Sparse Matrix ADT - Representation of Multidimensional Arrays - String ADT. **(8)**

STACKS AND QUEUES

Stack ADT - Queue ADT - Mazing Problem - Evaluation of Expressions - Multiple Stacks and Queues. **(6)**

LINKED LISTS

Pointers - Singly Linked Lists - Dynamically Linked Stacks and Queues - Polynomials - Additional List Operations - Equivalence Relations - Sparse Matrices - Doubly Linked Lists. **(8)**

TREES

Introduction - Binary Trees - Binary Tree Traversals - Additional Binary Tree Operations - Threaded Binary Trees - Heaps - Binary Search Trees. **(6)**

GRAPHS

Introduction - Elementary Graph Operations - Graph Traversal - Minimum Cost Spanning Trees Shortest Paths. **(6)**

SEARCHING AND SORTING

Searching and List Verification - Insertion Sort - Quick Sort. **(6)**

TOTAL : 45

REFERENCES

1. *Ellis Horowitz, Sartaj Sahni, Anderson Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition, 2008.*
2. *Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures - A Pseudocode Approach with C", Cengage Learning, 2nd Edition, 2007.*
3. *Yashavant P. Kanetkar, "Data Structures through C", BPB Publications, 2nd Edition, 2003.*
4. *Seymour Lipschutz, "Data Structures with C", Schaum's Outline Series, McGraw Hill Publications, 2nd Edition, 2014.*

20MCA13 - DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

***CO1** : Identify the components of RDMS software and its significance.*

***CO2** : Analyze the data requirements and create conceptual design of the database using Entity Relationship model.*

***CO3** : Identify functional dependencies and apply normalization techniques to optimize the data design.*

***CO4** : Write SQL queries based on the functional requirements of any real world database applications.*

***CO5** : Implement different concurrency control techniques in transactions and recovery mechanisms used in database.*

DATABASES AND DATABASE USERS

Introduction - Characteristics of the database approach - Actors - Advantages- Database system, Concepts and Architecture: Data models, schemas and instances - Three schema architecture - Data Independence - DBMS Languages and Interfaces - DBMS component modules - Centralized DBMS architecture - Basic Client/Server Architecture. **(6)**

DATA MODELING

Using high-level conceptual data models - Entity types, Entity sets, Attributes and Keys, Relationship types, Relationship sets, roles and structural constraints, Weak entity types - ER Naming conventions-Examples of ER design - Relationship types of degree higher than two- EER Model: Subclasses, Super classes and Inheritance-Specialization and Generalization. **(7)**

RELATIONAL DATA MODEL

Relational Model Concepts - Relational Model Constraints - Relational Database Schemas - Update Operations, Transaction and Dealing with Constraint Violations. Relational Algebra and Calculus - Unary Operations - Set Operations - Binary Operations - Additional Relation Operations. ER and EER to Relational Mapping. **(6)**

BASIC SQL

SQL Data Definition - Specifying Basic Constraints in SQL- Basic Retrieval Queries in SQL- Insert, Delete, Update Statements in SQL- Complex Queries: Views - Schema Change Statements in SQL- PL/SQL Programming. **(7)**

NORMALIZATION

Informal Design Guidelines for Relational Schema- Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms- Boyce Codd Normal Form-Multi-Valued Dependency and Fourth Normal Form-Join Dependencies and Fifth Normal Form. **(7)**

TRANSACTION PROCESSING CONCEPTS

Introduction-Transaction and System Concepts - Desirable Properties of Transactions- Characterizing Schedules Based on Recoverability and Conflict Serializability. **(6)**

CONCURRENCY AND RECOVERY

Concurrency Control Techniques: Two Phase Locking-Concurrency Based on Time Stamp Ordering. Recovery: Database Recovery Concepts - Recovery Techniques Based on Deferred Update and Immediate Update-Shadow Paging. **(6)**

TOTAL : 45

20MCA14 - OPERATING SYSTEM PRINCIPLES

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

***CO1** : Demonstrate the structure of operating system, batch programming, system calls and virtual machines*

***CO2** : Demonstration of Kernel Management specific to concurrent process for Inter Process Communication systems*

***CO3** : Estimate system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first*

***CO4** : Recognize memory allocation and de-allocation for both static and dynamic storage*

***CO5** : Design and develop a simple File System using Disk and File System Management*

INTRODUCTION

Abstract view of an Operating system - extended view of resource manager - Over view: Simple batch system multi programmed batch systems - time sharing systems - parallel systems - distributed systems - real time systems - system structure: IO structure- memory- CPU-Kernals and micro kernels - dual-mode operation - operating - system services - system calls - Structure of Operating system- Various components of Operating system **(8)**

PROCESS MANAGEMENT

Process Concepts - Process creation - Process Termination - Process states - Process Description - Process control - Relationship between process and threads - Thread State - Thread Scheduling- Thread Synchronization-Multithreading model - Concurrent Process -process synchronization: critical section problem - mutual exclusion - Dekker's algorithm -synchronization hardware - semaphore - classical problem of synchronization - critical regions - monitors - atomic transaction - race condition. Dead lock characterization - handling dead locks - prevention - avoidance - detection and recovery - combined approach **(10)**

PROCESSOR MANAGEMENT

Basic Concepts - scheduling criteria - preemptive versus non-preemptive scheduling - scheduling algorithms: FIFO - Shortest job first, priority, round robin, multi level queue - multi level feedback queue - multiprocessor scheduling **(9)**

MEMORY MANAGEMENT

Basic Concepts - logical versus physical address - swapping - Fixed partition and Dynamic partition - Simple paging - multi level paging - Inverted paging - simple segmentation- combined paging and segmentation - virtual memory - demand paging - thrashing- Working set model -demand segmentation. **(9)**

I/O AND FILE MANAGEMENT

I/O: hardware - application I/O interface - Logical structure of I/O functions -I/O Buffering - Disk I/O - disk scheduling . File management: file concepts - access methods - directory structure - file system structure - allocation methods - free space management. **(9)**

TOTAL : 45

REFERENCES

1. *Abraham Silberschatz. A, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", John Wiley, 10th Edition, 2018.*
2. *William Stallings, "Operating Systems: Internals and Design Principles", Prentice-Hall, 2008.*
3. *H.M.Dietel, "An Introduction to Operating Systems", Addison Wesley, 2nd Edition, 2007.*
4. *Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Pvt. Ltd, 2008.*

20MCA15 - SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Choose applicable software life-cycle model to develop software for given customer need and justify choice with reference to complexity, cost and time.*

CO2 *: Determine software requirements based on customer need and develop industry standard Software Requirement Specification (SRS) document*

CO3 *: Construct models using functional and object oriented design principles, concepts and tools based on SRS document.*

CO4 *: Prepare suitable structural and behavioural analysis models based on SRS document.*

CO5 *: Formulate test cases and test data using white box and black box techniques to deliver defect free software.*

INTRODUCTION TO SOFTWARE ENGINEERING

Software Engineering - Process Models - Agile Development. **(9)**

MODELING

Understanding Requirements - Requirements Modeling - Scenario Based Methods, Class Based Methods, Behavior, Patterns, and Web/ Mobile Apps. **(9)**

DESIGN ENGINEERING

Design Concepts - Architectural Design - Component Level Design - User Interface Design - Pattern Based Design - WebApp Design - MobileApp Design **(9)**

QUALITY MANAGEMENT

Software Testing Strategies - Testing for Conventional Software - Testing for Object Oriented Software - Testing for Web Applications - Testing for MobileApps **(9)**

MANAGING SOFTWARE PROJECTS

Project Management Concepts - Process and Project Metrics - Maintenance and Reengineering - Emerging Trends in Software Engineering. **(9)**

TOTAL : 45

REFERENCES

1. *Roger S. Pressman, "Software Engineering - A Practitioner's approach", McGraw Hill International, 8th Edition, 2019.*
2. *Rajib Mall, "Fundamentals of Software Engineering", PHI. 5th Edition, 2018.*
3. *Pankaj Jalote, "An Integrated Approach to Software Engineering", Narosa Publishing House, 3rd Edition, Reprint 2019.*

20MCA16 - DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

20MCA12

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Choose appropriate Data structures for implementing given scenario.*

CO2 *: Demonstrate the applications of Linked Lists, Stack, Circular Queue and Priority Queue.*

CO3 *: Design recursive algorithms and implement in real time application.*

CO4 *: Demonstrate various operations on Heap and Binary Search Tree.*

CO5 *: Compare various sorting and searching techniques in term of time complexity and space complexity.*

CONCEPTS TO BE COVERED

1. Applications of 2D, 3D arrays
2. Compute time and space complexity for simple programs
3. Implement linear linked list, doubly linked list
4. Basic operations of stack- Array, linked list implementation
5. Building applications using stack
6. Basic operations of queue- Array, linked list implementation
7. Implementing priority queue, circular queue
8. Recursion - Towers of Hanoi, Fibonacci series
9. Building Binary Search Tree, operations on BST operations on AVL trees
10. Graph operations
11. Implement Sorting & Searching technique

20MCA17 - DATABASE MANAGEMENT SYTEMS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application*

CO2 *: Formulate simple DML SQL queries to retrieve the required data for real world applications*

CO3 *: Generate DML queries using Sub Queries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications*

CO4 *: Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors as required by OLTP applications*

CO5 *: Develop a database project by constructing ER model, Creating Tables and write SQL and PL/SQL blocks using RDBMS software.*

CONCEPTS TO BE COVERED

PART I : SQL

1. Implementation of DDL and DML Statements
2. DCL and TCL Commands
3. Single Line and Group Line functions
4. Queries using multiple tables, Join
5. Set Operations in SQL
6. Aggregating data using Group functions, Use of Group by/Having clause
7. Sub queries in SQL
8. Constraints
9. Views, Sequence, Index, Synonym

PART II : PL/SQL

1. Simple programs
2. Exception Handling
3. Trigger and Cursor
4. Functions, Procedure and Packages

PART III - Client/Server Application

1. Embedded SQL within a programming language like VB.NET/Java, etc.

20MCA18 - PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Write, test, and debug simple Python programs using conditional and looping statements.*

CO2 *: Develop modular programs using functions.*

CO3 *: Represent compound data using strings, lists, tuples, and dictionaries.*

CO4 *: Perform numerical operations on large datasets.*

CO5 *: Apply suitable library function to analyze and classify the data.*

CONCEPTS TO BE COVERED

1. Simple programs using variables and operators.
2. Program development using conditional, control and repetition statements.
3. Data manipulation using lists, tuples and dictionaries.
4. Handling text data using string handling operations and functions.
5. Modular programming using functions and lambdas.
6. The use of local, global and built-in names within functions.
7. File operations - read, write, copy, word count.
8. Performing numerical operations using NumPy package.
9. Analyzing large datasets using Pandas package.

20MCA19 - COMMUNICATION SKILLS

L	T	P	C
0	0	2	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Develop Communication and Soft skills through self assesment to excel at work place.*

CO2 *: Apply intonation rules, Phonetic patterns and formulate appropriate speech patterns .*

CO3 *: Apply the rules of grammar viz., Parts of speech, Idioms, Phrasal Verbs, Concord, Cause and Effect, purpose and function and write a technical passage correctly.*

CO4 *: Summarize a technical text and write a process description.*

CO5 *: Plan, Structure and present a 15 minutes presentation on a technical topic.*

COMMUNICATION SKILLS

Introduction - Code and Content - Stimulus and Response: Source - The Encoding Process - The Channel - The Decoding Process - The Receiver - Speaking Skills - Effective Speaking Guidelines - Communicating Soft Skills: A Self-assessment - Closing Tips on Improving Speaking Skills.

INTRODUCTION TO SPEECH SOUNDS

Pronunciation Etiquette - Phonetics: Phonetic Chart - Exercise - Syllabus - Stress - Accent - Rhythm - Intonation

FOCUS ON LANGUAGE

Synonyms and Antonyms - Idioms - Phrasal Verbs - Nouns-Compound Nouns & Noun Phrases - Gerunds & Infinitives - Subject Verb Agreement- Tenses - Adjectives and Adverbs - Active Passive voice - Cause and Effect Sentences - Purpose and Function.

READING & WRITING

Reading Comprehension - Techniques for Good Comprehension - Skimming & Scanning -Sequencing of Sentences - Paragraph Construction - Paragraph Patterns - Kinds of Paragraph - Writing a First Draft, Revising & Finalizing - Steps to Effective Précis Writing - Process Description - Dialogue Writing

LISTENING & SPEAKING

Importance of Listening & Empathy in Communication - Reasons for Poor Listening - Traits of a Good listener - Listening Modes - Short Dialogues - Short Conversation Achieving Confidence, Clarity & Fluency - Paralinguistic Features - Barriers to Speaking - Types of Speaking - Persuasive Speaking - Public Speaking-Conversations - Telephonic Conversations & Etiquette - Effective Presentation Strategies - Planning - Outlining & Structuring - Nuances of Delivery.

REFERENCES

1. *Meenakshi Raman, Sangeeta Sharma, "Technical Communication - English Skills for Engineers", Oxford University Press, New Delhi, 2015.*
2. *Kiranmani Dutt P., "A Course in Communication Skills", Cambridge University Press, 2011.*
3. *Samson T, "Innovate with English", Cambridge University Press, 2012.*
4. *Michael Mc Carthy and Felicity O'Dell, "English Vocabulary in Use", Cambridge University Press, 2012.*

20MCA21 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

20MCA11

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Apply various heuristic search strategies in optimal decision making.*

CO2 *: Understand uncertainty in real world situations.*

CO3 *: Employ first order logic for building knowledge base and demonstrate reasoning.*

CO4 *: Express different planning strategies to deal with problems.*

CO5 *: Describe and apply various knowledge representation techniques.*

INTRODUCTION

Foundation of AI - Agents and Environments- Concept of Rationality - Nature of Environments - Structure of Agents. **(6)**

PROBLEM SOLVING

Problem-Solving Agents and examples - Uninformed and Informed Search Strategies - Heuristic Functions - Local Search Algorithms and Optimization Problems - Local search in Continuous spaces - Searching with Nondeterministic actions and Partial Observations. **(12)**

ADVERSARIAL SEARCH AND CONSTRAINT SATISFACTION PROBLEMS

Games - Optimal Decisions in Games - Alpha-Beta Pruning. Constraint Satisfaction Problems (CSP) - Backtracking Search for CSPs - Local Search for Constraint Satisfaction Problems - Structure of Problems. **(8)**

KNOWLEDGE AND REASONING

Knowledge based Agents - The Wumpus World - Logic - Propositional Logic- Syntax and Semantics of First-Order Logic - Using First-Order Logic - Knowledge Engineering in First-Order Logic - Unification and Lifting - Forward Chaining - Backward Chaining - Resolution - Knowledge Representation. **(12)**

PLANNING

Definition of classical planning - Algorithms for Planning as State-Space Search - Planning Graphs - Hierarchical Task Network Planning - Planning and Acting in Nondeterministic Domains - Multi agent Planning. **(7)**

TOTAL: 45

REFERENCES

1. *Stuart J Russell and Peter Norvig, "Artificial Intelligence- A Modern Approach", Pearson Education Series, Fourth Edition, 2020.*
2. *Dan W.Patterson, "Introduction to AI and ES", Pearson Education, First Edition, 2007*
3. *M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.*
4. *Elaine Rich, Kevin Knight, Shiva Shankar B Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition, 2013.*
5. *David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.*

20MCA22 - ADVANCED JAVA PROGRAMMING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Design an object oriented software solution by discovering appropriate classes and objects and identifying attributes, behavior and hierarchy among the classes*

CO2 *: Write java programs by employing the object oriented constructs of inheritance and polymorphism for a given software requirement*

CO3 *: Organize the application programs into packages and prepare a deployable application for the given software solution*

CO4 *: Generate robust java applications for a given user requirement by employing applicable object oriented concepts and handling all possible exceptions*

CO5 *: Design and develop full stack web applications using React JS and Node JS*

BASIC LANGUAGE ELEMENTS

Features of Java Language - JVM and Bytecode - Data Types - Variables - Keywords - Constants - Comments - Operators and Expressions - Control Statements. **(5)**

OBJECT ORIENTED PROGRAMMING

Classes - Object & Object reference - Constructors and Initialization - Access Control - Accessor and Mutator Methods - Overloading Methods and Constructors - Static Members - Use of Modifiers with Classes and Methods.

ARRAYS AND STRINGS

Defining an Array - Initializing and Accessing Array - Multi-dimensional Array- String Handling - Mutable & Immutable Strings - Creating Strings using StringBuffer. **(7)**

EXTENDING CLASSES AND INHERITANCE

Use and Benefits of Inheritance in OOP - Types of Inheritance in Java - Inheriting Data members and Methods - Role of Constructors in Inheritance - Overriding Super Class Methods - Use of "super" keyword - Dynamic Method Dispatch - Using Abstract Classes - Using Final with Inheritance - The Object Class - Interfaces - Implementing Interfaces - Nested Interfaces - Variables in Interfaces. **(8)**

PACKAGES

Organizing Classes and Interfaces in Packages - Access Protection - Defining Package - Importing Packages.

EXCEPTION HANDLING

Exception Hierarchy - Types of Exception - Control Flow In Exceptions - Use of try, catch, finally, throw, throws in Exception Handling -In-built and User Defined Exceptions - Checked and Un-Checked Exceptions. **(5)**

THREADS

Java Thread Model - Need for Concurrent Programming - Thread Life Cycle - Thread Priorities - Creating a Thread - Extending a Thread - Creating Multiple Threads - Using Thread Methods - Thread Exceptions - Inter-thread communication - Synchronizing Threads. **(5)**

20MCA23 - VIRTUALIZATION AND CLOUD COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES

20MCA14

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure*

CO2 *: Describe various service delivery models of cloud computing architecture*

CO3 *: Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services and Google AppEngine.*

CO4 *: Describe the virtualization technology behind the working of cloud computing.*

CO5 *: Identify security and privacy issues in cloud computing and devise appropriate security solutions for protecting cloud resources.*

OVERVIEW OF VIRTUALIZATION

Basics of Virtualization - Virtualization and Cloud Computing - Need of Virtualization - Virtualization Types - Application Virtualization - Desktop Virtualization - Network Virtualization - Storage Virtualization - System-level or Operating System Virtualization - Server Virtualization: Understanding Server Virtualization, Types of Server Virtualization - Virtualization Advantages. **(7)**

RESOURCE VIRTUALIZATION

Virtual Machine Basics - Types of Virtual Machines, Resource Virtualization: Processor - Memory - Input/Output - Hypervisor Concepts and Types - Creation and Migration of Virtual Machines using open source Hypervisors. Case Study: VMWare - Xen - KVM. **(9)**

UNDERSTANDING CLOUD COMPUTING

Cloud Computing - Definition and Characteristics - History of Cloud Computing - Cloud Architecture - Benefits and Challenges of Cloud Computing - Cloud Deployment models: Private cloud - Public cloud - Hybrid cloud **(6)**

CLOUD SERVICE MODELS

Software-as-a-Service - Understanding SaaS - Architecture of SaaS - Platform-as-a-Service - Understanding PaaS - Architecture of PaaS - Infrastructure-as-a-Service - Understanding IaaS - Architecture of IaaS - Developing and Deploying applications using Google App Engine - Creating instances in Amazon EC2 - Deploying and Accessing Applications in Amazon EC2. **(8)**

CLOUD SECURITY AND TRUST MANAGEMENT

Privacy and Security in Cloud - Security Service Boundary - Securing Data - Encryption - Data Integrity and Auditing - Identity Management and Access Control - Trusted Computing - Cloud Storage Services: Create and manage Amazon S3 instances - Upload files to S3 after applying proper security mechanisms to ensure data confidentiality and integrity. **(9)**

DISASTER RECOVERY AND SCALING

Disaster Recovery Planning - Disasters in Cloud - Disaster Management - Scaling a Cloud Infrastructure: Capacity Planning - Cloud Scale. **(6)**

TOTAL : 45

20MCA24 - SOA AND WEB SERVICES

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand and use the concepts of Service-Oriented Architecture for building platform independent distributed applications.*

CO2 *: Design and develop simple to complex web services by analyzing the requirements of web applications.*

CO3 *: Apply the concepts of RESTful web services and create dynamic web applications*

CO4 *: Determine the security requirements of web services and incorporate them in building web applications.*

CO5 *: Examine the requirements of distributed applications, identify and justify the need for using web services.*

SERVICE ORIENTED ARCHITECTURE

Architecture for Enterprise applications-Software platforms for Enterprise applications-Evolution of SOA - Key components of SOA - Considerations for Enterprise-wide SOA- Strawman architecture - Enterprise SOA layers- Solution architecture for Enterprise Applications - SOA Programming Models **(8)**

DISTRIBUTED INFORMATION SYSTEMS

Understanding middleware - RPC-TP Monitors - Object Brokers- Message Oriented Middleware-Technologies for connecting remote clients **(8)**

INTRODUCTION TO WEB SERVICES

Web Services and their Approach to Distributed Computing-Web Service Technologies - Web Services Architecture Case studies on overheads in gRPC and Business Process Management **(9)**

WEB SERVICES TECHNOLOGIES

JSON-gRPC open source RPC framework-WSDL-UDDI-RESTful Web Service: Architecture- RESTful, Web Service Design Technologies Relationship Run time Vs Design, SoaML Unified Modelling language, Service components and Profile **(12)**

WEB SERVICE SECURITY AND PERFORMANCE

Securing Web Service-Custom Token Authentiction-HTTP Basic Authentiction-OAuth- Performance **(8)**

TOTAL : 45

REFERENCES

1. *K. Milos SIA, "Web Services and Service Oriented Architecture", SIA Publishers, 2nd Edition 2020.*
2. *Thomas Erl, "SOA Principles of Service Design", Prentice Hall, 3rd Edition, 2017*
3. *Shankar Kambhampaty, "Service-Oriented Architecture for Enterprise and Cloud Applications", Wiley India, 2nd Edition, 2010.*
4. *Jose Sandoval, "RESTful Java Web Services", Packt Publishing, 2009.*
5. *Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, "Web Services", Pearson, 2018.*

20MCA25 - ARTIFICIAL INTELLIGENCE LAB

L	T	P	C
0	0	4	2

PRE-REQUISITES

20MCA11, 20MCA18

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Design and implement heuristic search procedures.*

CO2 *: Develop constraint satisfaction problem solution.*

CO3 *: Design and implement solutions for classical Artificial Intelligence problems.*

CO4 *: Design and implement knowledge based system.*

CO5 *: Become familiar with use of Artificial Intelligence tools.*

CONCEPTS TO BE COVERED

1. Implementing state space search algorithms for solving puzzle problems.
   a. A* Search
   b. Hill-climbing Search.
2. Implementation of MiniMax Search Procedure with alpha beta pruning for finding the solutions of games.
3. Implementation of Constraint Satisfaction Problem for solving Crypt-arithmetic.
4. Develop a knowledge base system consisting of facts and rules about some specialized knowledge domain of your choice.
5. Implementation of Unification algorithm by considering Resolution concept.
6. Solve the classical Water Jug problem.
7. Solve the classical Monkey Banana problem.
8. Solve the classical Blocks World problem.
9. Development of programs for simulation of computer games like : Tic-Tac-Toe, N-queens Problems, travelling salesman problem, Chess, etc.

20MCA26- ADVANCED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

20MCA22

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understanding Object oriented concepts and developing software modules.*

CO2 *: To develop effective GUI on Client side using Java Client and Server Side Technologies*

CO3 *: Write codes to handle the requests of client using JSP,*

CO4 *: Handle the backend processing from both client and server side.*

CO5 *: Choose a suitable development stack for the industry requirements.*

1. Exercises on basic OOPS Concepts and Java applets
2. Web Page using Bootstrap CSS
3. Client side Scripting using javascript
4. Handling Html elements with jquery
5. Design User Interface Component using React
6. Server side scripting using JSP
7. Storing and exchanging data using JSON

20MCA27 - PROFESSIONAL ENGLISH

L	T	P	C
0	0	2	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Generate ideas, Acquire right communication and interpersonal skills.*

CO2 *: Set career goals and formulate strategies by Prioritizing, Organizing and Scheduling for the required task.*

CO3 *: Project appropriate grooming and right etiquette in the corporate context.*

CO4 *: Prepare a job application letter with a Resume or C.V.*

CO5 *: Exhibit appropriate grooming and right etiquettes for Interviews and Group Discussion tasks.*

SOFT SKILLS

Introduction to Soft Skills - Lessons from the Three Case Studies - Change in Today's Workplace: Soft Skills as a Competitive Weapon - Antiquity of Soft Skills - Classification of Soft Skills: Time Management - Attitude - Responsibility - Ethics, Integrity, Values and Trust - Self-confidence and Courage - Consistency and Predictability - Teamwork and Interpersonal Skills - Communication and Networking - Empathy and Listening Skills - Problem Solving, Troubleshooting and Speed Reading - Leadership

GOAL SETTING AND TIME MANAGEMENT

Goal Setting - Immediate, Short Term and Long Term Goals - Smart Goals - Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management -Identifying Time Wasters - Time Management Skills.

ETIQUETTE

Etiquettes - Email, Professional, Dining & Telephone -Social Etiquette - Corporate Etiquette - Personal Grooming - Using minimal Body Language - Leadership and Entrepreneurship : Corporate Training - Professionalism - Self awareness - Creativity skills - Cognitive Development - Assertiveness - Positive Thinking and Attitude.

WRITING

- Job Applications: Writing Resume or Curriculum Vitae: Introduction - Difference between a Resume and a CV - The Strategy of Resume Writing - A Favourable First Impression - The Main Body of the Resume - A Fresher's Resume - A Few Helpful Tips - E-mails.

SPEAKING

Job Interviews: Introduction - Types of Interviews - Groundwork before the Interview -Importance of body Language in Interview - Need for proper Articulation - Concluding an Interview - Telephonic or Video Interview - A Mock Interview - Group Discussion: Introduction - Ability to Work as a Team - Communication Skills - Active Listening - Non-verbal Communication - Leadership and Assertiveness - Reasoning - Ability to Influence - Innovation. Creativity, and Lateral Thinking - Flexibility - Key Steps to Succeed in a Group Discussion - The Responsibility of the First Speaker - Concluding the Discussion - Dos and Don'ts during a Group Discussion

REFERENCES

1. *Meenakshi Raman, Sangeeta Sharma, "Technical Communication - Principles and Practice", 2nd edition, Oxford University Press, New Delhi, 2015.*

2. *Simon Sweeney, "English for Business Communication", Cambridge University Press, 2013.*
3. *Mukhopadhyay Lina, "Poly Skills: A Course in Communication Skills and Life Skills" Cambridge University Press, 2012.*
4. *Krishna Mohan & Merra Banerji, "Developing Communication Skills", 2nd Edition. Macmillan Publishers India Ltd. 2012.*
5. *Mitra K.Barun, "Personality Development and Soft Skills", Oxford University Press, 2011.*

20MCA28 - MINI PROJECT

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Analyze different domains, identify problems that require software solutions and justify.*

CO2 *: Choose appropriate problem solving techniques for the identified problem.*

CO3 *: Practice software engineering principles and programming skills in developing software solutions.*

CO4 *: Test the developed software to ensure compliance of requirements.*

CO5 *: Write the project report demonstrating the contribution and complete technical details.*

Students have to undertake a project approved by their concerned supervisor. Starting from Analysis to implementation, they have to follow software engineering concepts effectively. At the end of the semester, Students have to submit a report. Evaluation of the project will be carried out by a panel of examiners duly constituted twice besides the final presentation.

AREAS FOR PROJECT

1. Application using Android platform
2. Application in Internet of Things
3. Data Analytics / Data Mining applications using latest implementation software.
4. Network based applications
5. Application on Cloud computing
6. Application in Security/Block chain Management
7. Accounting / Commercial / Information Management / Scientific / web applications using latest software.
8. Not limited to the above. Any latest Concepts / Social problems can be considered.

20HAC01 - HACKATHON

L	T	P	C
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- One Credit course on Hackathon is Compulsory for the students of 2nd Semester MCA
- Evaluation will be done under continuous assessment Scheme
- The maximum mark is 100 and will be converted to appropriate grades. Pass is mandatory for the award of degree.
- There will be two reviews and the performance of the students participating in the Hackathon
- will be jointly evaluated by two examiners (One Internal + One External) during 2nd semester
- 75% attendance is mandatory for the students to appear in the final review.
- Candidates have to submit a detailed report on the Hackathon that he or she has attended and this report should be submitted during the final review.
- Candidates with shortage in attendance or failing to attend the final review have to redo the hackathon during the even semester of the next academic year.
- Credits earned shall be over and above of the credit requirement for the award of degree. Idea Submission and Evaluation Process
- Students are unveiled of problems on various hackathon portals for being aware of hackathons few of them listed as below

Sl.No	Name of Hackathon	Company
1.	Codevita / HackQuest	TCS
2.	Tata Cruicible Campus Hackathon	TATA
3.	Code Gladiators 2020	TECHGIG
4.	Smart India Hackathon 2020	MHRD

- Theme and problem statement of hackathon is chosen and duration and dates of hackathon are specified
- Students are allowed to participate as 6 member teams.
- The evaluation is of two stages first one for submission of a proposal and the second one for building a prototype.
- The hackathons are to be presented by the teams in two reviews first to the internal member and final to the external member
- Mark split up for internal and external members are decided with a total of 100 marks of which the pass percentage is 50%.

20MCA31 - CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand the basic principles of security and develop simple cryptosystems using classical ciphers*

CO2 *: Analyze the adequate basic security required by any computing system and apply cryptography algorithms to protect the confidentiality of information resources across networks*

CO3 *: Analyze security policies and best practices and apply suitable security technique to achieve integrity, and non-repudiation of information*

CO4 *: Demonstrate different threats and vulnerabilities of network security and apply suitable security controls to protect internal and external networks*

CO5 *: Understand threats against various system components and choose a best technique to control the threat*

CRYPTOGRAPHY : CONCEPTS AND TECHNIQUES

Need for Security - Security Approaches - Principles of Security - Plain Text and Cipher Text - Substitution Ciphers -Transposition Ciphers - Stream and Block Ciphers - Encryption and Decryption - Symmetric and Asymmetric Key Cryptography - Steganography. **(7)**

ENCRYPTION TECHNIQUES

Data Encryption Standard - Advanced Encryption Standard - Confidentiality using Symmetric Encryption - Public-Key Cryptography and RSA - Key Management - Diffie-Hellman Key Exchange - Elliptic Curve Cryptography - Symmetric Key Distribution - Kerberos - X.509 Authentication Service. **(10)**

HASH FUNCTIONS AND SIGNATURES

Message Authentication and Hash Functions - Description of MD Hash Family - Secure Hash Algorithms - SHA-512 - Digital Signatures and Authentication Protocols - Digital Signature Standard - Process - Services - Attacks on Digital Signature - Digital Signature Schemes. **(10)**

NETWORK SECURITY

Threats in Networks: Vulnerability - Categories of Attack - Software Based Packet Sniffing - Impersonation - Message Confidentiality Threats - Message Integrity Threats - Website Vulnerabilities - DoS - DDoS. Network Security Controls: Security Threat Analysis - Architecture - Encryption - Content Integrity - Strong Authentication - Access Controls - Wireless Security - Alarms and Alerts - Honeypots - Firewalls - Intruders - Intrusion Detection Systems - Types - Goals - Strengths and Limitations - Snort. **(9)**

SYSTEM SECURITY

Program Security: Secure Programs - Nonmalicious Program Errors - Targeted Malicious Code - Controls against Program Threats. Database Security: Security Requirements - Reliability and Integrity - Two-Phase Update - Redundancy / Internal Consistency - Recovery - Concurrency / Consistency - Monitors - Case studies on Cryptography and Security - Single Sign On (SSO). **(9)**

TOTAL : 45

REFERENCES

1. *William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson Education, 2017.*
2. *Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 4th Edition, Pearson Education, 2007.*
3. *Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 3rd Edition, 2017.*
4. *Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2017.*
5. *Joseph Migga Kizza, "A Guide to Computer Network Security", Springer International Edition, 2010.*

20MCA32 - MACHINE LEARNING

L	T	P	C
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PRE-REQUISITES

20MCA11

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Recognize fundamental issues and challenges of machine learning : data, model selection, model complexity, supervised and unsupervised learning.*

CO2 *: Understand and apply Decision trees and Artificial Neural Networks.*

CO3 *: Distinguish the strength and weakness of Bayesian learning.*

CO4 *: Analyze and apply Instance based learning and rule based learning.*

CO5 *: Assess capability of Reinforcement learning and study its application.*

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES

Designing a Learning System - Perspectives and Issues in Machine Learning - Concept Learning Task- Concept Learning as Search- Find-S- Version Space- Inductive bias. Decision tree representation, Decision tree Learning Algorithm- Hypothesis Basis- Inductive bias-Issues in Decision Tree learning. **(10)**

ARTIFICIAL NEURAL NETWORKS

Introduction- Neural Network Representations- Perceptrons - Multilayer Networks Back Propagation Algorithm- Remarks on the Back propagation Algorithm- Face Recognition Example- Advanced Topics in Artificial Neural Networks. **(10)**

EVALUATING HYPOTHESIS

Motivation, Estimating Hypothesis Accuracy, Basis of Sampling Theory, A General Approach for Deriving Confidence Intervals - Difference in Error of Two Hypothesis- Comparing Learning Algorithms **(5)**

BAYESIAN LEARNING

Bayes Theorem - Bayes theorem and Concept Learning- Maximum Likelihood and Least Square Error Hypothesis- Maximum Likelihood Hypothesis for Predicting Probabilities- Minimum Description Length Principle- Bayes Optimal Classifier- Gibs Algorithm- Naive Bayes Classifier-Bayesian Belief Networks- The EM Algorithm.

INSTANCE BASED LEARNING : k - Nearest Neighbour Learning, Locally weighted Regression- Radial Basis Functions- Case based Reasoning. **(10)**

LEARNING SET OF RULES : Sequential Covering Algorithms- Learning First Order Rules- Learning Sets of First order Rules FOIL- Induction as Inverted Deduction- Inverting Resolution.

REINFORCEMENT LEARNING : The learning task - Non deterministic Rewards and Actions - Temporal Difference Learning - Generalizing from Examples - Relationship to Dynamic Programming. **(10)**

TOTAL : 45

REFERENCES

1. *Tom M Mitchell, "Machine Learning", McGraw Hill, 1st Edition, 2018.*
2. *Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 4th Edition, 2020.*

20MCA33 - CRYPTOGRAPHY AND NETWORK SECURITY LAB

L	T	P	C
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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand the classical crypto systems used for the confidential information exchange and use different ciphers in secure data transfer*

CO2 *: Demonstrate understanding of security best practices and techniques to preserve confidentiality of information at rest, and in Transit and apply suitable cryptographic algorithm to preserve the confidentiality of information*

CO3 *: Apply hash and message digest algorithms to preserve the integrity of information*

CO4 *: Apply standard digital signature scheme to verify the authenticity of information and use Steganography to hide secret messages*

CO5 *: Demonstrate the working of network security tools including Packet capturing and Intrusion Detection*

CONCEPTS TO BE COVERED

1. Implementing Substitution and Transposition ciphers
2. Applying symmetric encryption algorithms to protect the confidentiality of users data
3. Applying asymmetric encryption algorithms to protect the confidentiality of users data
4. Comparing the performance of symmetric and asymmetric encryption algorithms in terms of computation time and storage space
5. Applying hash and message digest algorithms to ensure the integrity of users data
6 Using standard digital signature scheme to verify the authenticity of user's document
7. Applying Steganography to hide secret message in a document (image / text)
8. Given a scenario, choose appropriate security mechanisms to ensure confidentiality, integrity and non-repudiation of user's data and apply them to protect the data
9. Learning to install and work with an open source Packet capturing tool
10. Learning to install and work with an open source Intrusion Detection tool

20MCA34 - MACHINE LEARNING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

20MCA11, 20MCA18

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Introduce students the basic concepts and techniques of machine learning.*

CO2 *: Develop skills using recent machine learning software for solving practical problems.*

CO3 *: Gain experience of doing independent study and research in machine learning.*

CO4 *: Apply various classification and clustering techniques for problems.*

CO5 *: Design and development of game and traffic control system using reinforcement learning.*

CONCEPTS TO BE COVERED

1. Implement the FIND-S algorithm.
2. Demonstrate Decision Tree - ID3 Algorithm
3. Supervised Learning : Classification
   i) Implement Naïve Bayes Classifier on a Data set. Test for Accuracy and Precision.
   ii) Implement K-Nearest Neighbor Classifier on a Data set. Test for Accuracy and Precision.
4. Implement Artificial Neural Network Algorithms to simulate logical gates.
5. Implementing the Backpropagation algorithm and test the same using appropriate data sets.
6. Implement Bayesian network to demonstrate the diagnosis of a medical data.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file.
8. Implement clustering algorithm for identifying cancerous data.
9. Apply reinforcement learning and develop a game of your own.
10. Develop a traffic signal control system using reinforcement learning technique.

20MCAIT01 - INPLANT TRAINING

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0	0	0	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 : *Exposure to the industrial environment, recognize the requirement of the industry and cope up with the Industrial scenario.*

CO2 : *Recognize career paths taking into account their individual abilities and prepare a report about the work experience in industry*

CO3 : *Communicate effectively about the training through technical presentation.*

CO4 : *Develop their employability and start-up skills and to enhance the ability to engage in, life-long learning*

CO5 : *Develop individual confidence to handle various engineering assignments and ability to think strategically and expose themselves to acquire life skills to meet societal challenges*

20MCA41 - PROJECT WORK AND VIVA VOCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Supervisor assigned.

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Comprehensively demonstrate understanding of the software development processes and practices.*

CO2 *: Work to a professional standard in a specified role.*

CO3 *: Contribute effectively/co-operatively within a team.*

CO4 *: Exhibit industry-standards of professionalism in their work through knowledge or use of latest techniques and tools.*

CO5 *: Reflect on the work done and own role and present their work through a report and formal viva.*

20MCAOC01 - RECENT TRENDS IN WEB TECHNOLOGY

L	T	P	C
1	0	0	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

Web development using HTML, CSS and JavaScript

AJAX - Bootstrap CSS - Develop Website using Html5 and Bootstrap - Introduction to React - Client side JS.

Introduction to NodeJs - Server side JS.

Based on the industry requirements additional topics may be included as and when needed.

TOTAL : 15

REFERENCES

1. *https://developer.mozilla.org/en-US/docs/Learn/HTML/Introduction_to_HTML*
2. *http://web.mit.edu/6.813/www/sp16/labs/lab1-html-css/*
3. *https://github.com/kbalog/web-programming*
4. *https://speakerdeck.com/kbalog/web-programming-ajax*
5. *https://speakerdeck.com/kbalog/web-programming-bootstrap*
6. *https://developer.mozilla.org/en-US/docs/Learn/Tools_and_testing/Client- Side_JavaScript_frameworks/React_getting_started*
7. *https://developer.mozilla.org/en-US/docs/Learn/Server-side/First_steps/Introduction*
8. *https://developer.mozilla.org/en-US/docs/Learn/Server-side/Express_Nodejs*

20MCAE101 - GRAPHICS AND MULTIMEDIA

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Employ point- line and circle scan conversion algorithms for drawing graphical object.*

CO2 *: Employ fill area scan conversion algorithms for drawing of graphical objects.*

CO3 *: Construct a world coordinate scene from its constituent elements (defined in their local coordinate systems) by applying geometric transformations on the constituent elements.*

CO4 *: Determine the clipping operations required to change from the current display to a new display- when interactive operations through keyboard or mouse are performed.*

CO5 *: Analyse the performance of image- video- audio- text and graphics data compression techniques.*

INTRODUCTION

Graphics hardware - raster and random scan - display devices - input devices -hard copy devices. Implementation algorithms for graphic primitives - line- poly line- circle- ellipse- curves - attributes **(8)**

TRANSFORMATIONS AND VIEWING

wo dimensional geometric transformations - translation - scaling - rotation - reflection - shearing - composite transformations. Two dimensional viewing - window port- viewport - clipping - point - line - Cohen-Sutherland- Liang-Barsky- Nicholl-Lee-Nicholl. Three-Dimensional Geometric Transformations -Translation - Scaling - Rotation - reflection - shearing - affine transforms **(10)**

COMPUTER ANIMATIONS

Raster methods - double buffering - raster operations - morphing - simulating accelerations - motion Specifications - character animations - motion capture - OpenGL animation procedures. **(8)**

INTRODUCTIONS TO MULTIMEDIA

Multimedia Applications - Multimedia Systems Architecture - evolving technologies - defining objects - Compression and Decompression - Binary image compression - Color - gray scale- Still-video images - JPEG compression - video Image Compression. **(10)**

FILE FORMATS AND MULTIMEDIA I/O

Flich - text format - TIFF - RIFF - MIDI file formats- JPEG DIB- MPEG- AVI file formats. TWAIN - architecture - setting up new WAVE type. Pen Input- Video image display systems- Print output- Image Scanners- Digital Video and Audio- Video images and animation- Full-Motion video. **(9)**

TOTAL: 45

REFERENCES

1. *Donald D. Hearn, M. Pauline Baker, Warren, "Computer Graphics with Open GL", 4th Edition, Prentice Hall, 2010.*
2. *Prabhat K. Andleigh, KiranThakrar "Multimedia Systems Design", 2nd Edition, Prentice Hall of India Pvt. Ltd., 2007.*
3. *James D. Foley, Andries Van Dam, Steven K. Feiner, F. Hughes John, "Computer Graphics", 3rd Edition, Prentice Hall of India Pvt. Ltd., 2012.*

4. *Ralf Steinmetz and KlaraNahrstedt, "Multimedia: Computing- Communications and Applications", 2nd Edition, Pearson Educations, 2009.*
5. *Tarun kumar ghosh, "Graphics and Multimedia" First Edition, Penram, 2017.*
6. *Pakhira, Malay K, "Computer Graphics, Multimedia and Animation", Second Edition, PHI, 2017.*

20MCAE102 - ADVANCED DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES

20MCA13

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Analyze the background processes involved in queries and determine their impact on database operations and design.*

CO2 *: Analyze different methods and techniques for parallel and distributed query processing and apply appropriate algorithms for optimizing query execution.*

CO3 *: Demonstrate the usage of different architecture and design strategies for distributed and parallel databases.*

CO4 *: Apply the concepts of SQL for enterprise applications.*

CO5 *: Design data models for advanced applications using object oriented and other databases.*

QUERY PROCESSING

Overview - Measures of query Cost - Selection Operations - Sorting - Join Operations - Other Operations -Evaluation of Expressions.

QUERY OPTIMIZATION

Overview-Heuristics in query Optimization **(7)**

PARALLEL DATABASES

Introduction - I/O Parallelism - Interquery Parallelism - Intraquery Parallelism - Intraoperation Parallelism - Interoperation Parallelism.

DISTRIBUTED DATABASES

Homogenous and Heterogenous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Availability - Distributed Query Processing - Heterogenous Distributed Database - Cloud Based Databases. **(12)**

XML

Structure of XML Data - XML Document Schema - Querying and Transformation - Application Program Interfaces to XML - Storage of XML Data - XML Applications. **(9)**

OBJECT AND OBJECT RELATIONAL DATABASES

Introduction to Complex Objects - Object model of ODMG-ODL - OQL - Object Relational and Extended - Relational Systems - SQL and its Relational Features - Nested Relational Model. **(8)**

NoSQL DATABASES

Introduction to NoSQL - SQL vs NoSQL - Types - MongoDB - CRUD Operations - Advantages and Disadvantages. **(9)**

TOTAL : 45

REFERENCES

1. *Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th Edition, Mc Graw Hill International Edition, 2019.*
2. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2006.*
3. *Raghu Ramakrishnan, Johannes Gehrke, "Databases Management Systems", 3rd Edition, Graw Hill, 2003.*

20MCAE103 - DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES

20MCA13, 20MCA14

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Analyze the advantages and disadvantages of various models for a distributed system*

CO2 *: Compare Remote Procedure Call and Remote Method Invocation from the perspective of developing distributed applications*

CO3 *: Describe the role of distributed Operating System and distributed File System in developing distributed systems*

CO4 *: Design the process of discovering and locating distributed objects using Naming and Directory services*

CO5 *: Demonstrate the concurrency control mechanism for distributed transactions*

INTRODUCTION

Characterization of Distributed Systems : Example of Distributed Systems - Resource Sharing and Web - Challenges - System Models : Architectural Models and Fundamental Models - Distributed Objects and Components.

Remote Invocation : Communication between Distributed Objects - Request - Reply protocols - Remote Procedure Call - Remote Method Invocation. **(9)**

OPERATING SYSTEM SUPPORT

Introduction - Operating System Layer - Protection - Process and Threads - Communication and Invocation - OS Architecture.

DISTRIBUTED FILE SYSTEMS

Introduction - File Service Architecture - Sun Network File System. **(8)**

NAME SERVICES

Name Services and DNS - Directory and Discovery Services - Global Name Service - X.500 Directory Service.

CLOCK SYNCHRONIZATION

Clocks - Events and Process States - Synchronization - Logical time and Logical clocks - Global States. **(10)**

DISTRIBUTED TRANSACTION MANAGEMENT

Transaction and Concurrency Control: Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Time Stamp Ordering - Comparison of Methods for Concurrency Control. Distributed Transactions: Flat and Nested - Atomic Commit Protocols - Concurrency Control - Distributed Deadlock - Transaction Recovery. Replication: System model and Group Communication Fault Tolerant Services - Highly Available Services - Transactions with Replicated Data. **(12)**

DISTRIBUTED SHARED MEMORY

Design and Implementation Issues - Sequential and Release Consistency - Other Consistency Models. **(6)**

TOTAL : 45

20MCAE104 - GRID AND CLUSTER COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand the basics of distributed systems and programming models.*

CO2 *: Examine grid computing architecture and its components.*

CO3 *: Apply concepts of grid computing and build distributed applications.*

CO4 *: Access and Identify the need for cluster computing.*

CO5 *: Design cluster computing based solutions for real world problems by incorporating load balancing.*

GRID COMPUTING

The data centre- Cluster and Grid computing-Meta computing-Different types of Grids-Web services and the grid. **(7)**

TECHNOLOGIES AND ARCHITECTURE FOR GRID

Clustering and grid computing- Issues in data grids-Functional requirements in grid computing-Standards-Trends in large data grids. **(8)**

GRID STANDARDS AND TOOLKIT

Standards organization- Toolkit- Frameworks and middleware-Globus toolkit -Standards:OGSA and WSRF-Sample grid projects. **(8)**

CLUSTER COMPUTING

Basic Concepts: Approaches to parallel computing- Architecture and functionality of cluster -Categories of cluster. Cluster middleware-Early cluster architecture and High through put Computing Clusters-Setting up and administering a cluster. **(10)**

PROCESS AND MEMORY IN CLUSTER COMPUTING

Cluster architectures for high availability-Process scheduling: Job Management System-Resource management system - Jobs and Resource - Scheduling parallel jobs - Load sharing and load balancing-Distributed shared memory:Issues-Write synchronization for data consistency. **(12)**

TOTAL : 45

REFERENCES

1. *Prabhu C.S.R., "Grid and Cluster Computing" PHI Learning, 2018 Reprint*
2. *Daniel Minoli, "A Networking Approach to Grid Computing" John Wiley and Sons, INC Publications, 2010.*
3. *Hamid R. Arabnia, Fernando G. Tinetti, "Grid, Cloud and Cluster Computing and Applications", Csrea Publishers, 2017.*

20MCAE105 - INTERNET OF THINGS

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand general concepts of Internet of Things (IoT)*

CO2 *: Recognize various devices and challenges*

CO3 *: Apply design concept to IoT solutions*

CO4 *: Analyze various M2M and IoT architectures*

CO5 *: Develop IoT solutions using sensors, actuators and Devices*

INTRODUCTION TO IOT

Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Scope, Characteristics - Applications - Physical and logical design of IoT, Communication models & APIs - IoT Enabling Technologies. **(8)**

M2M vs IoT AN ARCHITECTURAL OVERVIEW

IoT and M2M - System Architecture - Main design principles and needed capabilities - An IoT architecture outline, standards considerations. **(5)**

IoT REFERENCE ARCHITECTURE

Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world- Introduction, Technical design Constraints. **(5)**

IoT LOGICAL DESIGN USING PYTHON

Introduction to Python - IoT Physical devices and Endpoints - Building blocks of an IoT device - Raspberry pi - Raspberry Pi interfaces - Programming Raspberry Pi with Python - Other IoT devices. **(12)**

DEVELOPING IOT SOLUTIONS

Introduction to Arduino - Implementation of IoT with Arduino and Raspberry pi , Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT. **(10)**

DOMAIN SPECIFIC APPLICATIONS OF IOT - CASE STUDIES

Home Automation - Cities - Environment - Agriculture - Productivity Applications **(5)**

TOTAL : 45

REFERENCES

1. *Arshdeep Bahga, Vijay Madisetti "Internet of Things: A Hands on Approach", Universities Press, 2014.*
2. *Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle,"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.*
3. *Dr. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, "Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024", Yole Dévelopment Copyrights, 2014*
4. *Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015.*

20MCAE106 - SOFTWARE METRICS AND MEASUREMENT

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Analyze the problem to ascertain the type of software measurement.*

CO2 *: Apply selected statistical methods and enlist the findings of analysis.*

CO3 *: Design and tailor the selected metric to match the information reliabilities need.*

CO4 *: Determine a plan to decide what data to collect and who should collect it.*

CO5 *: Interpret and communicate the metric results.*

FUNDAMENTALS OF SOFTWARE MEASUREMENT

Measurement in software engineering - scope of software metrics - measurement and models - measurement scales and scale types - classifying software measures - determining what to measure software measurement validation. Software metrics data collection - Analyzing software measurement data: Introduction- Analyzing the results of experiments- Simple analysis Techniques- Overview of statistical tests. **(10)**

SOFTWARE METRICS

Product quality metrics- In- Process quality metrics - Complexity metrics and models - Size metrics - Effort- cost and time measurement - Object Oriented metrics - software maintenance metrics **(10)**

SOFTWARE RELIABILITY MEASUREMENT

Basics of reliability theory- software reliability problem- parametric reliability growth models- the recalibration of software reliability growth predictions **(9)**

METRICS TO MANAGE PROJECTS

Tracking software progress - software project metrics - utilization and efficient project management **(7)**

MEASUREMENT AND MANAGEMENT

Planning a measurement program - Metrics plan - developing goals- questions and metrics - mapping measures to activities - measurement tools - measurers- analysts and audience - Measurement in practice. **(9)**

TOTAL : 45

REFERENCES

1. *Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Second Indian Reprint, New Delhi, 2014.*
2. *N orman Fenton and Shari Lawrence Pfleeger, "Software Metrics - A Rigorous & Practical Approach", Third Edition, Thomson Asia Pvt Ltd, Singapore- 2014.*
3. *Highsmith J, "Agile Software Development Ecosystems", Addison Wesley, 2005.*
4. *Kent Beck, "Junit Pocket Guide", O'Reilly Media, First Edition, 2004.*
5. *Craig Larman, "Agile & Iterative Development - A Manager's Guide", Pearson Education, 2009.*

20MCAE107 - AGILE METHODS FOR SOFTWARE DEVELOPMENT

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PRE-REQUISITES

20MCA15

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Ascertain the need of software development methodologies with agility and self adaptability features to develop the software which meets the user needs.*

CO2 *: Compare the practices followed in different agile methodologies and choose the suitable methodology for a given project*

CO3 *: Synthesize the various agile methodology practices to produce a methodology for a project*

CO4 *: Develop the system by employing test first programming concept using Junit framework*

CO5 *: Develop a simple application using Scrum or XP methodology*

INTRODUCTION TO AGILE DEVELOPMENT

Agile and Self Adapting : The Cooperative Game Principle - Agile Overview-Evolution of Agile - Agile Software Development Ecosystem -Iterative and Evolutionary approach. Evolution of Agile Methodologies - Agile outside Software Development **(9)**

AGILE SOFTWARE DEVELOPMENT ECOSYSTEMS (ASDE)

The Scrum Process - Scrum's Contributions - Dynamic Systems Development Method (DSDM) Principles - The DSDM Process- DSDM's Contributions-Crystal Methodology Design Principles - The Crystal Framework - Crystal Methods - Crystal's Contributions. **(9)**

FEATURE DRIVEN DEVELOPMENT

The Feature Driven Development(FDD) Process Model - Beyond the FDD process Description - Conceptual Similarities and Differences - FDD's Contributions - Extreme Programming(XP) Basics - XP values and Principles - XP's Contributions - Adaptive Software Development Life Cycle - Leadership-Collaboration Management - ASD's Contributions **(9)**

DEVELOPING AN ASDE

Articulating Ecosystem - Designing Agile Methodology - The Agile Metamorphosis **(8)**

JUNIT FRAMEWORK

I/O : Automatic Tests - Goal -Fixtures-Testing Exceptions - JUnit's Implementation - JUnit API - Test First Programming - Stub - Other Uses for Tests - Extending JUnit - JUnit and Ant - Running JUnit Standalone - JUnit and IDEs-Test Infection. **(10)**

TOTAL : 45

REFERENCES

1. *Rubin Kenneth S, " Essential Scrum: A Practical Guide to the Most Popular Agile Process", Addison-Wesley, First Edition, July 2012.*

20MCAE108 - SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Ascertain the need for Software Architecture and its features to develop software that meets user needs.*

CO2 *: Choose the suitable architectural style for a given project*

CO3 *: Synthesize the various architectural styles to produce a quality project*

CO4 *: Develop system by employing Design Patterns.*

CO5 *: Develop a simple application using Software Architecture and Design Pattern.*

INTRODUCTION TO SOFTWARE ARCHITECTURE

Introduction Software Architecture Definition Prospects - State of Art Architecture Business Cycle-Importance of Software Architecture - Architectural Structures. **(9)**

SOFTWARE ARCHITECURAL STYLES

Architectural Styles: Pipes and Filters- Layered Systems- Repositories -Process Control- Other familiar Architecture- Heterogeneous Architecture - Organizing Architectural Styles **(9)**

SOFTWARE ARCHITECTURE QUALITY

The Architectures and Quality Attributes Achieving Qualities - Achieving Quality goals with Architectural Styles -Unit Operations - Applying Unit Operations to User Interface - Case Studies- World Wide Web **(9)**

INTRODUCTION TO DESIGN PATTERN

Introduction - Definition - Making a pattern - Pattern categories - Relationship between patterns - Patterns and software architecture **(9)**

DESIGN PATTERNS

Creational patterns - Structural patterns - Behavioral patterns - Frameworks for patterns - Patterns catalogs and writing patterns. Case studies in UML. **(9)**

TOTAL : 45

REFERENCES

1. *Len Bass, Paul Clements & Rick Kazman, "Software Architecture in Practice", Addision Wesley, 3rd Edition, 2013.*
2. *Mary Shaw & David Garlan, "Software Architecture Perspectives on an emerging discipline", Prentice Hall of India, 3rd Indian Reprint, 2006.*
3. *Eric Gamma, Richard Helm, Ralph Johnson, John Vissides, "Grady Booch, Design Patterns", Addision Wesley, 2007.*
4. *Craig Larman, "Applying UML and Patterns", Prentice Hall, 2009.*

20MCAE201 - DATA ANALYTICS

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Outline the definitions, concepts and enabling technologies of data analytics.*

CO2 *: Analyze different statistical analysis techniques to be applied on different types of datasets.*

CO3 *: Develop regression models using R for a given dataset.*

CO4 *: Apply text analysis methods to analyze unstructured data.*

CO5 *: Create solutions for real world business problems and effectively present results using data visualization techniques.*

INTRODUCTION

Introduction to Big Data Analytics : Big Data Overview - State of the Practice in Analytics - Key Role for the New Big Data.

Ecosystem- Examples of Big Data Analytics. Data Analytics Lifecycle: Overview - Discovery - Data Preparation - Model Planning- Model Building - Communicate Results - Operationalize - Case Study. **(10)**

BASIC DATA ANALYTIC METHOD USING R

Introduction to R - Exploratory Data Analysis - Statistical Methodsfor Evaluation. **(8)**

REGRESSION AND TIME SERIES ANALYSIS

Linear Regression - Logistic Regression- Time Series Analysis : Box-Jenkins Methodology-ARIMA Model: Autocorrelation Model - Auto Regressive Models - Moving Average Model ARMA and ARIMA Models. **(9)**

TEXT ANALYSIS

Text Analysis Steps with Example- Collecting- Representing Text - Term Frequency -Categorizing Documents by Topics - Determining Sentiments. **(10)**

DATA ANALYTICS PROJECT

Communicating and Operationalizing and Analytics Project - Creating the Final Deliverables Data Visualization. **(8)**

TOTAL : 45

REFERENCES

1. *EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley, 2015.*
2. *Thomas A. Runkler, "Data Analytics - Models and Algorithms for Intelligent Data Analysis", Springer, 2012.*

20MCAE202 - INTELLIGENT INFORMATION RETRIVEL

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand algorithms and techniques for information retrieval.*

CO2 *: Design a search engine or any text retrieval system.*

CO3 *: Apply data mining techniques and quantitative evaluation methods for IR systems.*

CO4 *: Develop applications with retrieval capabilities.*

CO5 *: Combine aspects of information visualization and mining for information retrieval and web information retrieval.*

BASICS OF INFORMATION RETRIVEL

Boolean Retrieval - The Term Vocabulary and Posting Lists - Scoring- Term Weighting and the Vector Space Model - Computing Scores in a Complete Search System - Evaluation in Information Retrieval. **(11)**

IR MODELS

XML Retrieval - Probabilistic Information Retrieval : Review - Ranking Principle Binary Independence Model - Language Models for Information Retrieval : Language Models - Query Likelihood Model **(10)**

TEXT CLASSIFICATION AND SVM MODEL

Text Classification and Naïve Bayes : Text Classification Problem - Naïve Bayes Text Classification Bernoulli Model - Properties of Naïve Bayes - Feature Selection. Support Vector Machines and Machine Learning on Documents : SVM Models - Machine Learning methods **(9)**

CLUSTERING AND MATRIX DECOMPOSITIONS

Flat Clustering : Problem Statement - K-means - Hierarchical Clustering: Agglomerative Clustering - Centroid Clustering - Divisive Clustering - Matrix Decompositions and Latent Semantic Indexing. **(9)**

WEB SEARCH AND IR

Web Search Basics - Web Crawling and Indexes : Overview - Crawling - Link Analysis : Pagerank. **(6)**

TOTAL : 45

REFERENCES

1. *Christopher Manning, Prabhakar Raghavan and Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, 2012.*
2. *Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The concepts and Technology behind Search" (ACM Press Books), Second Edition, 2011.*
3. *D.A. Grossman, O. Frieder, "Information Retrieval: Algorithms and Heuristics", Springer, 2004.*
4. *Bruce Croft, Donald Metzler and Trevor Strohman, "Search Engines: Information Retrieval in Practice", Addison Wesley, First Edition, 2009.*
5. *Mark Levene, "An Introduction to Search Engines and Web Navigation", Wiley, Second Edition, 2010.*

20MCAE203 - BIG DATA TECHNOLOGIES

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Build single and multi-node Hadoop clusters on Linux or Windows platform*

CO2 *: Use Hadoop file system commands to load and execute programs on it.*

CO3 *: Write map-reduce programs for data intensive applications and execute them on the Hadoop platform.*

CO4 *: Use NoSQL databases like MongoDB in data processing applications.*

CO5 *: Choose appropriate big data technologies to analyse big data for a given analytic requirement.*

FUNDAMENTALS OF BIG DATA

Classification of Digital Data- Characteristics of Data-Evolution of Big Data-Definition-Challenges-Traditional Business Intelligence versus Big Data. **(6)**

BIG DATA ANALYTICS

Introductionto Big Data Analytics-Classification of Analytics-Challenges of Big Data-Terminologies used in Big Data Environments-Big Data technologies: NoSQL and Hadoop. **(6)**

HADOOP

Data Storage and Analysis-Comparison with Other Systems-A Brief History of Hadoop-Apache Hadoop and the Hadoop Ecosystem-Setting up a Hadoop Cluster. **(8)**

HADOOP DISTRIBUTED FILE SYSTEM

Design of HDFS -HDFS Concepts: Blocks-Name Nodes and Data Nodes-HDFS Federation-HDFS High-Availability-The Command-Line Interface-Basic File System Operations-Hadoop File Systems-The Java Interface-Reading Data From a Hadoop URL-Reading Data Using the File System API- Writing Data-Directories-Querying the File System-Deleting Data. **(9)**

MAP REDUCE

A Weather Dataset- Data Format- Analyzing the Data with Hadoop -Map and Reduce- Java Map Reduce-Scaling Out-Data Flow-Combiner Functions-Running a Distributed Map Reduce Job-Map Reduce Program Examples. **(9)**

NOSQL AND MONGODB

Introduction to NoSQL-Types of NoSQL Databases-Advantages and Use-SQL versus NoSQL. Introduction to MongoDB-Data Types-MongoDB Query Language. **(7)**

TOTAL : 45

REFERENCES

1. *Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley, 2019.*
2. *Tom White, "Hadoop: The Definitive Guide, O'Reilly Media", 3rd Edition, Yahoo Press, 2012.*
3. *Chuck Lam, "Hadoop in Action", Manning Publications, 2011.*
4. *Srinath Perera,Thilina Gunarathne, "Hadoop Map Reduce Cookbook", Packt Publishing Limited, 2013.*

20MCAE204 - DATA MINING AND WAREHOUSING

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Examine a given dataset identify the analysis goals and providing data mining solutions to achieve those goals.*

CO2 *: Choose proper pre-processing techniques by studying the characteristics of the attributes of the dataset and prepare it for data mining.*

CO3 *: Apply association rule mining techniques such as Apriori and FP-Tree to a given dataset and generate association rules from it.*

CO4 *: Analyze the suitability of classification (Decision Tree) and clustering algorithms(K-Means and K-Medoids) for a given data analysis requirement.*

CO5 *: Mine hidden patterns from the dataset after applying pre-processing techniques and derive inference from the results of mining.*

INTRODUCTION

Definition- Need for Data Mining- Kinds of Data and Patterns- Applications and Issues. Types of data: Data objects and Attribute-Types-Measuring Data Similarity and Dissimilarity. Data Preprocessing: Overview- Data Cleaning-Data Integration-Data Reduction-Data Transformation-Data Discretization. **(12)**

DATA WAREHOUSE AND OLAP TECHNOLOGY

Data Warehouse-Basic Concepts-Data Warehouse Modeling-Data Warehouse Implementation. **(7)**

ASSOCIATION AND CLASSIFICATION TECHNIQUES

Mining Frequent Patterns and Associations : Basic Concepts-Frequent Itemset Mining Methods.

Classification : Basic Concepts-Decision Tree Induction- Bayes Classification Methods. **(12)**

CLUSTER AND OUTLIER ANALYSIS

Cluster Analysis Concepts-Partitioning Methods-Hierarchical Methods : Agglomerativeand Divisive Hierarchical Clustering-BIRCH. Outlier Detection : Outliers and Outlier Analysis-Outlier Detection Methods. **(7)**

MINING COMPLEX DATA TYPES

Mining Sequence Data-Mining Graphs and Networks-Mining Other Kinds of Data- Visual and Audio Data Mining. **(7)**

TOTAL : 45

REFERENCES

1. *Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining - Concepts and Techniques", 3rd Edition, Elsevier Publications, 2012.*
2. *Paul C. Zikopoulos, Chris Eaton, Dirk deRoos and George Lapis, "Understanding Big Data", Mc-Graw Hill, 2012.*
3. *Arun K. Pujari, "Data Mining Techniques", Universities Press, 2009.*
4. *Mohammed J. Zaki, Wagner Meira, "Data Mining and Machine Learning : Fundamental Concepts and Algorithms", 2nd Edition, Cambridge University Press, 2020.*

20MCAE301 - COMPUTER NETWORKS

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Identify the components required to build different types of networks and have an understanding of network models.*

CO2 *: Analyze the layered functionality and data communication mechanisms used between nodes.*

CO3 *: Identify the protocols involved at the various layers and demonstrate the role of each protocol.*

CO4 *: Analyze and describe the working principles of Internet.*

CO5 *: Apply various routing protocols, demonstrate the best routing between nodes and describe the network functionalities for a given application.*

INTRODUCTION

Uses of computer networks - Network hardware - Network software - Reference models - Example networks: RFID and Sensor Networks. Physical Layer: Theoretical basis for data communication - Guided transmission media: Twisted pairs- Coaxial cable- Fiber Optics - Unguided transmission: The Electromagnetic spectrum - Radio wave transmission- Micro wave transmission - Infrared transmission. **(9)**

DATA LINK LAYER

Design issues - Services provided to the network layer - Framing - Flow Control - Error Control. Error detection and correction - Elementary data link protocols: A Simplex Stop- and-Wait protocol for an Error -Free Channel - Sliding window protocols: A One-Bit Sliding window Protocol. Example Data Link protocols: Packet over SONET. MAC Layer: Channel allocation problem - Multiple access protocols: ALOHA - CSMA. **(9)**

NETWORK LAYER

Design issues - Services provided to the Transport Layer - Routing algorithms: Shortest Path Algorithm - Distance Vector Routing - Link State Routing. Congestion control algorithms: Traffic aware routing - Admission Control. Internetworking: Tunneling - Internetwork Routing - Packet Fragmentation. **(9)**

TRANSPORT LAYER

Transport service - Services provided to upper layer - Transport Service primitives - Elements of transport protocols -Addressing - Connection Establishment and Release - Error Control and Flow Control - Multiplexing - A Simple transport protocol: TCP: Introduction -Service Model - Connection Establishment and Release **(9)**

APPLICATION LAYER

Domain Name System: The DNS Name Space - Domain Resource Records - Name Servers - Electronic mail: Architecture and Services - The User Agents - Message Formats - Message Transfer and Delivery - World Wide Web: Architectural overview - Static and Dynamic Web Pages- HTTP - Mobile Web - Web Search. **(9)**

TOTAL : 45

REFERENCES

1. *Andrew S Tanenbaum and David J. Wetherall, "Computer Networks", Pearson Education, Asia, 5th Edition, 2011.*
2. *Behrouz A.Forouzan, "Data Communications and Networking", McGraw-Hill Science/Engineering/Math Publication, 5th Edition, 2012.*

20MCAE302 - INTERNETWORKING PROTOCOLS AND MANAGEMENT

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Illustrate the working principles of link layer and network layer protocols used for data communication in the Internet.*

CO2 *: Determine the suitability of User Datagram Protocol for the given application in terms of reliability and Performance.*

CO3 *: Understand and experiment the working of Transmission Control Protocol for the given application based on its requirements.*

CO4 *: Analyze the requirements for monitoring and controlling a network using Simple Network Management Protocol and the Management Information Base.*

CO5 *: Develop TCP and UDP based socket programs for the given client server communication scenario.*

LAYER I & II PROTOCOLS

OSI and TCP/IP Reference model - Concepts of multiplexing and switching - MAC protocols - ALOHA, CSMA/CD - Address Resolution Protocol- IPv4 headers-IP forwarding- Host Processing of IP datagrams - IP Fragmentation - ICMPv4 - DHCP Auto configuration Protocol **(9)**

UDP AND APPLICATIONS

Introduction to UDP - UDP Header and Encapsulation - Broadcasting and Multicasting - Internet Group Management Protocol - Trivial File Transfer Protocol - Bootstrap Protocol **(9)**

TRANSMISSION CONTROL PROTOCOL

Introduction to TCP - TCP Header and Encapsulation - Connection Management - Timeout and Retransmission - Data Flow and Window Management - Congestion Control - TCP Timers **(9)**

NETWORK MANAGEMENT

Introduction - Network Monitoring - Network Control. SNMPv1: Concepts - Management Information Standard MIBs - Simple Network Management Protocol **(9)**

SOCKET PROGRAMMING

Introduction to Sockets - Socket Addresses - Elementary and advanced Socket System Calls-Client Server Communication using Sockets: Connection Oriented Protocol- Connection less Protocol - Socket Options **(9)**

TOTAL : 45

REFERENCES

1. *Kevin R. Fall, W. Richard Stevens, "TCP/IP Illustrated- Volume 1:The Protocols", Pearson Education Asia, 2nd Edition, 2012.*
2. *William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Pearson Education Asia, 3rd Edition, 2013.*
3. *W. Richard Stevens, "UNIX Network Programming", Prentice-Hall of India Pvt.Ltd, 2nd Edition, 2009.*
4. *Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw-Hill Publishing Company Limited, New Delhi, 4th Edition, 2010.*
5. *Michael J.Donahoo, Kenneth L.Calvert, "TCP/IP Sockets in C - Practical Guide for Programmers", Morgan Kauffman, 2nd Edition, 2009.*

20MCAE303 - MOBILE COMPUTING

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Describe wireless and mobile computing systems and analyze the architecture- functions and emerging techniques in GSM*

CO2 *: Understand the issues and techniques used in the design of MACfor Wireless communication.*

CO3 *: Explain the structure and components for Mobile IP and Mobility Management*

CO4 *: Describe the types and functionalities of transport and application layer services for wireless communication*

CO5 *: Develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.*

INTRODUCTION TO MOBILE COMPUTING

Introduction to MC- novel applications- limitations- and architecture. GSM : Mobile services- System architecture- Radio interface- Protocols- Localization and calling- Handover- Security- and New data services-Layouts, views and resources. **(8)**

WIRELESS MOBILE APPLICATION AND MEDIUM ACCESS CONTROL

Wireless Application Protocol - Introduction - protocol architecture - WDP - WTLS - WTP - WSP - WML - WML Script - WAE - WTA. Motivation for a specialized MAC (Hidden and exposed terminals- Near and far terminals)- SDMA- FDMA- TDMA- CDMA. **(10)**

LAYERS

Mobile Network Layer : Mobile IP - Goals- assumptions- entities and terminology - IP packet delivery - registration - optimizations - Dynamic Host Configuration Protocol (DHCP). Mobile Transport Layer- Traditional TCP- Indirect TCP- Mobile TCP- Transmission /time-out freezing- Selective retransmission- Transaction oriented TCP. **(9)**

ENHANCING ANDROID MOBILE APPLICATIONS

Android development environment -user interface - Application fundamentals - Extending the applications-preparing the working environment-adaptive layouts-adapters-localization-custom views-debugging the user interface-material design-Intents-observer patterns-fragments-files-accessibility-activity-themes and styles-Background tasks-Connecting to internet-preferences-alarms-broadcast receivers-notification-widgets-transferring data efficiently-publishing app. **(10)**

SECURITY SERVICES

Security and system permissions - multiple form factors - sensors - google cloud messaging- monetizing app - content resolvers and providers - fragment programming - security services-processes and threads-recycler view **(8)**

TOTAL : 45

REFERENCES

1. *Raj Kamal, "Mobile Computing", 3rd Edition, Oxford University Press, 2018.*
2. *JochenSchiller, "Mobile Communications", Addison-Wesley, Second Edition, 2014.*
3. *Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2016*
4. *William Stallings, "Wireless Communications and Networks", 2nd Edition, Prentice Hall of India, Pearson Education, 2015.*
5. *Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi, 2017.*

20MCAE401 - ORGANIZATIONAL BEHAVIOR

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Given a case study, analyze the behavior of the individual.*

CO2 *: Given a case study, analyze the behavioral pattern of group interaction in organization*

CO3 *: Given a scenario in an organization assess the attitude and personality of the individuals in the organization.*

CO4 *: Given a business problem form groups and finds a solution to the problem.*

CO5 *: Given a problem in an organization, apply emotional intelligence and solve the problem.*

INTRODUCTION TO ORGANIZATIONAL BEHAVIOR

Concept- Nature- Characteristics- Conceptual Foundations and Importance- Models of Organizational Behavior- Management Challenge- A Paradigm Shift- Relationship with Other Fields- Organizational Behavior : Cognitive Framework- Behavioristic Framework and Social Cognitive Framework **(8)**

PERCEPTION AND ATTRIBUTION

Concept- Nature- Process- Importance. Management and Behavioural Applications of Perception. Attitude: Concept- Process and Importance- Attitude Measurement. Attitudes and Workforce Diversity. Personality: Concept- Nature- Types and Theories of Personality Shaping- Personality Attitude and Job Satisfaction.

Learning : Concept and Theories of Learning. **(10)**

MOTIVATION

Concepts and Their Application- Principles- Theories- Employee Recognition- Involvement- Motivating a Diverse Workforce. Leadership: Concept- Function- Style and Theories of Leadership-Trait- Behavioural and Situational Theories. Analysis of Interpersonal Relationship- Group Dynamics: Definition- Stages of Group Development- Group Cohesiveness- Formal and Informal Groups- Group Processes and Decision Making- Dysfunctional Groups. **(10)**

ORGANIZATIONAL POWER AND POLITICS

Concept- Sources of Power- Distinction Between Power- Authority and Influence- Approaches to Power- Political Implications of Power: Dysfunctional Uses of Power. Knowledge Management & Emotional Intelligence in Contemporary Business Organisation.

ORGANIZATIONAL CHANGE

Concept- Nature- Resistance to change- Managing resistance to change- Implementing Change- Kurt Lewin Theory of Change. **(8)**

CONFLICT

Concept- Sources- Types- Functionality and Dysfunctionality of Conflict- Classification of Conflict Intra- Individual- Interpersonal- Intergroup and Organizational- Resolution of Conflict- Meaning and Types of Grievance and Process of Grievance Handling. Stress: Understanding Stress and Its Consequences- Causes of Stress- Managing Stress. Organizational Culture: Concept- Characteristics- Elements of Culture- Implications of Organisation culture- Process of Organisational Culture. **(9)**

TOTAL : 45

REFERENCES

1. *Newstrom John W., "Organizational Behaviour: Human Behavour at Work", Tata Mc Graw Hill- 12th Edition, 2017.*
2. *Luthans Fred, "Organizational Behaviour", Tata McGraw Hill, 3rd Edition, 2019.*
3. *Judge and Stephen P.Robbins,"Organizational Behavior", Pearson, 13th Edition, 2020.*
4. *Ace simpson, stewart Clegg, "Positive Organizational Behaviour- A reflective approach", Taylor & Francis, 5th Edition, 2020.*

20MCAE402 - PRINCIPLES OF MANAGEMENT

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Describe the principles of management.*

CO2 *: Prepare a decision tree for a given statement.*

CO3 *: Given a business plan, specify the management functions (planning- organizing- controlling and evaluating)*

CO4 *: Construct the organizational chart for given company.*

CO5 *: Prepare a flow chart of the selection process of a given company.*

MANAGEMENT

Concept- Nature- Importance- Management : Art and Science- Management as a Profession- Management Vs. Administration- Management Skills- Levels of Management- Characteristics of Quality Managers. Evolution of Management: Early contributions- Taylor and Scientific Management- Fayol's Administrative Management- Bureaucracy- Hawthorne Experiments and Human Relations- Social System Approach- Decision Theory Approach. Business Ethics and Social Responsibility: Concept- Shift to Ethics- Tools of Ethics. **(9)**

INTRODUCTION TO FUNCTIONS OF MANAGEMENT

Planning :Nature- Scope- Objectives and Significance of Planning- Types of Planning- Process of Planning-Barriers to Effective Planning- Planning Premises and Forecasting- Key to Planning- Decision Making. Organizing: Concept- Organisation Theories- Forms of Organisational Structure- Combining Jobs: Departmentation- Span of Control- Delegation of Authority- Authority & Responsibility- Organisational Design. **(11)**

STAFFING

Concept- System Approach- Manpower Planning- Job Design- Recruitment & Selection- Performance Appraisal Directing: Concept- Direction and Supervision Motivation: Concept- Motivation and Performance- Theories Of Motivation- Approaches for Improving Motivation- Pay and Job Performance- Quality of WorkLife- Morale Building. **(9)**

LEADERSHIP

The Core of Leadership: Influence- Functions of Leaders- Leadership Style- Leadership Development **(2)**

Communication : Communication Process- Importance of Communication- Communication Channels-Barriers to Communication. Controlling: Concept- Types of Control- Methods: Pre-control: Concurrent Control: Post-control- An Integrated Control System- The Quality Concept Factors affecting Quality- Developing a Quality Control System- Total Quality Control- Pre-control of Inputs- Concurrent Control of Operations. Post Control of Outputs. Change and Development: Model for Managing Change- Forces for Change- Need for Change- Alternative Change Techniques- New Trends in Organisational Change. **(7)**

Training and Development : Need for training- advantages of training programme- Types of training programmes- Training methods- Selection of a training method- Evaluation of training and development- Training practices in India. **(7)**

TOTAL : 45

REFERENCES

1. *Robbins S.P., Coulter Mary & Niharika Vohra, "Management", 10th Edition, Pearson Education, 2019.*
2. *S.A. Sherlekar, "Ethics in Management", Himalayan Publishing Company, 2016.*
3. *H.R. Appannaiah, G Dinakar, H.A. Bhaskar, "Principles of Management", 6th Edition, Himalaya, 2019.*
4. *Dr. L.M. Prasad, "Principles and practise of management", 10th Edition sultan chand & sons, 2020.*

20MCAE403 - ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Prepare books of accounts and verify correctness using trial balance, for any business organization.*

CO2 *: Prepare statements of final accounts to ascertain the profit,forany trading or manufacturing organization.*

CO3 *: Perform cost estimation and determine the optimum cost/price/profit for a firm using Cost Sheet, CVP analysis and Marginal Costing Techniques.*

CO4 *: Prepare financial statements using ratio analysis, budgeting, working capital management, capital budgeting and budgetary control techniques and present facts to assist in strategic decision making, given a set of investment options for a business.*

CO5 *: Develop software solutions to automate a given accounting, costing or financial process, using MS-Excel.*

FINANCIAL ACCOUNTING

Introduction : Accounting Concepts, Principles and Conventions - basic accounting procedures - Journal and Ledger, Trial Balance. **(15)**

FINAL ACCOUNTS

Manufacturing and Trading Account - Profit and Loss Account - Balance Sheet. Final accounts with adjustments - Working with excel worksheets for automating Final Accounts. Depreciation. Type - Straight Line Method - Written-Down Value Method, Sinking Fund Method - Preparation of Depreciation Account **(15)**

COST ACCOUNTING

Methods and Techniques of Cost Accounting - Classification of Cost - Material Cost, Labour Cost, Overheads, Fixed and Variable Costs, Cost-Volume-Profit Analysis - Marginal Costing and Decision Making. **(9)**

FINANCIAL MANAGEMENT

Objective and scope of Financial Management - Analysis and Interpretation of Financial Management Ratio Analysis - financial system - Working Capital Management - Capital Investment Decision Through Pay-back Period Method - Average Rate of Return - Internal Rate of Return - Cost of Capital - Discounted Cash Flow Analysis by using Spread Sheet. **(12)**

BUDGETING AND BUDGETARY CONTROL

Types of budgets - Preparation of various functional budgets - Preparation of cash budget - Flexible budget - Advantages of Budgeting and budgetary control **(9)**

TOTAL : 60

REFERENCES

1. *M. C. Shukla, T. C. Grewal,S. C. Gupta , "Financial Accounting I", Sultan Chand & Sons, Paperback, 2019.*
2. *Maheshwari S.N., Dr Suneel K. Maheshwari, CA Sharad K. Maheshwari, "Principles of Management Accounting", Sultan Chand & Sons, 2021.*

3. *R L Gupta & V K Gupta, "Principles and Practice of Accountancy", S.Chand & Co.,Ltd., Paperback 2019.*
4. *Jain S.P. & Narang K.L., "Advanced Accountancy - Principles of Accountancy Vol 1", Kalyani Publishers, Paperback 2018.*
5. *Sashi K. Gupta & R.K Sharma, Neeti Gupta "Management Accounting", Kalyani Publishers, 2014.*
6. *Khan M.Y. and Jain P.K., "Financial Management", Tata McGraw Hill, Paperback 2017.*

20MCAE404 - E-COMMERCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Specify Infrastructural requirements & Business models for an e-commerce start up. (From the prespective of Indian Businesses)*

CO2 *: Analyze different types of e marketing and e advertising stategies and e-payment alternatives commonly used in the industry and summarize the relative merits in Indian socio economic scenario.*

CO3 *: Discuss trends in CRM- SCM and Knowledge Management using web technologies and point out the suitable adaptations for a medium scale e-commerce firm in India.*

CO4 *: Appraise the impact of different types of mobile and wireless technologies on success of e- commerce in India.*

CO5 *: Understand ERP and EDI technologies can transform the Indian Business environment into paperless, cashless, easy-to-manage and regulated, with the use of cloud and open source technologies.*

INTRODUCTION

History - Early Business Information Interchange Efforts - Emergence of internet- WWW. E-Commerce - Advantages- Disadvantages - BAM Models - Transition to E-Commerce in India- E-Transmission Challenges- The Information Technology Act 2000 - Business Models - Enabling Technologies of WWW. Social Networks- Auctions- Portals: Social networks and online communities Online auctions - E-commerce portals. **(7)**

ELECTRONIC MARKETING- SECURITY AND PAYMENT

Traditional Marketing - Web Presence Goal - Browsing Behavior Model - Online Marketing- E-Advertising- Trends- E-branding- Strategies. E- Security - Internet Security- E-business Risk Management Issues- Information Security Environment in India. E-Payment - Concerns in Internet Banking- Digital Payment Requirements- Token Based E-Payment Classification- E-Cash- Cheque Payment- Risk and E-Payment. **(8)**

CRM- SCM & SKM

E-CRM Solutions - Business Touch Points - Case Studies. Supply Chain - The new way- e-logistics- Fulfilling Customer's Needs- Smart Chains Smarter Gains. Real Time Benefits and Strategies - Advantages. Knowledge as Key Business Asset- Changes in - Global Business Economy- Technology. Knowledge - Definition- Management - Knowledge Management- Data Warehousing and Data Mining. Virtual value chain - 7 Dimensions - E-Commerce Strategy - planning E-Commerce Project. **(10)**

MOBILE COMMERCE AND TECHNOLOGIES

E-Business Portals. What? - Issues - Wireless- Cellular- Wireless Spectrum. - Success Stories. Technologies - mobile commerce- WAP Wireless Generations. Portals - Different Types- benefits- features. Requirements for Intell. **(10)**

ERP & EDI

Introduction -ERP and E2RP - Business Problems- New Paradigm- Drivers - Business processes and supporting processes. Architecture- Implementation- ERP Processes. ERP - Cloud and Open Sources.EDI - Concepts and Technology. **(10)**

TOTAL : 45

REFERENCES

1. *P.T. Joseph S.J, "E-Commerce - An Indian Perspective", PHI Learning Private Limited, 4th Edition, 2012.*
2. *Kenneth C. Laudon, "E-Commerce : Business - Technology - Society", 4th Edition, Pearson, 2012.*
3. *Sandeep Desai, Abhishek Srivastava, "ERP to E2RP - A Case Study Approach", Eastern Economy Edition, PHI Learning Pvt. Ltd., 2013.*
4. *Kamalesh K. Bajaj, Debjani Nag, "E-Commerce - The Cutting Edge of Business", McGraw Hill Education (India) Private Limited, 2nd Edition, 2005.*
5. *Ravi Kalakota- Marcia Robinson, "E - Business 2.0 - Roadmap for Success", Addison Wesley Professional, 2001.*

20MCAE405 - DECISION MAKING

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Critically discuss different theories and theoretical perspectives in leadership - negotiation and decision making.*

CO2 *: Evaluate models to describe how leaders are perceived (leadership style)-analyse a leader's decision-making and role in negotiations.*

CO3 *: Analyse how decision-making and strategies in negotiations affect a leader's perception*

CO4 *: Use decision making tools to quantitatively analyse its impacts in a given situation*

CO5 *: Apply programmed and non-programmed decisions to effectively manage uncertainty*

INTRODUCTION TO DECISION MAKING

Basic concepts of decision making - The art of decision management- Fundamentals of Decision Making - The strategy pyramid. The DM portfolio- drivers of poor decision management- The ten cardinal decision issues and reviews- rationalistic versus evolutionary strategic decision making- Players in a decision- Representation of decision problem. **(9)**

STRATEGIC DECISION ANALYSIS

Introduction to strategic decision analysis - The decision analysis cycle- Sensitivity analysis- Expert and stakeholder opinions- Risk analysis- Public perception and risk communication- Deliberative democracy and public participation- Good heuristics for decision analysis- Negotiation and bargaining. **(9)**

RATIONAL DECISION MAKING

The Importance and Limitations of Rational Decision Making: Limited or "bounded" rationality. The Decision Process- Quantitative and qualitative factors- marginal analysis- cost effective analysis. **(9)**

DECISION ANALYSIS & UNCERTAINITY

Modelling Uncertainity- utility model- risk attitude- Subjective Expected Utility (SEU) modelling- Decision Tress and Influence diagrams. Programmed and Non-Programmed Decisions- the Uncertainty Problem: deal with unknowns. The Madness and wisdom of crowds. **(9)**

INFORMATION AND COMMUNICATION

Negotiation-Information to support decisions-Framing and Communicating Decisions. **(9)**

TOTAL : 45

REFERENCES

1. *French- Simon. Maule- John. & Papamichail- Nadia, "Decision Behaviour- Analysis and Support", New Delhi: Cambridge University Press, 2010.*
2. *James M. Kouzes, Barry Z.Posner, John Wiley & Sons "The Leadership challenge, How to make Extraordinary things happen in organizations", 2016.*
3. *J.Edward Russo and Paul J.H. Shoemaker "Winning decisions : getting it right the first time", Special markets, Currency books, 1st Edition, 2002.*
4. *Mark Koscinski, "Decision Making Essentials", 2nd Edition, Vibrant Publishers, 2020*
5. *Pankaj Garg, "Mastering the Art of Decision Making", 4th Edition, Notion Press, 2020*

20MCAE406 - ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Highlight the characteristics of a successful entrepreneur.*

CO2 *: Understand the role of entrepreneurship in the economic development of a country.*

CO3 *: Formulate the business plans for an efficient and successful \ business.*

CO4 *: Justify the need for developing rural entrepreneurship and agripreneurship in India.*

CO5 *: State the economic factors influencing the emergence and development in country.*

ENTERPRENEURSIP

Entrepreneur - Types of Entrepreneurs - Difference between Entrepreneur and Intrapreneur - Entrepreneurship in Economic Growth- Factors Affecting Entrepreneurial Growth. **(9)**

MOTIVATION

Major Motives Influencing an Entrepreneur - Achievement Motivation Training- Self Rating - Business Games- Thematic Apperception Test - Stress Management - Entrepreneurship Development Programs - Need - Objectives. Rural entrepreneurship and agri-preneurship development **(9)**

BUSINESS

Small Enterprises - Definition- Classification - Characteristics- Ownership Structures - Project Formulation - Steps involved in setting up a Business - identifying- selecting a Good Business opportunity- Market Survey and Research- Techno Economic Feasibility Assessment - Preparation of Preliminary Project Reports - Project Appraisal - Sources of Information - Classification of Needs and Agencies. **(9)**

FINANCING AND ACCOUNTING

Need - Sources of Finance- Term Loans- Capital Structure- Financial Institution- Management of working Capital- Costing- Break Even Analysis- Taxation - Income Tax- Excise Duty - Sales Tax. **(9)**

SUPPORT TO ENTREPRENEURS

Sickness in small business - Concept- Magnitude- Causes and Consequences- Corrective Measures - Business Incubators - Government Policy for Small Scale Enterprises - Growth Strategies in small industry - Expansion- Diversification- Joint Venture- Merger and Sub Contracting. **(9)**

TOTAL : 45

REFERENCES

1. *Khanka. S.S., "Entrepreneurial Development", S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.*
2. *Donald F Kuratko, "Entrepreneurship Theory Process and Practice", Cengage Learning, 9th Edition, 2014.*
3. *Hisrich R D, Peters M P, "Entrepreneurship", Tata McGraw-Hill, 8th Edition, 2013.*
4. *Poornima M Charantimath "Entrepreneurship Development And Small Business Enterprise", Pearson Publication, Paper Back, 2006.*

20MCAE407 - PRINCIPLES OF ENVIRONMENTAL SCIENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Predict the values of biodiversity for the development*

CO2 *: Design the methods for the prevention of environmental pollution and solid waste management.*

CO3 *: llustrate the use of alternate energy resources for growing energy needs*

CO4 *: Classify the environmental segments, the causes for its deterioration, he measure taken for its prevention and the need for sustainable development.*

CO5 *: Identify the threats to environment, social issues related to it, the necessity for environmental legislation, sustainable development and the applications of bio technology and green chemistry for environmental protection.*

ENVIRONMENTAL CHEMISTRY

Chemistry and the Environment - Environmental segments - Composition and Characteristics of Atmosphere, Hydrosphere, Lithosphere, and Biosphere: Chemical species and particulates present in the environment - reactions occur in the atmosphere. Photochemical smog. Impact of man on the environment. Impact of Environment upon humans. **(9)**

ECOSYSTEMS AND BIODIVERSITY

Concepts of an ecosystem : types, structure and functions of the ecosystem. Food chains, food webs and ecological pyramids. Biodiversity: Definition - Genetic, species, ecosystem and landscape diversities - India as a mega diversity nation - Hot spots of biodiversity. Importance of biodiversity - loss of biodiversity - causes of reduction in biodiversity. Conservation of biodiversity - restoration of biodiversity. **(9)**

ENVIRONMENTAL POLLUTION

Sources, causes, effects and management of Air, Water, Soil, Marine, Noise and Radioactive pollution. Sources of Solid, Hazardous, Biomedical and Chemical wastes. Solid Waste Disposal and treatment **(9)**

ENERGY AND ENVIRONMENT

Energy resources - Growing energy needs - renewable and non-renewable energy sources - use of alternate energy sources - Solar, Wind, Tidal, Geothermal and OTEC - (Principles only) merits and limitations. **(3)**

SOCIAL ISSUES AND THE ENVIRONMENT

Sustainable development - Urban Population - problems related to energy - Water Conservation. Rainwater harvesting - Environment Ethics - Green house effect, Global warming, climate change, Nuclear hazards and accidents. Issues involved in enforcement of environment legislation - precautionary principle - polluter pays principle - the Beneficiary pays principle - role of an Individual in Environment protection - Environment (Protection) Act - Air (Prevention and Control of Pollution) Act. Water (Prevention andControl of Pollution) Act. Wildlife Protection Act and Forest (Conservation)Act. **(9)**

BIOTECHNOLOGY AND GREEN CHEMISTRY

Biotechnology and its applications in environmental protection - Bioinformatics - Bioremediation. Biological purification of contaminated air. Green chemistry for clean technology: Significance of green chemistry - Basic components of Green chemistry. Industrial applications of green chemistry. Green fuels - e-green Propellants and Biocatalysts. **(6)**

TOTAL : 45

REFERENCES

1. *Dara, S.S. "A Text Book of Environmental Chemistry and Pollution Control", S. Chand and Company Ltd, 8th Revised Edition, 2008.*
2. *Kaushik, A. and Kaushik, C.P. "Environmental Science and Engineering", 2nd Edition, New Age International (P) Limited Publishers, 2006.*
3. *Dr. Raghavan Nambiar, K. "Text Book of Environmental Studies", Scitech Publications (India) Pvt. Ltd, Chennai, 2007.*
4. *Benny Joseph, "Environmental Studies", Tata McGraw Hill Publishing Company Ltd, 2008.*
5. *Surinder Deswal and Anupama Deswal, "A Basic course in Environmental Studies" Dhanpat Rai and Co. (P) Ltd, 2006.*

20MCAEL01 - MOBILE APPLICATION DEVELOPMENT LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Use the components of Android development environment for mobile application development*

CO2 *: Design GUI forms using layouts,views, event handling, notifications and content providers in Android studio.*

CO3 *: Implement database applications using SQLite and perform CRUD operations*

CO4 *: Develop mobile applications that make use of camera and media player in Android.*

CO5 *: Use location based services, network services and graphics to develop innovative mobile apps.*

CONCEPTS TO BE COVERED

1. Android Development Environment
   Download and Install SDK and ADT
   Working of Eclipse and Android Emulator
2. Generic UI development
   Views and View groups
   Event Handling and Listeners
   Layouts and spinner
3. Storing and Retrieving Data
   Android storing and retrieving data using SQL file
   Working with content provider
4. Notification and Alarms
   Action Bars-Menus-Dialogs
   Notifications and Toast
5. Camera and Media player
   Camera Application
   Media player and media recorder
6. Location Based Services
   Finding locations and Tracking Movement
   Map based activity and Proximity alerts
7. Communication via Network and Web
   SMS and MMS
   Bluetooth and WI-FI
8. Graphics and Animation
   Different shapes of different colours
   Moving from one direction to another
   Tweened animation

20MCAEL02 - GRAPHICS AND MULTIMEDIA LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

***CO1** : Design graphical primitives using algorithms*

***CO2** : Develop 2D Transformations.*

***CO3** : Design interactive graphics applications.*

***CO4** : Design objects and layers for scene in animation.*

***CO5** : Develop animated application software.*

CONCEPTS TO BE COVERED COMPUTER GRAPHICS

1. Primitive Algorithms
   Line - Bresenham- DDA- Midpoint. Circle - Midpoint- Trigonometric Ellipse - Midpoint- Trigonometric
2. Polygon- Polygon Filling.
3. Transformations - 2D Translations- Scaling- Rotation

MULTIMEDIA AND ANIMATIONS

1. Flash Programming (OR) Maya
2. Creating Layers- Symbol objects- effects for objects
3. Creating scene by combining objects and layers
4. Creating Animations using various technologies
5. Creating Interactive Animation.
6. Adding audio to animations.
7. Creating small animation projects.

20MCAEL03 - INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Choose the required sensor and perform calibration, for a given requirement.*

CO2 *: Devise interface circuit for connecting a chosen sensor to Galileo board.*

CO3 *: Develop software for Galileo board to interact with the sensor to meet requirements.*

CO4 *: Develop software to interact(send/receive data) with Web/Application server located in the Internet.*

CO5 *: Use data analytics tool to analyze the data collected and present the report to the end user.*

CONCEPTS TO BE COVERED

1. Programs for exploring the features of Contiki such as protothreds- timers- networking primitives by using Cooja simulator.
2. Developing applications using Galileo board- exploiting all features of the board.
3. Application on wireless sensor networks
4. NesC Programming language
5. WSNs Projects of the SENSES Lab
6. A simple application blink

20MCAEL04 - DATA ANALYTICS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Understand the basics in R programming in terms of constructs, control statements, string functions.*

CO2 *: Able to perform different exploratory analysis for the real time dataset.*

CO3 *: Identify and apply appropriate regression models for the given dataset.*

CO4 *: Apply text analysis methods to analyze unstructured data.*

CO5 *: Represent the analysis results using different visualization methods such as charts, tables etc.*

CONCEPTS / TOOLS TO BE COVERED

1. Basic constructs of R Programming
2. Descriptive and Exploratory Analysis
3. Data Visualization - Histogram, Bar Charts, Text Tables, Line Charts, Scatter Plots, Gantt Bar, Charts, Pie Charts, Box Plots, Packed Bubble Charts.
4. Linear Regression
5. Multiple Linear Regression
6. Logistic Regression
7. Program involving Regular Expressions
8. Text Pre-processing with TF-IDF
9. Forecasting time series using ARIMA model.
10. Sentiment Analysis of Social Media Data
11. Customer Churn Detection

20MCAEL05 - DATA MINING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

Upon completion of the course students will be able to

CO1 *: Learn to use open source data mining tools such as Weka and/Rapidminer and build data mining applications using these tools.*

CO2 *: Select appropriate data pre-processing techniques to be applied on standard datasets various domains such as healthcare, finance, insurance etc and prepare the data for the mining process based on the analysis goal.*

CO3 *: Apply association rule mining techniques to derive useful and new pattern information from the given datasets.*

CO4 *: Apply classification algorithms to classify a given dataset and derive useful and new insights from the dataset.*

CO5 *: Represent the analysis results using different visualization methods such as charts, graphs etc.*

CONCEPTS / TOOLS USED

1. Apply pre-processing techniques on datasets downloaded from Internet under different domains.
2. Apply core data mining techniques on different datasets like Iris, Cancer, Accidents etc.
   a) Association Rule mining algorithms such as Apriori, FP Tree and other algorithms.
      Compare the results.
   b) Classification algorithms - Decision Tree
   c) Clustering algorithms - K-Means, K-Medoids
3. Application of text mining algorithms.
4. Use different data visualization techniques to display the mined results and derive inference from them. Shiny tool can be used apart from the usual data mining tools.

20MCAB11- BASICS OF DATA STRUCTURES

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

BASIC CONCEPTS

System Life Cycle - Algorithm Specification - Data Abstraction - Primitive Data Structures - Iterative and Recursive algorithms - Performance Analysis - best case - worst case - average case complexities - Notations. **(3)**

ARRAYS

Array as an Abstract Data Type (ADT) - Polynomial ADT - Sparse Matrix ADT - Representation of Multidimensional Arrays - String ADT. **(3)**

STACKS AND QUEUES

Stack ADT - Queue ADT - Mazing Problem - Evaluation of Expressions - Multiple Stacks and Queues. **(3)**

LINKED LISTS

Pointers - Singly Linked Lists - Dynamically Linked Stacks and Queues. **(3)**

SEARCHING AND SORTING

Searching and List Verification - Insertion Sort - Quick Sort. **(3)**

TOTAL : 15

REFERENCES

1. *Ellis Horowitz, Sartaj Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition, 2008.*
2. *Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach with C", Cengage Learning, 2nd Edition, 2007 .*
3. *Yashavant P. Kanetkar, "Data Structures through C", BPB Publications, 2nd Edition, 2003.*
4. *Seymour Lipschutz, "Data Structures with C", Schaum's Outline Series, McGraw Hill Publications, 2nd Edition, 2014.*

20MCAB12 - PROGRAMMING IN C

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

ARRAYS AND POINTERS

Array manipulation: single, two and multi dimensional arrays. declaration, assignment and accessing using index values. Algorithms using arrays. Matrix operations, sort, search and applications using arrays. Pointers - Declaration. Accessing pointers. Pointers and Arrays. **(4)**

RECURSIVE FUNCTIONS

Recursive Function basic need for it. Declaration, Definition and Calling. Parameter passing - Local variables in recursive functions - Applications of recursive functions - Real time applications **(3)**

STRUCTURES, UNION AND ENUMERATION

Structure definition, declaration and using structures in programs. Pointers and structures. Structured arrays - creation and manipulation. Linked structures - Creation and manipulation. Applications of Linked Structures. Enumerations. **(4)**

FILE AND ERROR HANDLING

File concept - File opening in various modes and closing of a file - Reading from a file - Writing onto a file. Preprocessor: Conditional Compilation directives - Macros - Command Line Arguments. **(4)**

TOTAL : 15

REFERENCES

1. *Herbert Schildt, "C - The Complete Reference, McGraw Hill", 4h Edition, 2017.*
2. *R.G. Dromey, "How to solve it by Computer", Pearson Education, 5th Edition, 2007.*
3. *Kernighan B.W. and Ritchie D.M., "C Programming Language (ANSI C)", Paperback-1, Pearson Education, 2015.*
4. *Yashawant Kanetkar, "Let us C", BPB, 16th Edition, 2018.*
5. *Terrence W Pratt, "Programming language: Design and Implementation", Prentice Hall of India, 4th Edition, 2001.*

20MCAB13 - COMPUTER HARDWARE AND ORGANIZATION

L	T	P	C
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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

BASIC STRUCTURE OF COMPUTERS

Computer Types, Functional unit, Basic OPERATIONAL concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data Representation. Fixed Point Control memory, Address sequencing, microprogram example and control, Basic concepts semiconductor RAM memories. Read-only memory Computer Fundamentals. **(3)**

COMPUTER HARDWARE

History and Generations of Computer, Description of Different parts of a Computer and System Software and Application Software, Learn and apply basic safety procedures, Assemble a personal computer in accordance with configuration, Performing installation of operating system and other application, Usage of relevant tools and diagnostic techniques Configure Internet and Email, Perform routine, The software and Hardware parts, Preliminary information of hardware components. **(3)**

PREVENTIVE MAINTENANCE

Perform repairs to personal computers, The different types of Operating Systems and its importance, Complete information computer configuration activities, How to assemble the computer according customer requirements in a real environment, How to install computer Software, devices drivers as well as configuration of peripheral devices, How to install and configure networking devices setting and applications, How to configure internet and email configuration according to the requirements, How to diagnose, repair and maintain the computer according to the standards. Identifying, using, and connecting hardware components and devices. **(3)**

INPUT-OUTPUT ORGANIZATION

Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt Direct memory Access, Input -Output Processor (IOP) Serial communication; Introduction to peripheral component, Interconnect (PCI) bus. Introduction to standard serial communication protocols like RS232, USB, IEEE1394. **(3)**

PIPELINE, VECTOR & MULTI PROCESSORS

Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors, Characteristics or Multiprocessors, Interconnection Structures, Interprocessor Arbitration. InterProcessor Communication and Synchronization Cache Coherance. Shared Memory Multiprocessors. **(3)**

TOTAL : 15

REFERENCES

1. *Carl Hamacher, Zvonks Vranesic, SafeaZaky, "Computer Organization", Vth Edition, McGraw Hill. 2016.*
2. *M.Moris Mano, "Computer Systems Architecture" IIIrd Edition, Pearson/PHI 2017.*
3. *Morris Rosenthal "The Laptop Repair Workbook: An Introduction to Troubleshooting and Repairing Laptop Computers", 2nd Edition, PHI, 2016.*
4. *Jyotika Deshmukh, "A text book of Computer Hardware and Networking", Prentice Hall, 4th Edition, 2019.*
5. *Richand M. Roberts "Computer Service & Repair, 4th Edition, PHI, 2019.*

20MCAB21 - BASICS OF INTERNET

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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

INTRODUCTION

Internet Today - The WWW - History - Resources - Architecture - Client / Server Technology - Accessing the Web: Browsers, its features, extension, plugins, Services by google to the web. **(2)**

INTERNET AND RESOURCES

The network technology - Network Addresses - Protocols - URL - format - accessing the web. Resources: The Web pages, applications, database and attachments. MIME types. Applications:- Intermediaries - agents - monitors - resource identifiers - Data Exchange by commercial applications. **(2)**

TECHNOLOGIES

Static & Dynamic Page Development: HTML, DHTML, CSS, XML, - Versions and Standards - Scripting languages - Java Script - accessing the tags and web content using java script. Script Event Programming. Web Server - Accessing the Server - HTTP methods - Requests/Response. Server Page Development: JSP. Servlet Technologies. **(4)**

WEB BACKEND

Web database: XML, Structure - tags, attributes. XSD - Resource standards. Exchange data using XSD format. XSD and SOAP technologies. Connecting to databases on both client and Server Side. **(4)**

INTERNET SECURITY

Fire Wall - Setting up the firewall security, Data exchange security: Encryption/ Decryption standards. Threats and VIRUS. How to Save? Security Methods. **(3)**

TOTAL : 15

REFERENCES

1. *Harvey Deitel, Abbey Deitel, "Internet and World Wide Web How To Program", Fifth Edition, Pearson, 2012.*
2. *John R. Vacca, "Cyber Security and IT Infrastructure Protection", Paperback, Elsevier Science, 2013.*

20MCAB22 - SOFTWARE PROJECT MANAGEMENT

L	T	P	C
1	0	0	0

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

Introduction to Software Project Management : Introduction Software Project Management Importance, Project definition, Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, Project Management Life Cycle, Traditional versus Modern Project Management Practices. **(3)**

Project Evaluation and Programme Management : Introduction, Business Case, Project Portfolio Management, Evaluation of Individual Projects, Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programmes, Strategic Programme Management, Creating a Programme Management. **(3)**

Project Planning Selection and managing resource : Introduction to Step Wise Project Planning, Software Processes and Process Models, The Waterfall Model, Software Prototyping, Managing People in Software Environments: Introduction, Selecting the Right Person for the Job, Working in Teams: Introduction, Becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership. **(3)**

Software Effort Estimation and Risk Management : Introduction, Estimates methodology, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom- up Estimating, The Top-down Approach and Parametric Models, Cost Estimation, Staffing Pattern, Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning. **(3)**

Software Quality management and Project Closeout : Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans.Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report. **(3)**

TOTAL : 15

REFERENCES

1) *Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", 6th Edition, Tata Mcgraw Hill, 2017.*
2) *Shailesh Mehta "SPD Project Management and Tools & Technologies - An overview", PHI, 1st Edition, 2016.*
3) *Walker Royce, "Software Project Management", 1st Edition, Addison Wesley/Pearson, 2015.*
4) *Rober K.Wysocki, "Effective Software Project Management", 2nd Edition, Wiley Publication, 2016.*
5) *Gopalaswamy Ramesh, "Managing Global Software Projects", 3rd Edition, McGraw Hill Education (India), 2019.*

20MCAB23 - OBJECT ORIENTED PRINCIPLES AND PROGRAMMING IN C++

L	T	P	C
1	0	0	0

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

INTRODUCTION

Object Oriented Principles - Key concepts of object oriented programming - Object identification- Software Complexity - The Object model - Classes and Objects - Classification. **(1)**

BASIC FACILITIES IN C++

Overview of C++ - Types and Declarations - Arrays, Pointers, Structures, References and Functions - Function Overloading - Name spaces - Source Files and Programs. **(2)**

ABSTRACT DATA TYPE IN C++

Class - Class members and Access control - Constructors- Static members - Default copy constructor - this pointer - Inline function definition - Concrete classes - Destructors - new and delete. **(3)**

OPERATOR OVERLOADING

Operator Functions - Binary and Unary Operators - Member and Non Member Operators - Friend Functions - Function call - Increment and Decrement - A String class. **(3)**

INHERITANCE

Derived Classes - Class Hierarchies - Virtual Functions - Abstract classes. **(3)**

EXCEPTION HANDLING AND LIBRARY CLASSES

Grouping of exceptions - Catching exceptions - Exceptions that are not errors - Uncaught Exceptions - Standard exceptions - The standard library - I/O streams - File streams. **(3)**

TOTAL : 15

REFERENCES

1. *Bjarne Stroustrup, "The C++ Programming Language", 4th Edition, Addison Wesley, 2013.*
2. *Herbert Schildt, "The Complete Reference C++", 6th Edition, Tata McGraw Hill, 2013.*
3. *Stanley B Lippman, Jove Lajoie, and Barbara Moo, "C++ Primer", 5th Edition, Addison Wesley, 2012.*

Year- 5 (2019-20)			
Sl.No	**Name of the programme**	**Name of the Course**	**Course Code**
Civil Engineering			
1	BE Civil Engineering	Partial Differential Equations and Its Applications	19CEM31
2	BE Civil Engineering	Professional Practices and Ethics	19CE46
3	BE Civil Engineering	Practical Geotechnical Engineering	19CEOC01
4	BE Civil Engineering	Green Buildings	19CEOC02
5	BE Civil Engineering	Sustainable Architecture	19CEOC04
Mechanical Engineering			
6	B.E. Mechanical Engineering	Micro and Nano Electro-mechanical Systems	
7	B.E. Mechanical Engineering	Project Phase 1	19ME73
8	B.E. Mechanical Engineering	Project Phase 2	19ME81
9	B.E. Mechanical Engineering	Material Characterization and Testing Laboratory	19MEL47A
10	B.E. Mechanical Engineering	Manufacturing Processes Laboratory	19MEL47B
11	B.E. Mechanical Engineering	Applied Thermal Sciences Laboratory	19MEL56A
12	B.E. Mechanical Engineering	Dynamics and Metrology Laboratory	19MEL56B
13	B.E. Mechanical Engineering	One Credit Course on Foundry Practice and Procedure	19MEOC05
14	B.E. Mechanical Engineering	MATLAB Programming*	19ME0C01
15	B.E. Mechanical Engineering	Non Destructive Evaluation	19ME0C02
16	B.E. Mechanical Engineering	Advanced Industrial Automation Systems*	19ME0C03

Sl.No	Name of the programme	Name of the Course	Course Code
17	B.E. Mechanical Engineering	Recent Trends in Quality	19ME0C04
18	B.E. Mechanical Engineering	Basics of Automotive Electrical Systems	19ME0C06
19	B.E. Mechanical Engineering	Design Thinking - A Primer	19ME0C07
20	B.E. Mechanical Engineering	Aircraft Maintenance*	19ME0C08
21	B.E. Mechanical Engineering	Inspection and Quality Control in Manufacturing*	19ME0C09
22	B.E. Mechanical Engineering	Constitution of India	19ME0C10
23	B.E. Mechanical Engineering	Biology for Engineers	19ME0C11
24	B.E. Mechanical Engineering	Human Values	19ME0C12
25	B.E. Mechanical Engineering	E-Commerce Security*	19ME0C13
Electrical and Electronics Engineering			
26	B.E.Electrical and Electronics Engineering	Calculus and Numerical Methods	19FYM12
27	B.E.Electrical and Electronics Engineering	Vector Calculus, Linear Algebra and Partial Differential Equations	19FYM22
28	B.E.Electrical and Electronics Engineering	C programming and Data Bases	19CSL21
29	B.E.Electrical and Electronics Engineering	Electric and Magnetic Circuits	19EE22
30	B.E.Electrical and Electronics Engineering	Intelligent Techniques for Electrical Engineering	15EEE30
31	B.E.Electrical and Electronics Engineering	OOPS and C++ for electrical engineers	19EE46
Electronics and Communication Engineering			
32	B.E.Electronics and Communication Engineering	Real Time Applications using Python	15ECE35
33	B.E.Electronics and Communication Engineering	Foundations for Employability	16ECOC02

Sl.No	Name of the programme	Name of the Course	Course Code
34	B.E.Electronics and Communication Engineering	Advanced C Programming	16ECOC03
35	B.E.Electronics and Communication Engineering	Introduction to Machine Learning	15ECE36
Chemical Engineering			
36	B.Tech. Chemical Engineering	Introduction to Chemical Computing	19CHL21
Structural Engineering			
37	M.E Structural Engineering	Prefabricated Structures	19MCEE18
38	M.E Structural Engineering	Energy Efficient Building	19MSEOE02
Construction Management			
39	M.E Construction Management	Landscaping and Architecture	19MCMOE01
40	M.E Construction Management	Data Analysis Laboratory for Construction Management	19MCM16
41	M.E Construction Management	Project Planning Laboratory for Construction Management	19MCM24
42	M.E Construction Management	Advanced Construction Materials & Equipment	19MCME01
43	M.E Construction Management	Quality Management for Construction Projects	19MCME02
44	M.E Construction Management	Construction Risk Management	19MCME06
45	M.E Construction Management	Lean Construction Concepts, Tools & Practices	19MCME12
Advanced Manufacturing Technology			
46	M. E. Advanced Manufacturing Technology	Product Design and Development	19MMAE12
47	M. E. Advanced Manufacturing Technology	Advanced Manufacturing Planning and Control	19MMAE14

Sl.No	Name of the programme	Name of the Course	Course Code
48	M. E. Advanced Manufacturing Technology	Advanced Biomaterials	19MMAE22
49	M. E. Advanced Manufacturing Technology	Smart materials and Systems	19MMAE24
50	M. E. Advanced Manufacturing Technology	Design of Experiments and Taguchi methods.	19MMAE27
51	M. E. Advanced Manufacturing Technology	Design and Analysis of Experiments.	19MMAE30
52	M. E. Advanced Manufacturing Technology	Automation and Robotics	19MMAOE01
53	M. E. Advanced Manufacturing Technology	Work Study and Ergonomics	19MMAOE02
54	M. E. Advanced Manufacturing Technology	Product Life Cycle Management	19MMAOE03
55	M. E. Advanced Manufacturing Technology	IOT in Manufacturing	19MMAOE04
56	M. E. Advanced Manufacturing Technology	Artificial Intelligence and Machine Learning in Design and Manufacturing	19MMAOE05
57	M. E. Advanced Manufacturing Technology	Research methodology and IPR	19MMAOE06
M.E Computer Science Engineering			
58	M.E Computer Science Engineering	Probability and Statistics	19MCS21
MSC Software Systems			
59	MSC Software Systems	Advanced Web Technology	15MSSE37
60	MSC Software Systems	Advanced Web Technology Lab	15MSSL14
61	MSC Software Systems	Quantum Computing Lab	15MSSL15

Sl.No	Name of the programme	Name of the Course	Course Code
Master of Computer Applications			
62	Master of Computer Applications	Advanced Programming Laboratory	18MCAE35
63	Master of Computer Applications	Network Programming Laboratory	18MCAE37
64	Master of Computer Applications	Web Frameworks Laboratory	18MCAEL07
Decision and Computing Sciences			
65	MSc Decision and Computing Sciences	Modeling and Simulation	17MDC81
66	MSc Decision and Computing Sciences	Decision Support Systems	17MDC82
67	MSc Decision and Computing Sciences	Game Theory and Decision Analysis	17MDC83
68	MSc Decision and Computing Sciences	Business Intelligence Laboratory	17MDC84
69	MSc Decision and Computing Sciences	Decision Analysis Lab (Game Theory)	17MDC85
70	MSc Decision and Computing Sciences	Entrepreneurship Development	17MDC86
71	MSc Decision and Computing Sciences	Principles of Information Security	17MDC91
72	MSc Decision and Computing Sciences	Project Management	17MDC92
73	MSc Decision and Computing Sciences	Human Computer Interface and Interaction	17MDC93
74	MSc Decision and Computing Sciences	Human Computer Interface and Interaction Lab	17MDC94

Sl.No	Name of the programme	Name of the Course	Course Code
75	MSc Decision and Computing Sciences	Minor Project (Decision Tool Development)	17MDC95
76	MSc Decision and Computing Sciences	Business Ethics	17MDC96
77	MSc Decision and Computing Sciences	Security Analysis and Portfolio Management	17MDCE01
78	MSc Decision and Computing Sciences	Equity Valuation	17MDCE02
79	MSc Decision and Computing Sciences	Derivatives and Risk Management	17MDCE03
80	MSc Decision and Computing Sciences	Credit Risk Analytics and Management	17MDCE04
81	MSc Decision and Computing Sciences	Consumer Behavior	17MDCE11
82	MSc Decision and Computing Sciences	Services Marketing	17MDCE12
83	MSc Decision and Computing Sciences	Customer Relationship Management	17MDCE13
84	MSc Decision and Computing Sciences	Brand Management	17MDCE14
85	MSc Decision and Computing Sciences	Strategic Human Resource Management	17MDCE21
86	MSc Decision and Computing Sciences	Organizational Development	17MDCE22
87	MSc Decision and Computing Sciences	Performance Management	17MDCE23
88	MSc Decision and Computing Sciences	Compensation Management	17MDCE24
89	MSc Decision and Computing Sciences	Total Quality Management	17MDCE31

Sl.No	Name of the programme	Name of the Course	Course Code
90	MSc Decision and Computing Sciences	Logistics Strategy and Planning	17MDCE32
91	MSc Decision and Computing Sciences	Supply Chain Management	17MDCE33
92	MSc Decision and Computing Sciences	Warehouse and Distribution Management	17MDCE34
93	MSc Decision and Computing Sciences	Business Environment	17MDCE41
94	MSc Decision and Computing Sciences	Legal Aspects of Business	17MDCE42
95	MSc Decision and Computing Sciences	Information Technology for Managers	17MDCE43
96	MSc Decision and Computing Sciences	Direct and Indirect Tax	17MDCE44
97	MSc Decision and Computing Sciences	Technology and Innovation Management	17MDCE45
98	MSc Decision and Computing Sciences	Business Process Management	17MDCE46
99	MSc Decision and Computing Sciences	Distributed Systems	17MDCE51
100	MSc Decision and Computing Sciences	Minor Project in Business / Data Analytics	17MDCEL1
101	MSc Decision and Computing Sciences	Modeling and Simulation Laboratory	17MDCEL2
Artificial Intelligence & Machine Learning			
102	M.Sc. Artificial Intelligence & Machine Learning	Applied Algebra	19MAM12
103	M.Sc. Artificial Intelligence & Machine Learning	Fundamental Statistical Methods	19MAM13

Sl.No	Name of the programme	Name of the Course	Course Code
104	M.Sc. Artificial Intelligence & Machine Learning	Data Structures	19MAM14
105	M.Sc. Artificial Intelligence & Machine Learning	Theory of Programming Languages	19MAM15
106	M.Sc. Artificial Intelligence & Machine Learning	Algebra and Statistics Lab	19MAM16
107	M.Sc. Artificial Intelligence & Machine Learning	Data Structures Lab	19MAM17
108	M.Sc. Artificial Intelligence & Machine Learning	Python Programming Lab	19MAM18
109	M.Sc. Artificial Intelligence & Machine Learning	Applied Calculus	19MAM21
110	M.Sc. Artificial Intelligence & Machine Learning	Computer System Architecture	19MAM23
111	M.Sc. Artificial Intelligence & Machine Learning	Advanced Data Structures	19MAM24
112	M.Sc. Artificial Intelligence & Machine Learning	Calculus and Probability Lab	19MAM25
113	M.Sc. Artificial Intelligence & Machine Learning	Programming Paradigm Lab	19MAM26
114	M.Sc. Artificial Intelligence & Machine Learning	Advanced Data Structures Lab	19MAM27

19CEM31 - DIFFERENTIAL EQUATIONS AND BOUNDARY VALUE PROBLEMS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon the completion of the course, the students will be able to

CO1 *: Analyze the concepts of ordinary differential equations in modelling and solving physical problems*

CO2 *: Demonstrate accurate and efficient use of numerical solutions of ordinary differential equations and their role in modern mathematics and applied contexts*

CO3 *: Formulate concrete problems and finding the solutions of partial differential equations*

CO4 *: Solve the boundary value problems relevant to vibration of strings*

CO5 *: Familiarize finite difference approximation to get numerical solutions of partial differential equations*

ORDINARY DIFFERENTIAL EQUATIONS

Second and higher order linear differential equations with constant coefficients - Cauchy-Euler equation, Cauchy-Legendre equation- Method of variation of parameters - System of simultaneous linear differential equations with constant coefficients **(9)**

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Numerical solution of first order ordinary differential equation: Taylor Series Method -Picard's Method - Euler's method -Modified Euler's method- Fourth order Runge- Kutta method - Milne's predictor and corrector method **(9)**

PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations - Solutions of first order non-linear partial differential equations(standard types) - Lagrange's linear equations -Second and higher order homogeneous linear equations with constant coefficients **(9)**

BOUNDARY VALUE PROBLEMS

Method of separation of variables - Vibration of strings - One dimensional wave equation - One dimensional heat flow equations with steady state and unsteady state solutions **(9)**

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

Difference quotients - Graphical representation of partial quotients - Classification - One dimensional heat equation: Explicit formula - Bender Schmidt recurrence method - One dimensional wave equation: Explicit formula **(9)**

TOTAL: 45+15=60

TEXT BOOKS

1. *B.S. Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, 2012.*
2. *B.V.Ramana, "Higher Engineering Mathematics", Kindle Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.*

19CE46 - PROFESSIONAL PRACTICE AND ETHICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of the course, student will be able to

CO1 *: Acquire the knowledge of Building by laws and regulations and plan approval methods*

CO2 *: Perform and establish approval process for any type of buildings including electrical supply and water supply.*

CO3 *: Able to execute the Fundamentals for establishment of individual firms, registration with government agencies and membership in professional bodies.*

CO4 *: Able to perform documentation and preparation of bills from commencement till the closure of the project.*

CO5 *: Perform ethics and fundamentals in establishing professional practice with social responsibility.*

BUILDING BY LAWS RULES AND REGULATION AND PLAN APPROVAL PROCESS

Building by laws - importance - acts and rules of public interest - state and central - approval bodies- Metros - Corporation - Municipalities - Town Panchayats. Land use Classification in urban & Mofussil Areas-Related Regulatory and approvals. Preparation and Submission of Drawings and Documents for Building Approval and Layout. **(9)**

MUNICIPAL SERVICES (WATER SUPPLY SEWAGE AND ELECTRICAL CONNECTIONS

Local approvals and clearances for residential, industrial and commercial Buildings - General specifications for water supply and sewers - Water Supply - Process for waste water connections to public Mains. Domestic water supply connection from public mains, types and sizes of pipes, special installation in multi-storeyed buildings. Connections to Public sewers.

General Specifications - Electrical supply for residential, industrial and commercial Buildings - List of procedures - Standards - Local approvals and clearances for residential, industrial and commercial Buildings-Temporary - Permanent Services-Consumer Guidance TNEB. **(9)**

ESTABLISHMENT FOR PROFESSIONAL PRACTICE

Establishment of firm - Consultancy, Construction - Registration of firms with GST, CST, Companies -IT - Licensing from local bodies - Metros - Municipalities, town panchayats - Obtaining Chartered Engineership, approved valuership, registered valuership with income tax, Bank empanelment-Membership of other professional bodies- BAI, ACCE(I) Etc., - Registration of contractors with Government Departments, Public undertakings & Private organizations. **(9)**

DOCUMENTATION FOR PROJECT COMMENCEMENT AND CLOSURE AND TAX ASSESSMENT

Documentation for formal approval of work commencement - Procedures. Documentation for procurement and mobilization of resources - Record of works - Changes - Deviation - Preparation of running account bill & Final bill. Submission of project closure report. Handing over documents -Procedure for contract closure. **(9)**

19MEL47A / 19MEL47B	Material Characterization and Testing Laboratory / Manufacturing Processes Laboratory	0	0	2	0.5	PCC
	One Credit Course - Elective II	1	0	0	1	EEC
19HOC41	Communication Skills for Engineers - II*	0	0	2	1	EEC
	TOTAL CREDITS				**22**	

* Not to be counted for GPA. Pass is required.

Semester V

Course Code	Course Name	L	T	P	C	Category
19ME51	Heat and Mass Transfer	3	1	0	4	PCC
19ME52	Design of Machine Elements	3	1	0	4	PCC
19ME53	Manufacturing Processes - II	3	0	0	3	PCC
19ME54	Metrology and Quality Control	3	0	0	3	PCC
19ME55	Operations Research	3	1	0	4	HS
	Elective 1	3	0	0	3	PEC
19MEL47A / 19MEL47B	Material Characterization and Testing Laboratory / Manufacturing Processes Laboratory	0	0	2	0.5	PCC
19MEL56A / 19MEL56B	Applied Thermal Sciences Laboratory / Dynamics and Metrology Laboratory	0	0	2	0.5	PCC
	One Credit Course - Elective III	1	0	0	1	EEC
19INT51	Internship - I	0	0	0	1	EEC
19ME67	Mini Project	0	0	3	0	EEC
19HOC51	Employability and Personality Development Skills - I*	0	0	2	1	
	TOTAL CREDITS				**25**	

Semester VI

Course Code	Course Name	L	T	P	C	Category
19ME61	Refrigeration and Air-conditioning	3	0	0	3	PCC
19ME62	Finite Element Analysis	3	1	0	4	PCC
19ME63	Design of Transmission Systems	3	1	0	4	PCC
19ME64	Computer Aided Engineering	3	1	0	4	PCC
	Elective 2	3	0	0	3	PEC
19MEL56A / 19MEL56B	Applied Thermal Sciences Laboratory / Dynamics and Metrology Laboratory	0	0	2	0.5	PCC
19MEL65	CAD / CAM Laboratory	0	0	2	1	PCC
	One Credit Course - Elective IV	1	0	0	1	PCC
19INT61	Internship - II	0	0	0	1	EEC
19ME67	Mini Project	0	0	3	3	EEC
19HOC61	Employability and Personality Development Skills - II*	0	0	2	1	
	TOTAL CREDITS				**25.5**	

* Not to be counted for GPA. Pass is required.

Semester VII

Course Code	Course Name	L	T	P	C	Category
19ME71	Control Theory and Mechatronics	2	0	2	3	PCC
19ME72	Quality Engineering and Management	3	0	0	3	PCC
	Elective 3	3	0	0	3	PEC
	Elective 4	3	0	0	3	PEC
	Elective 5	3	0	0	3	OEC
	Elective 6	3	0	0	3	OEC
19ME73	Project Work Phase - I	0	0	6	3	EEC
	TOTAL CREDITS				**21**	

Semester VIII

Course Code	Course Name	L	T	P	C	Category
	Elective 7	3	0	0	3	PEC
	Elective 8	3	0	0	3	PEC
19ME81	Project Work Phase - II	0	0	10	5	EEC
	TOTAL CREDITS				**11**	

Semester 1	20
Semester 2	19
Semester 3	22.5
Semester 4	22
Semester 5	25
Semester 6	25.5
Semester 7	21
Semester 8	11
Total Credits	**166**

List of Professional Elective Courses (PEC)

STREAM : MATERIALS AND DESIGN

Course Code	Course Name	L	T	P	C
19MEE01	Composite Materials	3	0	0	3
19MEE02	Design for Manufacturing and Assembly	3	0	0	3
19MEE03	Design of Jigs and Fixtures	3	0	0	3
19MEE04	Mechanical Behaviour of Materials	3	0	0	3
19MEE05	Machine Tool Design	3	0	0	3
19MEE06	Mechanical Vibrations and Control	3	0	0	3
19MEE07	Tribology	3	0	0	3
19MEE08	Experimental Stress Analysis	3	0	0	3
19MEE09	Fluid Power Control Systems	3	0	0	3
19MEE10	Sensor Technology	3	0	0	3
19MEE11	Smart Materials	3	0	0	3
19MEE12	Non-Destructive Evaluation and Imaging	3	0	0	3
19MEE13	Automotive Electronics and Power Train Systems	3	0	0	3
19MEE14	Bio-materials	3	0	0	3
19MEE15	Micro and Nano Electro-mechanical Systems	3	0	0	3

STREAM : THERMAL SCIENCES

Course Code	Course Name	L	T	P	C
19MEE16	Solar Energy Technology	3	0	0	3
19MEE17	Gas Dynamics and Space Propulsion	3	0	0	3
19MEE18	Computational Fluid Dynamics	3	0	0	3
19MEE19	Alternative Energy Conversion Techniques	3	0	0	3
19MEE20	Advanced Fluid Mechanics	3	0	0	3
19MEE21	Advanced Thermodynamics	3	0	0	3
19MEE22	Cryogenics	3	0	0	3
19MEE23	Combustion and Internal Combustion Engines	3	0	0	3
19MEE24	Energy Conservation and Waste Heat Recovery	3	0	0	3
19MEE25	Design of Heat Exchangers	3	0	0	3
19MEE26	Turbo machines	3	0	0	3
19MEE27	Power Plant Engineering	3	0	0	3

STREAM : MANUFACTURING AND MANAGEMENT

Course Code	Course Name	L	T	P	C
19MEE28	Industrial Psychology	3	0	0	3
19MEE29	Work System Design	3	0	0	3
19MEE30	Total Productivity Management	3	0	0	3
19MEE31	Plant Layout and Material Handling	3	0	0	3
19MEE32	Project Management	3	0	0	3
19MEE33	Rapid Prototyping	3	0	0	3
19MEE34	Advanced Welding Technology	3	0	0	3
19MEE35	Advanced Foundry Technology	3	0	0	3
19MEE36	Supply Chain Management	3	0	0	3
19MEE37	Quantity Production Methods	3	0	0	3
19MEE38	Production Planning and Control	3	0	0	3
19MEE39	Lean and Agile Manufacturing	3	0	0	3
19MEE40	Production and Operations Management	3	0	0	3
19MEE41	Smart Manufacturing	3	0	0	3
19MEE42	Manufacturing Planning and Cost Estimation	3	0	0	3
19MEE43	Manufacturing Systems Management	3	0	0	3

ONE CREDIT COURSES (ELECTIVES) OFFERED

Course Code	Course Name	Category	L	T	P	C
19MEOC01	MATLAB Programming*	OC	1	0	0	1
19MEOC02	Non-Destructive Evaluation	OC	1	0	0	1
19MEOC03	Advanced Industrial Automation Systems*	OC	1	0	0	1
19MEOC04	Recent Trends in Quality	OC	1	0	0	1
19MEOC05	Foundry Practice and Procedures	OC	1	0	0	1
19MEOC06	Basics of Automotive Electrical Systems*	OC	1	0	0	1
19MEOC07	Design Thinking - A Primer	OC	1	0	0	1
19MEOC08	Aircraft Maintenance*	OC	1	0	0	1
19MEOC09	Inspection and Quality Control in Manufacturing*	OC	1	0	0	1
19MEOC10	Constitution of India	OC	1	0	0	1
19MEOC11	Biology for Engineers	OC	1	0	0	1
19MEOC12	Human Values	OC	1	0	0	1
19MEOC13	E-Commerce Security*	OC	1	0	0	1
19MEOC14	Innovation and Entrepreneurship	OC	1	0	0	1
19MEOC15	3-D Scanning Technology	OC	1	0	0	1

* Employability enhancement courses

19HOC31 - COMMUNICATION SKILLS FOR ENGINEERS - I

L	T	P	C
0	0	2	1

COURSE OUTCOMES

The student will be able to

CO1 *: Gain confidence, enhance Personality and develop positive attitude in their work and life.*

CO2 *: Effectively communicate and present opinions using appropriate functional expressions for a given situation.*

CO3 *: Compose Emails, Reports for a given business scenario using appropriate sentence construction and in the prescribed format.*

CO4 *: Generate ideas and speak confidently on a given topic in a competitive scenario like Debate, Group Discussion, and Public Speaking.*

PERSONALITY DEVELOPMENT

Motivation and Self Confidence, SCOT Analysis - Personality Development - What is Personality, Developing Positive Attitude towards work and life, Building Relationship with others - Personality Development - Paradigms of Human Interaction, Fear Management. **(4)**

VERBAL COMMUNICATION

English Conversation - Asking and Giving Opinions - English Conversation -Thanking People, Asking and Giving Suggestions - English Conversation - Asking for Direction, Agreeing and Disagreeing - Role Play-Business. **(5)**

BUSINESS COMMUNICATION

Email Writing - Format, Etiquettes and Tips - Report Writing - Introduction, elements and tips - Drafting a report - Error Identification - Rules, Common Mistakes and Exercises - Sentence Completion Filler (fill in the blanks using apt words). **(5)**

PUBLIC SPEAKING

How to start and sustain a conversation - Debate - Extempore - Group Discussion - Importance and Process - Public Speaking - Introduction, Tips - Drafting a Public Speech - Interview - Types, Dos and Don'ts - Mock Press. **(6)**

REFERENCES

1. *https://nptel.ac.in/content/storage2/courses/109104030/references/references.pdf (online resource)*
2. *John Seelay, Oxford Guide to Effective Writing and Speaking, 2nd Edition, Kindle Edition by Oxford University Press, 2007.*
3. *Sabina Pillai, Agna Fernandez, Soft Skills and Employability Skills - Published by Cambridge University Press, 2017.*

19MEL47A - MATERIAL CHARACTERIZATION AND TESTING LABORATORY

L	T	P	C
0	0	2	0.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

At the end of the course, the students will be able to

CO1 *: Evaluate grain size, morphology, microstructure and microhardness of metals and alloys.*

CO2 *: Estimate hardness and conduct impact tests on specimens.*

CO3 *: Perform tension, shear, torsion and deflection tests on a given specimen.*

LIST OF EXPERIMENTS

1. Evaluation of grain size, morphology, distribution of the reinforcement in copper metal matrix composites.
2. Evaluation of microstructure and microhardness of the friction stir welded steel and aluminium alloy.
3. Evaluation of microstructure of the post weld heat treated SMA welded mild steel.
4. Measurement of hardness of the quenched sample using Jominy End Quench Test Apparatus.
5. Tension & Shear test on mild steel rod.
6. Hardness test - Brinell & Rockwell.
7. Impact test on metals (Izod and Charpy tests)
8. Test on helical spring.
9. Deflection test on wooden beams (simply supported and cantilever)
10. Torsion test on mild steel rod.

REFERENCES

1. *Strength of Materials Laboratory Manual, Department of Civil Engineering, CIT, 2018.*
2. *Rajput R.K, "Strength of Materials", S.K. Kataria and Sons, New Delhi, 2018.*
3. *I.S: 3495 Part I to IV, "Methods of Test for Burnt Clay Building Bricks", Bureau of Indian Standards, New Delhi, 2017.*
4. *Materials and Metallurgy Laboratory Manual, Department of Mechanical Engineering, CIT, 2019.*
5. *https://nptel.ac.in/courses/113/106/113106034/*
6. *https://nptel.ac.in/courses/115/103/115103030/*

19MEL47B - MANUFACTURING PROCESSES LABORATORY

L	T	P	C
0	0	2	0.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

At the end of the course, the students will be able to

***CO1** : Identify suitable mold making process and pattern to perform Packing Gland, Bracket, Stepped Pulley, Bend Pipe, Loose Piece and Square Box patterns.*

***CO2** : Demonstrate Principle and operations of a center lathe to produce cylindrical components of ferrous metals (mild steel) and apply threading process to generate external V - threads and find the pitch, speed and feed of center lathe.*

***CO3** : Apply taper turning process and create a conical shape component made of ferrous and nonferrous metals using center lathe and create a contour shape like concave and convex shapes on cylindrical components of ferrous and non-ferrous using center lathe.*

***CO4** : Perform Butt Joint, Lap joint, T Joint, and Corner Joint in mild steel of 3 mm thickness using welding process, also prepare WPS for different joints.*

***CO5** : Calculate cutting parameters and generate a spur gear and helical gear of ferrous metals using a milling/gear hobbing machine.*

***CO6** : Calculate cutting parameters and generate different shapes using special purpose machines.*

LIST OF EXPERIMENTS

1. Determine the Grain size, Permeability and Compressive Strength of the Moulding Sand.
2. Prepare green sand mould using a solid pattern/ split pattern.
3. Prepare green sand mould using loose piece patterns.
4. Prepare "Butt Joint / lap joint" using MMAW Process and prepare a welding procedure specification (WPS Sheet) & report on post weld inspection.
5. Prepare a WPS Sheet for making "T Joint/ Corner Joint" using TIG/MAG welding Process and perform visual inspection to identify welding defects on weld bead.
6. Prepare a lap Joint on the given work pieces using spot welding equipment.
7. Prepare a component by Lathe machine using operations like Plain, Step Turning and chamfering and Calculate the machining time.
8. Machine a tapered surface in a cylindrical object using any one taper turning method, create a hole and make Convex / concave profile on it. Prepare a dimensional inspection report for the component produced.
9. To produce a spur gear and helical gear using a universal milling machine / gear hobbing machine. Prepare a dimensional inspection report for the component produced.
10. To create holes and make threads by tapping using a drilling machine also make a square keyway using a slotting machine. Prepare a dimensional inspection report for the component produced.
11. To make a cube, stepped slide, male and female stepped slide, angular slide and curve slide using a shaping machine. Prepare a dimensional inspection report for the component produced.
12. To machine a square, a pentagon, a hexagon, and a triangular head using a vertical milling machine. Prepare a dimensional inspection report for the component produced.

19HOC41 - COMMUNICATION SKILLS FOR ENGINEERS - II

L	T	P	C
0	0	2	1

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the student will be able to

CO1 *: Solve objective questions on analogy, Statement and Argument, Statement and Conclusion, Data Sufficiency and Sentence improvement within a given time.*

CO2 *: Construct grammatically correct sentences.*

CO3 *: Speak confidently to describe a process, present information on the specified topic and disseminate information in a professional manner.*

SELF EVALUATION

Self believe and self Esteem - Activities based on Current Events **(2)**

VERBAL AND LOGICAL RESONING

Analogy - Introduction, Types and Exercises - Statement and Argument - Statement and Conclusion - Data Sufficiency - Sentence Improvement - Critical Reasoning / Theme Detection **(5)**

GRAMMAR

Basic Grammar- Subject Verb Agreement - One word substitute - Preposition- Cause and Effect - Basic level questions and Moderate level questions. **(4)**

PRESENTATION TECHNIQUES

Describing a Process - Presentation Skills - Introduction, Planning and Preparation - Presentation on a Topic - Group Discussion - Dos and Don'ts - Functional Expressions used in Group Discussion - Interview Skills - Ideal Grooming for an interview, Preparing for the Interview **(9)**

REFERENCES

1. *Sanjay Kumar, Pushp Lata, Communication Skills, 2nd Edition, Oxford University Press, New Delhi, India, 2015.*
2. *Anthony Manning, Chris Sowton and Craig Thaine, Cambridge Academic English, published by Cambridge University Press, U P, India, 2012.*

19MEL56A - APPLIED THERMAL SCIENCES LABORATORY

L	T	P	C
0	0	2	0.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

At the end of the course, the students will be able to

CO1 *: Identify and explain components and mechanisms of IC engines.*

CO2 *: Conduct performance tests on IC engines, reciprocating compressors and refrigeration systems.*

CO3 *: Evaluate performance of refrigeration system*

CO4 *: Estimate heat transfer parameters - radiant factor, emissivity, free and forced convection heat transfer coefficients*

CO5 *: Estimate thermal conductivity of different solids*

CO6 *: Conduct performance tests on pin-fin and heat exchangers*

LIST OF EXPERIMENTS

1. Construction of Port timing (2S) and Valve timing (4S) diagrams for a single-cylinder engine.
2. Performance test on four stroke multi-cylinder petrol engine (MPFI).
3. Heat balance test on four stroke single-cylinder diesel engine.
4. Determination of volumetric efficiency of reciprocating air compressor.
5. Viscosity of lubricating oil - Redwood viscometer.
6. Performance test on vapor compression refrigeration system.
7. Determination of Radiant Factor and Emissivity using Stefan Boltzmann Apparatus
8. Determination of Convective heat transfer coefficient in Free and Forced Convection
9. Determination of Thermal Conductivity in Composite walls, Insulation Sheets and Insulation Powder
10. Unsteady state Heat Transfer Analysis
11. Determination of Heat Transfer in Pin-Fin
12. Performance Analysis of Plate Heat Exchanger, and Shell and Tube Heat Exchanger

REFERENCES

1. *Thermal Engineering Laboratory Manual, Department of Mechanical Engineering, CIT, 2015.*
2. *Heat Transfer Laboratory Manual, Department of Mechanical Engineering, CIT, 2019.*
3. *Frank P Incropera, "Principles of Heat and Mass Transfer", John Wiley and Sons (Asia) Ltd., 2013.*
4. *C.P.Kothandaraman and S.Subramanyan, "Heat and Mass Transfer Data Book", New Age International Publishers, 2008.*

19MEL56B - DYNAMICS AND METROLOGY LABORATORY
DYNAMICS LABORATORY

L	T	P	C
0	0	2	0.5

ASSESSMENT : PRACTICAL

DYNAMICS LABORATORY

COURSE OUTCOMES

At the end of this course, the students will be able to

CO1 *: Model and analyze the mechanism to evaluate the position, velocity and acceleration using MATLAB.*

CO2 *: Demonstrate the working principle of gyroscope, governor and cam.*

CO3 *: Examine the balancing of reciprocating mass.*

CO4 *: Inspect the critical speed of the shaft under the given load conditions.*

CO5 *: Determine the vibration response of different systems.*

LIST OF EXPERIMENTS

1. Kinematic and Dynamic analysis of a four bar and slider crank mechanism using MATLAB.
2. Study of gyroscopic couple using motorized gyroscope apparatus.
3. Determination of the whirling speed of a shaft using whirling of shafts demonstrator.
4. Using universal vibration apparatus,

a. Determining the radius of gyration of a compound pendulum;

b. Determining the radius of gyration of a body using bifilar suspension;

c. Determining the radius of gyration of a body using tri-filar suspension;

5. Experiment on different types of cam and followers.
6. Determination of the controlling force at a given speed, sensitiveness at given limits of lift and governor effort and power of various types of governors.
7. Study on balancing of reciprocating mass.
8. Determination of vibration response using free and forced vibration test.

REFERENCES

1. *Mechanisms and Machines Laboratory manual, Department of Mechanical Engineering, CIT, 2015.*
2. *http://mdmv-nitk.vlabs.ac.in/*
3. *http://mm-nitk.vlabs.ac.in/*
4. *Kinematics and Dynamics of Mechanical Systems, Second Edition: Implementation in MATLAB® and SimMechanics® 2nd Edition, Kindle Edition by Kevin Russell, Qiong Shen, Rajpal S. Sodhi, 2019.*

19MEOC01 - MATLAB PROGRAMMING

L	T	P	C
1	0	0	1

COURSE OUTCOMES

The students will be able to do

CO1 *: Themes of data analysis*

CO2 *: Visualization and modeling for engineering problems*

CO3 *: Programs for various mechanical engineering problems.*

MATLAB FUNDAMENTALS

Working with the MATLAB user interface, Entering commands and creating variables **(2)**

VECTORS AND MATRICES

Analyzing vectors and matrices, Visualizing vector and matrix data **(3)**

DATA FILES

Working with data files, Working with data types **(3)**

SCRIPTS AND LOOPS

Automating commands with scripts, Writing programs with branching and loops, Writing functions. **(3)**

APPLICATIONS

Engineering Mechanics, Theory of Machines and Robotics, Mechanical Vibrations and Control Systems using MATLAB. **(4)**

TEXT BOOKS

1. *MATLAB Onramp - MATLAB & Simulink Tutorial, https://in.mathworks.com/learn/tutorials/matlab-onramp.html*
2. *Dan B. Marghitu, Mechanisms and robot analysis with MATLAB, Springer, 2009.*
3. *Rao V. Dukkipati, MATLAB an introduction with applications, New age international private limited, 2010.*

19MEOC03 - ADVANCED INDUSTRIAL AUTOMATION SYSTEMS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

The students will be able to

CO1 *: Understand various components in an automated system.*

CO2 *: Understand the principle of operation and construction of mechanisms, hydraulic and pneumatic systems*

CO3 *: Understand the microprocessor technology, programming and CNC technology.*

AUTOMATION IN MANUFACTURING

Introduction : Importance of automation in the manufacturing industry. Use of mechatronics. Systems required.

Design of an automated system : Building blocks of an automated system, working principle and examples. **(4)**

MECHANISMS

Electronic cams, indexing mechanisms, tool magazines, and transfer systems. **(2)**

HYDRAULICS AND PNEUMATICS SYSTEMS

Hydraulic systems: hydraulic power pack, pumps, valves. Hydraulic systems: designing of hydraulic circuits.

Pneumatic systems: configurations, compressors, valves, distribution and conditioning. **(4)**

MICROPROCESSOR TECHNOLOGY AND CNC

Microprocessor Technology: signal conditioning and data acquisition, use of microprocessor or microcontroller. Configurations, Working.

CNC technology: basic elements, interpolators and programming. **(5)**

BOOKS AND REFERENCES

1. *HMT Ltd. Mechatronics, Tata McGraw Hill, New Delhi, 1988.*
2. *Bolton, W., "Mechatronics: E lectronic Control Systems in Mechanical and Electrical Engineering", Longman, Singapore,1999.*
3. *Gaonkar, R. S., Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing (India), Delhi, 2000.*
4. *Bradley, D. A., Dawson D., Burd, N. C. and Loader A. J., Mechatronics: Electronics in products and processes, CRC Press, Florida, USA, 2010.*
5. *Parr, A. A., Hydraulics and Pneumatics, Elsevier, 1999.*
6. *Smid, P., CNC Programming Handbook, Industrial Press, New York, USA, 2008.*

19MEOC05 - FOUNDRY PRACTICE AND PROCEDURES

L	T	P	C
0	0	2	1

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the course, the students will be able to:

CO1 *: Demonstrate process variables for molding process and to design gating system for sound casting components.*

CO2 *: Select the variables involved in the casting of ferrous and non-ferrous alloys.*

CO3 *: Explain the inspection techniques for assessing casting quality.*

GATING

Gating system design for pattern design - Method of calculation. **(4)**

MOULDING

Moulding Process set - Alpha set **(1)**

MELTING

Melting process - carbon steel and stainless steel (ASTM A216 and ASTM A351). **(3)**

HEAT TREATMENT

Heat Treatment - for carbon steel and stainless steel **(2)**

QUALITY

Quality - for Carbon steel and stainless steel - Destructive testing - NDT - Final Inspection **(4)**

RECENT DEVELOPMENTS

Recent developments in casting processes **(1)**

TOTAL : 15

NAME OF THE INDUSTRY

KOSO INDIA PRIVATE LIMITED

1/80, Telungalayam Road, Pillayappampalayam, Annur, Coimbatore - 641697

NUMBER OF STUDENTS PER BATCH : 15

19MEOC06 - BASICS OF AUTOMOTIVE ELECTRICAL SYSTEMS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1 *: Know the importance of Electrical standards in automobiles.*

CO2 *: Understand the electronic fuel injection/ignition components and their function.*

CO3 *: Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.*

CO4 *: Diagnose electronic engine control systems problems with appropriate diagnostic tools.*

CO5 *: Analyses the chassis and vehicle safety system*

INTRODUCTION

Evolution of electronics in automobiles. Charging systems: Working and design of charging circuit diagram - Alternators - Requirements of starting system - Starter motors and starter circuits. **(2)**

IGNITION AND INJECTION SYSTEMS

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition - Distribution less ignition - Direct ignition - Spark Plugs. Electronic fuel Control, Petrol fuel injection - Diesel fuel injection. **(4)**

SENSOR AND ACTUATORS IN AUTOMOTIVES

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors - study of fuel injector, exhaust gas recirculation actuators. **(3)**

ENGINE CONTROL SYSTEMS

Control modes for fuel control-engine control subsystems - ignition control methodologies - different ECU's used in the engine management. **(3)**

CHASSIS AND SAFETY SYSTEMS

Traction control system - Cruise control system - electronic control of automatic transmission - antilock braking system - electronic suspension system - working of airbag and role of MEMS in airbag systems - centralized door locking system - climate control of cars. **(3)**

TOTAL : 15

TEXT BOOK

1. *Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier, Indian Reprint, 2018*

REFERENCES

1. *Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2015.*
2. *Richard K. Dupuy "Fuel System and Emission controls", Check Chart Publication, 2015.*
3. *Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 2020.*
4. *Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2016*

19MEOC09 - INSPECTION AND QUALITY CONTROL IN MANUFACTURING

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

To know about basic aspects and tools related to inspection and quality control in manufacturing.

INSPECTION

Introduction, Fundamental Concept of Quality, Role of Inspection and Measurement for Quality Control in Manufacturing, Need of Inspection, Inspection types and Principles, Design for Inspection, Destructive Inspection, Testing of Composite Materials. **(3)**

NON-DESTRUCTIVE INSPECTION-I

Visual Inspection, Dye Penetrant Inspection, Magnetic Particle Inspection, Eddy Current Inspection, Ultrasonic Testing. **(3)**

NON-DESTRUCTIVE INSPECTION-II

Acoustic Emission Inspection, Radiography, Leak Testing, Thermographic Non-destructive Testing, Advanced, Non-destructive Techniques, NDT Standards, Safety in NDT. **(3)**

QUALITY CONTROL

Introduction, Aim and functions of quality control, Kaizen and innovation - the Kaizen management practices - Total Quality Control (TQC). **(2)**

QUALITY CONTROL TOOLS

Small group activities - quality circles - Comparison of kaizen and Deming's approach. Affinity diagram - brainstorming - cause and effect analysis -checklist- flow charts - Pareto analysis - quality costing - Quality Function Deployment (QFD) - Training of quality - self managing teams. **(4)**

TOTAL : 15

TEXT BOOKS

1. *"Nondestructive Evaluation and Quality Control", ASM Handbook, Vol. 17 of 9th Edition Metals Handbook.*
2. *Winchell William, "Inspection and Measurement in Manufacturing", Society of Manufacturing Engineers.*
3. *Juran J.M & Gryna F.M., ?Quality Planning and Analysis - From Product development through use, Tata McGrawHill Publishing Limited, new Delhi, 3rd Edition, 1995*
4. *Pyzdek T and Berger R W, "Quality Engineering Handbook", Tata-McGraw Hill, New Delhi, 1996.*

REFERENCES

1. *Taguchi G, Elsayed E A and Hsiang, T.C., "Quality Engineering in Production Systems", Mc-Graw-Hill Book company, Singapore, 1989.*
2. *"Welding Inspection", 3rd Edition, American Welding Society.*
3. *Logothetics N ., Managing for total quality - From Deming to Taguchi and SPC, Prentice hall Ltd, New Delhi, 1997.*
4. *Kaniska Bedi, "Quality Management" Oxford University Press, Chennai, 2007.*

19MEOC10 - CONSTITUTION OF INDIA

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

On Completion of the course, the students should be able to:

CO1 *: Explain the meaning of constitution and salient features of Indian Constitution*

CO2 *: Explain Fundamental Rights, Duties and Discuss Historical Perspectives of Constitutional Amendments.*

CO3 *: Examine Provisions for Emergency*

INTRODUCTION TO CONSTITUTION

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution **(5)**

FUNDAMENTALS, AMENDMENTS AND HISTORICAL PERSPECTIVES

Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India **(5)**

EMERGENCY SITUATIONS

Emergency Provisions : National Emergency, President Rule, Financial Emergency, and Local Self-Government - Constitutional Scheme in India. **(5)**

TOTAL : 15

TEXT BOOKS

1. *Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.*

19MEOC12 - HUMAN VALUES

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OBJECTIVE

1 *To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence.*

COURSE OUTCOMES

On Completion of the course, the students should be able to:

CO1 *: Explain the need for harmony within self and fellow humans.*

CO2 *: Justify the need for harmony with nature for sustainability.*

HARMONY WITH SELF AND OTHER HUMANS

Harmony in the Human Being - Harmony in Myself - Harmony in the Family and Society- Harmony in Human Relationship **(6)**

HARMONY WITH SELF AND NATURE

Harmony in the Nature and Existence - Whole existence as Co-existence - Implications of the above Holistic Understanding of Harmony on Professional Ethics **(9)**

TOTAL : 15

TEXT BOOKS

1. *B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.*
2. *PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.*

19MEOC13 - E-COMMERCE SECURITY

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OBJECTIVE

- *To understand, implement and defend against canonical attacks on web security.*

COURSE OUTCOMES

On Completion of the course, the students should be able to:

CO1 *: Explain the need for Web Security, Defense against Web attacks and Security Certificates*

CO2 *: Discuss the protocols for security in web payments*

CO3 *: Explain cryptocurrencies, security threats and regulations.*

INTRODUCTION TO WEB SECURITY

Harmony Web Security - Basic web security model - Web attacks (e.g., SQL injection, XSS, CSRF) and defenses - Session management and user authentication - Certificates and PKI - HTTPS: Design and pitfalls **(6)**

SECURITY IN WEB PAYMENTS

Payments - Legacy payment systems EMV protocol Attacks on EMV Securing CNP transactions and PCI compliance Tokenization **(4)**

CRYPTOCURRENCIES

Cryptocurrencies Early digital currencies Building blocks - The Bitcoin blockchain - Bitcoin mechanics - Bitcoin storage and use - Bitcoin security threats - Regulating cryptocurrencies **(5)**

TOTAL : 15

TEXT BOOK

1. *Bryan Sullivan and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Education, 1st Edition.*

REFERENCES

1. *Narayanan, Bonneau, Felten, Miller, Goldfeder. Bitcoin and Cryptocurrency Technologies : A Comprehensive Introduction, Princeton University Press, 1st Edition.*

19MEOC14 - INNOVATION AND ENTREPRENEURSHIP

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

The students will be able to

CO1 *: Discuss the relationship between innovation and entrepreneurship.*

CO2 *: Recognize societal and environmental needs and propose innovative solutions*

CO3 *: Distinguish between Intrapreneurship, Business and Entrepreneurship and explain the various stages of entrepreneurship.*

INTRODUCTION

Innovation and its Need - Entrepreneurial Stages **(3)**

INNOVATION

Principles of Innovation, Do's and Don'ts - Sources for Innovation, unexpected success and failure, demographics and perception - Motivation for Innovation, Societal and Environmental Needs, Incongruities between perceived and actual customer values and expectations - High-risk High-return Innovation **(6)**

ENTREPRENEURSHIP

Intrapreneurship vs Entrepreneurship - Business vs Entrepreneurship- Entrepreneurial Processes **(6)**

TOTAL : 15

TEXT BOOK

1. *Peter F Drucker, "Innovation and Entrepreneurship", Harper and Row Publishers Inc, USA, 2009.*

REFERENCE

1. *Robert D Hisrich, Michael P Peters and Dean A Shepherd, "Entrepreneurship", Tata Mc Graw Hill, 10th Edition, 2017.*

19ECE26 - REAL TIME APPLICATIONS USING PYTHON

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 *: Infer the programming concepts of Python to develop simple computational programs.*

CO2 *: Implement Python programs with conditionals & loops and functions.*

CO3 *: Use Python lists, tuples & dictionaries for representing compound data and perform input/output with files.*

CO4 *: Implement Python programs using OOPs concepts.*

CO5 *: Develop real time applications of Raspberry Pi3 using LEDs , Sensors, LCD Display & Servo motor control and web server.*

INTRODUCTION TO PYTHON

Basic Syntax Variable and Data Types Operator: int, float, boolean, string, and list -Variables, expressions, statements, tuple assignment, precedence of operators, comments -Modules and functions, function definition and use, flow of execution, parameters and arguments - Illustrative programs: Exchange the values of two variables - Circulate the values of n variables - Distance between two points. **(9)**

CONTROL FLOW & FUNCTIONS

Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else) - Iteration: state, while, for, break, continue, pass - Fruitful functions: return values, parameters, local and global scope, function composition, recursion - Strings: string slices, immutability, string functions and methods, string module - Lists as array s- Lists, Tuples, Dictionaries- Illustrative programs: Square root - GCD - Exponentiation - Sum an array of numbers - Linear search - Binary search **(9)**

LISTS, TUPLES, DICTIONARIES & FILE HANDLING

Lists - List Operations - Mutation - Aliasing - Cloning - Tuple assignment - Tuple as return value - Dictionaries: Operations and methods - Advanced list processing - List comprehension - Variables - Illustrative programs: Selection sort - Insertion sort - Mergesort, Histogram.

Files and exception Handling : text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: Word count - Copy file. **(9)**

CLASSES AND INHERITANCE

Object Oriented Programming - Class Instances - Class and object- Attributes -Inheritance -Overloading - Overriding - Data hiding- An Extended Example: Building a Class - Visualizing the Hierarchy - Adding another Class - Using Inherited Methods - Grade book - Generators. **(9)**

PROGRAMMING THE RASPBERRY PI 3 USING PYTHON

Programming General Purpose Input / Output (GPIO) port pins -Interfacing seven segment LED and LCD Display , servomotor - Real time Monitoring & Data logging System using I2C protocol - Email notifier using Gmail SMTP server -Data Acquisition and control for Industrial/ Home Automation using MQTT Protocol. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Shroff/O'Reilly Publishers, 2016.*
2. *Sai Yamanoor& Srihari Yamanoor, "Python Programming with Raspberry Pi" Packt Publishing, 1st Edition, 2017.*

IV. COMPUTER AND COMMUNICATION (CC)

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19EEE30	Computer Architecture and Parallel Processing	3	0	0	3	EC
2	19EEE31	Multi Core Architecture	3	0	0	3	EC
3	19EEE32	Data Communication Networks	3	0	0	3	EC
4	19EEE33	Fog Computing	3	0	0	3	EC
5	19EEE34	Internet of Things	3	0	0	3	EC
6	19EEE35	Data Analytics	3	0	0	3	EC
7	19EEE36	Virtual Instrumentation	3	0	0	3	EC
8	19EEE37	Cyber Physical Systems	3	0	0	3	EC
9	19EEE38	Intelligent Techniques for Electrical Engineers	3	0	0	3	EC
10	19EEE39	Industrial Automation	3	0	0	3	EC
11	19EEE40	Deep Learning	3	0	0	3	EC

BS - BASIC SCIENCES

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19FYM12	Calculus and Numerical Methods	3	1	0	4	BS
2	19FYP13	Engineering Physics	3	0	0	3	BS
3	19FYC11	Engineering Chemistry	3	0	0	3	BS
4	19PL11	Physics Laboratory-I	0	0	1	0.5	BS
5	19CL11	Chemistry Laboratory-I	0	0	1	0.5	BS
6	19FYM22	Vector Calculus, Linear Algebra and Partial Differential Equations	3	1	0	4	BS
7	19PL21	Physics Laboratory-II	0	0	1	0.5	BS
8	19CL21	Chemistry Laboratory-II	0	0	1	0.5	BS
9	19MEL12	Engineering Practices Laboratory	0	0	2	1	BS
10	19EEM31	Transforms, Probability and Random Variables	3	0	0	3	BS
		TOTAL CREDITS				**20**	

HS - HUMANITIES AND SOCIAL SCIENCES

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19FYE11	Technical English	1	0	2	2	HS
2	19FYE21	Language Elective	1	0	2	2	HS
3	19FYC21	Environmental Science and Engineering	1	0	0	1	HS
4	19HSS01	Science of Creativity and Professional Ethics	1	0	0	1	HS
		TOTAL CREDITS				**6**	

ES - ENGINEERING SCIENCES

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19CM11	Basic Civil and Mechanical Engineering	3	0	0	3	ES
2	19MEL11	Engineering Graphics	1	0	4	3	ES
3	19FYP23	Electron Devices	3	0	0	3	ES
4	19EE22	Electric and Magnetic Circuits	3	0	0	3	ES
5	19CSL21	C Programming and Data Bases	0	0	4	2	ES
		TOTAL CREDITS				**14**	

PCC - PROFESSIONAL CORE COURSE

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19EE31	Electric Circuit Analysis	2	1	0	3	PCC
2	19EE32	Electromagnetic Fields	2	1	0	3	PCC
3	19EE33	DC Machines and Transformers	3	0	0	3	PCC
4	19EE34	Analog Electronics	3	0	0	3	PCC
5	19EE35	Digital Electronics	3	0	0	3	PCC
6	19EEL36	DC Machines and Transformers Laboratory	0	0	2	1	PCC
7	19EEL37	Analog and Digital Electronics Laboratory	0	0	2	1	PCC
8	19EE41	AC Rotating Machines	3	0	0	3	PCC
9	19EE42	Networks and Systems	3	0	0	3	PCC
10	19EE43	Measurements and Instrumentation	3	0	0	3	PCC
11	19EE44	Linear Integrated Circuits	3	0	0	3	PCC
12	19EE45	Transmission and Distribution	3	0	0	3	PCC
13	19EE46	OOPS and C++ for Electrical Engineers	3	0	0	3	PCC
14	19EEL47	AC Rotating Machines Laboratory	0	0	2	1	PCC
15	19EEL48	Linear Integrated Circuits Laboratory	0	0	2	1	PCC
16	19EE51	Control Systems	3	0	0	3	PCC
17	19EE52	Power System Analysis	3	0	0	3	PCC
18	19EE53	Data Structures and Algorithms	3	0	0	3	PCC
19	19EE54	Embedded System Design	3	0	0	3	PCC
20	19EEL55	Control systems Laboratory	0	0	2	1	PCC
21	19EEL56	Embedded System Design Laboratory	0	0	2	1	PCC
22	19EE61	Power Electronics	3	0	0	3	PCC
23	19EE62	Digital Protection of Power Systems	3	0	0	3	PCC
24	19EE63	Digital Signal Processing	3	1	0	4	PCC
25	19EEL64	Power Electronics Laboratory	0	0	2	1	PCC
26	19EEL65	Power Systems Laboratory	0	0	2	1	PCC
27	19EE71	Solid State Drives and Control	3	0	0	3	PCC
28	19EE72	Generation of Electrical Energy	3	1	0	4	PCC
29	19EE73	Smart Grid	3	0	0	3	PCC
30	19EEL74	Electrical Drives Laboratory	0	0	2	1	PCC
31	19EEL75	Professional Competency	0	0	4	2	PCC
		TOTAL CREDITS				**76**	

EEC - EMPLOYABILITY ENHANCEMENT COURSE

S. No.	Course Code	Course Name	L	T	P	C	Category
1	19FYEL11	Employability Skills	0	0	2	1	EEC
2	19FYEL21	English for Employability	0	0	2	1	EEC
3	19HOC31	Communication Skills For Engineers I*	0	0	2	1	EEC
4	19HOC41	Communication Skills For Engineers II*	0	0	2	1	EEC
5	19HOC51	Employability and Personality Development Skills - I *	0	0	2	1	EEC
6	19HOC61	Employability and Personality Development Skills - II *	0	0	2	1	EEC
7	19INT51	Internship - I	-	-	-	1	EEC
8	19EEL66	Mini Project	0	0	6	3	EEC
9	19INT61	Internship - II	-	-	-	1	EEC
10	19EE76	Project Work Phase - I	0	0	6	3	EEC
11	19EE81	Project Work Phase - II	0	0	10	5	EEC
		TOTAL CREDITS				**19**	

LIST OF ONE CREDIT COURSES *

1. DEPARTMENT BASED ONE CREDIT COURSES

S. No.	Course Code	Course Name	Credit	Category
1	19EEOC06	Electrical Safety Standards and Practices	1	OCC
2	19EEOC07	Scilab Programming	1	OCC

2. INDUSTRY BASED ONE CREDIT COURSES

S. No.	Course Code	Course Name	Credit	Category
1	19EEOC08	Machine Vision	1	OCC
2	19EEOC09	Cyber Security in Manufacturing and Smart Grid	1	OCC
3	19EEOC10	Robotics and Automation	1	OCC
4	19EEOC12	AWS Cloud Practitioner Essentials	1	OCC
5	19EEOC13	Introduction to IoT	1	OCC
6	19EEOC14	TCS ION Career Edge Young Professional	1	OCC

* One credit courses could be opted from Department/Industry/NPTEL

19EE46 - OOPS AND C++ FOR ELECTRICAL ENGINEERS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After successful completion of this course, the students will be able to,

CO1 *: Distinguish object oriented Programming and traditional programming techniques*

CO2 *: Develop, compile and debug programs*

CO3 *: Illustrate key concepts such as encapsulation and polymorphism*

CO4 *: Use files for reading and writing data*

CO5 *: Write C++ program for practical electrical applications*

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING

Programming Paradigms - Object Oriented Technology - Basic concepts and benefits of OOP - Application of OOP - OOP languages. Introduction to C++: Basic data types - Derived data types - Symbolic constants - Scope resolution operator - Type modifiers - Type casting -Operators and control statements - Input and output statements - Function Prototyping - Inline function - Overloaded function - Introduction to friend function **9**

CLASSES AND OBJECTS

Class specification - Member function - Static data members - Instance creation - Array of objects - Dynamic objects - Static Objects. Constructors - Parameterized constructors - Overloaded Constructors - Constructors with default arguments - Copy constructors - Dynamic constructors - Dynamic initialization using constructors - Destructors. **9**

OPERATOR OVERLOADING AND INHERITANCE

Operator function - Overloading unary and binary operator - Overloading the operator using friend function - Stream operator overloading - Data Conversion.

Defining derived classes - Single Inheritance - Protected Data with private inheritance - Multiple Inheritance Multilevel inheritance - Hierarchical Inheritance - Hybrid Inheritance - Multipath inheritance- Abstract classes - Virtual function and dynamic polymorphism - Virtual Destructor - Nested Classes. **9**

I/O STREAMS

I/O STREAMS - Unformatted I/O operations - Formatted I/O operations - Manipulators - Hierarchy of file stream classes - Opening and closing of files - File pointers and Manipulation - Sequential access file - Random access file. **9**

APPLICATIONS IN ELECTRICAL ENGINEERING

Series RLC circuit transient analysis- Synthesis of typical wave forms-FFT Analysis-Mesh and Nodal analysis-Mason's gain formula-Calculation of efficiency and voltage regulation in transmission lines using T and Π model-Tariff Calculations Power System Analysis: Y- Bus formation, Z- Bus formation, Load flow analysis **9**

TOTAL - 45

BASIC SCIENCE COURSES (BSC)

Course Code	Course Name	L	T	P	C	Semester
19FYM14	Matrices and Calculus	3	1	0	4	I
19FYP13	Engineering Physics	3	0	0	3	I
19FYC11	Engineering Chemistry	3	0	0	3	I
19PL11	Physics Laboratory-I	0	0	2	0.5	I
19CL11	Chemistry Laboratory-I	0	0	2	0.5	I
19MEL12	Engineering Practices Laboratory	0	0	2	1	I
19FYM24	Fourier Series and Partial Differential Equation	3	1	0	4	II
19PL21	Physics Laboratory-II	0	0	2	0.5	II
19CL21	Chemistry Laboratory-II	0	0	2	0.5	II
19CIM31	Linear Algebra, Complex Variables and Transform Techniques	3	1	0	4	III

ENGINEERING SCIENCE COURSES (ESC)

Course Code	Course Name	L	T	P	C	Semester
19CSL12	Python Programming	1	0	4	3	I
19FYP24	Introduction to Electronic Devices	3	0	0	3	II
19CS21	C Programming	3	1	0	4	II
19CSL11	C Programming Laboratory	0	0	4	2	II
19MEL11	Engineering Graphics	1	0	4	3	II
19CI32	Digital Design	3	0	0	3	III
19CIL34	Digital Design Laboratory	0	0	3	1.5	III

PROFESSIONAL CORE COURSES (PCC)

Course Code	Course Name	L	T	P	C	Semester
19CI31	Data Structures and Algorithms - I	3	1	0	4	III
19CS31	Discrete Mathematics	2	0	0	2	III
19CI33	Object Oriented Programming and Java	3	0	0	3	III
19CIL35	Object Oriented Programming Laboratory	0	0	3	1.5	III
19CI41	Data Structures and Algorithms- II	3	0	0	3	IV
19CI42	Database Management Systems	3	0	0	3	IV
19CI43	Computer Architecture	3	0	0	3	IV
19CI44	Operating Systems	3	0	0	3	IV
19CI45	Software Engineering	2	1	0	3	IV
19CS41	Formal Languages and Automata Theory	2	0	0	2	IV
19CIL46	Database Management Systems Laboratory	0	0	3	1.5	IV
19CIL47	Data Structures and Algorithms Laboratory	0	0	3	1.5	IV
19CI51	Computer Networks	3	0	0	3	V

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Course Code	Course Name	L	T	P	C	Semester
19FYEL11	Employability Skills	0	0	2	1	I
19FYEL21	English for Employability	0	0	2	1	II
19HOC31	Communication Skills for Engineers - I	1	0	0	1	III
19HOC41	Communication Skills for Engineers -II	1	0	0	1	IV
19HOC51	Employability and Personality Development Skills-I	0	0	2	1	V
19IT65	Mini Project	0	0	3	-	V
19INT51	Internship-I	0	0	0	1	V
19IT65	Mini Project	0	0	3	3	VI
19HOC61	Employability and Personality Development Skills-II	0	0	2	1	VI
19INT61	Internship-II	0	0	0	1	VI
19IT75	Project Phase-I	0	0	6	3	VII
19IT81	Project Phase-II	0	0	10	5	VIII

ONE CREDIT COURSES (OCC)

1. DEPARTMENT BASED

Course Code	Course Name	L	T	P	C
19CIOC01	C++ Programming	0	0	2	1
19CIOC02	R Programming	0	0	2	1
19CIOC03	Applications of Probability	0	0	2	1
19CIOC04	User Interface Design	0	0	2	1
19CIOC05	Open-Source Tools for Network Analysis	0	0	2	1
19CIOC06	Comprehensive Exam Training	0	0	2	1
19ITOC01	Aptitude Training	0	0	2	1

2. INDUSTRY BASED

Course Code	Course Name	L	T	P	C
19ITOC02	Data Visualization Tools	0	0	2	1
19ITOC03	Data Science Tools	0	0	2	1
19ITOC04	Cloud Computing Applications	0	0	2	1
19ITOC05	Agile Software Development	0	0	2	1
19ITOC06	Software Testing Tool	0	0	2	1

3. NPTEL Offered (4 weeks courses not part of the curriculum)

4. Institute Based

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

LIST OF OPEN ELECTIVES

DEPARTMENT OF CIVIL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CEOE01	Town Planning and Architecture	3	0	0	3	All Branches
19CEOE02	Climate Change and Adaptation	3	0	0	3	All Branches
19CEOE03	Metro Systems and Engineering	3	0	0	3	All Branches
19CEOE04	Renewable Energy Sources	3	0	0	3	All Branches
19CEOE05	Principles of Sustainable Development	3	0	0	3	All Branches
19CEOE06	Disaster Management	3	0	0	3	All Branches

DEPARTMENT OF MECHANICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19MEOE01	Design of Experiments	3	0	0	3	All branches
19MEOE02	Engineering Optimization	3	0	0	3	All branches
19MEOE03	Engineering Polymers, Composites and Allied Manufacturing Processes	3 3	0 0	0 0	3 3	Mechanical Chemical & Civil
19MEOE04	Industrial Robotics	3	0	0	3	Mechanical EEE and ECE
19MEOE05	Business Process Re-engineering	3	0	0	3	All branches
19MEOE06	Engineering Economics and Financial Management	3	0	0	3	All branches

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19EEOE01	Energy Auditing	3	0	0	3	ECE, Mech, Chemical, Civil
19EEOE02	Solar and Wind Energy Systems	3	0	0	3	ECE, Mech, Chemical
19EEOE03	Electrical Safety Procedures and Management	3	0	0	3	All Branches
19EEOE04	Energy Efficient Illumination Systems	3	0	0	3	All Branches
19EEOE05	Electric Vehicle Technology	3	0	0	3	All Branches except Civil & Chemical
19EEOE06	Energy Efficiency in Thermal and Electrical Utilities	3	0	0	3	EEE & Mechanical

17MDC71 - PROJECT WORK AND VIVA VOCE - I

L	T	P	C
18			

PRE-REQUISITES

Should have undergone all courses upto 6th Semester

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

17MDC81 - MODELING AND SIMULATION

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Define Simulation, Systems, models and perform basic manual simulations*
- *To illustrate changes in the dynamic systems like queuing system using simulation.*
- *To predict the behavior of linear and non-linear systems using empirical modeling*
- *To evaluate the behavior of deterministic and stochastic systems using Simulation techniques*

INTRODUCTION TO SIMULATION

When Simulation Is the Appropriate Tool - When Simulation Is Not Appropriate- Advantages and Disadvantages of Simulation- Areas of Application- Systems and System Environment- Components of a System- Discrete and Continuous Systems - Model of a System- Types of Models- Discrete-Event System Simulation- Steps in a Simulation Study

Simulation example-Queuing-Inventory-General Principles of Simulation. **(9)**

STATISTICAL BASICS AND QUEUING MODEL SIMULATION

Useful Statistical Models- Discrete Distributions - Continuous Distributions- Poisson Process- Properties of a Poisson Process- Non-stationary Poisson Process- Empirical Distributions-

Characteristics of Queuing Systems- Queuing Notation- Long-Run Measures of Performance of Queuing Systems- The Conservation Equation- Steady-State Behavior of Infinite-Population Markovian Models - Single-Server Queues with Poisson Arrivals and Unlimited Capacity: M/G/1, Multi-server Queues - Steady-State Behavior of Finite-Population Models- Networks of Queues **(9)**

RANDOM NUMBERS

Generation of Pseudo-Random Numbers- Techniques for Generating Random Numbers- Linear Congruential Method- Combined Linear Congruential Generators- Tests for Random Numbers- Frequency Tests, Tests for Autocorrelation-Random variate generation-Inverse-Transform Technique- Exponential Distribution- Uniform Distribution- Weibull Distribution- Triangular Distribution- Empirical Continuous Distributions- Continuous Distributions without a Closed-Form Inverse- Discrete Distributions- Acceptance-Rejection Technique- Poisson Distribution- Non-stationary Poisson Process- Gamma Distribution- Direct Transformation for the Normal and Lognormal Distributions- Convolution Method-special properties. **(9)**

ANALYSIS OF SIMULATION DATA

Input Modeling- Data Collection- Identifying the Distribution with Data-Histograms- Selecting the Family of Distributions-Quantile-Quantile Plots- Parameter Estimation- Preliminary Statistics: Sample Mean and Sample Variance- Suggested Estimators-Goodness-of-Fit Tests- Chi-Square Test-Kolmogorov--smimov Goodness-of-Fit Test.

Verification and Validation of Simulation Models- Model Building, Verification, and Validation- Verification of Simulation Models-Calibration and Validation of Models- Face Validity-Validation of Model Assumptions-Validating Input-Output Transformations-Input-Output Validation: Using Historical Input Data- Input-Output Validation: Using a Turing Test

OUTPUT ANALYSIS FOR A SINGLE MODEL

Comparison of Two System Designs-Independent Sampling with Equal Variances-Independent Sampling with Unequal Variances. Meta modeling. **(9)**

SIMULATION SOFTWARES / LANGUAGE

Manufacturing systems and Material Handling system

Simulation Software : History of Simulation Software- Selection of Simulation Software-An Example Simulation- Simulation in GPSS- Arena-AutoMod-ProModel- QUEST- SIMULA-Witness- Extend, Simio.

Simulation of Manufacturing and Material-Handling Systems : Manufacturing and Material-Handling. Simulations- Models of Manufacturing Systems- Models of Material-Handling Systems- Goals and Performance Measures- Issues in Manufacturing and Material-Handling Simulations- Modeling Downtimes and Failures- Trace-Driven Models- Case Studies of the Simulation of Manufacturing and Material-Handling Systems **(9)**

Total : 45

TEXT BOOK

1. *Jerry Banks,John S. Carson II,Barry L Nelson, David M Nicol, Discrete-Event System Simulation, Second Edition, Prentice Hall, 1996.*

REFERENCE BOOKS

1. *Law A.M. & Kelton, W.D, Simulation Modeling and Analysis, 2nd ed, New York McGraw Hill Inc. (1991*
2. *Geoffrey Gordon, System Simulation, Prentice Hall publication, 2nd Edition, 1978, ISBN:81-203-0140-4.*
3. *FrankR.Giordano, Maurice D.Weir and William P.Fox. Mathematical Modeling, Thomson Brooks/Cole, Vikas Publishing House Pvt Ltd., New Delhi.[Para 1, II & III]*
4. *H.Sayama, Introduction to the Modeling and Analysis of Complex Systems, Open SUNY Textbooks, Milne Library State University of New York at Geneseo,Geneseo, NY 14454, 2015.*
5. *Clive L.Dym, Principles of Mathematical Modeling, 2nd Edition, Elsevier, 2004.*

17MDC82 - DECISION SUPPORT SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC54

ASSESSMENT : THEORY

COURSE OUTCOME

- *Identify the components of Decision Support Systems*
- *Work with data modeling and visualization for the given management problem*
- *Choose appropriate model to be used for a problem and design Decision Support System accordingly*
- *Analyze different tools and technologies for knowledge management in an organization*
- *Apply advanced intelligent system concepts to provide insight in the business*

INTRODUCTION

Management Support Systems : Overview : Managers and Decision-Making - Managerial Decision-Making and Information Systems - Managers and Computer Support - Computerized Decision Support and the Supporting Technologies - A Framework for Decision Support - The Concept of Decision Support Systems - Group Support Systems - Enterprise Information Systems - Knowledge Management Systems - Expert Systems - Artificial Neural Networks - Advanced Intelligent Decision Support Systems - Hybrid Support Systems.

Decision-Making Systems, Modeling and Support : Decision-Making: Introduction and Definitions - Systems - Models - Phases of the Decision-Making Process - Decision-Making: The Intelligence Phase - The Design Phase - The Choice Phase - The Implementation Phase - Decision Support Strategy - Personality Types, Gender, Human Cognition, and Decision Styles - The Decision-Makers. **(10)**

DECISION SUPPORT SYSTEMS (DSS)

Decision Support Systems **:** Configuration - Characteristics and Capabilities of DSS - Components of DSS - The Data Management Subsystem - The Model Management Subsystem - The User Interface Subsystem - The Knowledge-Based Management Subsystem - The User - DSS Hardware - DSS Classifications.

Modeling and Analysis : Management Support System (MSS) Modeling - Static and Dynamic Models - Certainty, Uncertainty, and Risk - Influence Diagrams - MSS Modeling with Spreadsheets - Decision Analysis of a Few Alternatives - The Structure of MSS Mathematical Models - Mathematical Programming Optimization - Multiple Goals, Sensitivity Analysis, What-If, and Goal Seeking - Problem-Solving Search Methods - Heuristic Programming - Simulation - Visual Interactive Modeling and Visual Interactive Simulation - Quantitative Software Packages. **(10)**

BUSINESS INTELLIGENCE

The Nature and Sources of Data - Data Collection, Problems, and Quality - The Web/Internet and Commercial Database Services - Database Management Systems in Decision Support Systems/Business Intelligence - Database Organization and Structures - Data Warehousing - Data Marts - Business Intelligence/Business Analytics - Online Analytical Processing (OLAP) - Data Mining - Data Visualization, Multidimensionality, and Real-Time Analytics - Geographic Information Systems - Business Intelligence and the Web: Web Intelligence/Web Analytics. **(13)**

DECISION SUPPORT SYSTEM DEVELOPMENT

Introduction to DSS Development - The Traditional System Development Life Cycle - Alternative Development Methodologies - Prototyping: The DSS Development Methodology - Change Management - DSS Technology Levels and Tools - DSS Development Platforms - DSS Development Tool Selection - Team-Developed DSS - End User Developed DSS - Putting The DSS Together. **(5)**

GROUP SUPPORT SYSTEMS AND KNOWLEDGE MANAGEMENT

Group Support Systems : Group Decision-Making, Communication, and Collaboration - Communication Support - Collaboration Support: Computer-Supported Cooperative Work - Group Support Systems - Group Support Systems Technologies - Groupsystems

Meetingroom and Online - The GSS Meeting Process - Distance Learning - Creativity and Idea Generation.

Knowledge Management : Introduction to Knowledge Management - Organizational Learning and Transformation - Knowledge Management Initiatives - Approaches to Knowledge Management - Information Technology in Knowledge Management - Knowledge Management Systems Implementation - Roles of People in Knowledge Management. **(7)**

TOTAL : 45

TEXT BOOK

1. *Efraim Turban and Jay E. Aronson, Decision Support System and Intelligent Systems, Prentice Hall International, 9th Edition 2010*

REFERENCE

1. *V.L. Sauter, Decision Support Systems For Business Intelligence, New York: John Wiley & Sons, 2011*

17MDC83 - GAME THEORY AND DECISION ANALYSIS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Design game model to describe the issue using game theory strategies*
- *Analyze and derive decisions using decision tree and analysis methods*
- *Design and perform decision analysis using Markov chain principles and 6 Sigma Concepts*

GAME THEORY : Decision making-Description of a game-Basic elements of game theory- the Two Person, zero-sum Games - Characteristics of a game- The maxmin and minmax principles- Steps in solving the game- Saddle point method- Principle of dominance in games- Solutions to 2 x 2 games without saddle point: (Mixed strategies)- Method of Oddments (for 2 × 2 games)- Solutions to 2 × n or m × 2 games-Graphical Method-Algebraic Method-Method of Linear Programming-Iterative Method for Approximate Solution-Bidding Problems-n- Person Zero sum games. Strategic games-Nash Equilibrium. **(12)**

DECISION ANALYSIS **:** Decision Making without Experimentation- Decision Making with Experimentation- Decision Trees-Using Spreadsheets to Perform Sensitivity Analysis on Decision Trees-Utility Theory- The Practical Application of Decision Analysis- Advanced Decision Trees- Chi-Square Automatic Interaction Detection (CHAID)-CHAID Tree Development-Bonferroni Correction-Generating Business Rules using CHAID Tree-Classification and Regression Tree-Gini Impurity Index-Entropy-Cost-Based Splitting Criteria-Ensemble Method-Random Forest **(12)**

MULTI-CRITERION DECISION MAKING : Multi-attribute Decision making - an overview-classification of MCDM methods-deterministic, stochastic and fuzzy-MCDM application areas-MCDM methods-The weighted sum model-The weighted product model-The Analytic Hierarchy process-The revised Analytic Hierarchy process-Goal Programming-The ELECTRE method-The TOPSIS method-Sebsitivity analysis of MCDM methods-Data Estimation of MCDM Problems. **(10)**

STOCHASTIC MODELS-MARKOV CHAINS : Introduction to Stochastic Process-Poisson Process-Compound Poisson Process-- Markov Chains - Chapman-Kolomogorov Equation - Classification of States of Markov Chain - Long run properties of Markov Chains- First Passage times-Markov Chains with Absorbing States- Expected Duration to Reach a State from other States-Calculation of Retention Probability and Customer Lifetime Value using Markov Chains-Markov Decision Process (MDP) **(6)**

SIX SIGMA : Introduction to Six Sigma- What is Six Sigma?- Origins of Six Sigma- Three-Sigma versus Six-Sigma Process- Cost of Poor Quality- Sigma Score- Industrial Applications of Six Sigma- Six Sigma Measures- Yield- DMAIC Methodology. **(5)**

Total : 45

TEXT BOOKS

1. *Rama Murthy P. Operations Research, New Age Intenational, Second Edition, 2007, New Delhi [Para 1]*
2. *Dinesh Kumar U. Business Analytics, Wiley, First Edition, 2017 [Para 2,4,5]*
3. *Triantaphyllou, Evangelos. (2000). Multi-Criteria Decision Making Methods: A Comparative Study. 10.1007/978-1-4757-3157-6, Kluwer Academic Publishers[Para 3]*

REFERENCE BOOKS

1. *Martin Osborne, An Introduction to Game Theory, Oxford University Press, 2003*
2. *Frederick S.Hiller, Gerald J.Leberman, Bodhibrata Nag and PreetamBasu, "Introduction to Operations Research", Ninth Edition, McGraw Hill, 2010.*
3. *HamdyA.Taha, "Operations Research - An Introduction", Eighth Edition, 2010.*
4. *EdmundasKazimierasZavadskas (2019), Multiple-Criteria Decision-Making (MCDM) Techniques for Business Processes Information Management, Publisher: MDPI AG*

5. *Belton, Valerie and Theodor Stewart (2001), Multi Criterion Decision Analysis : An Integrated Approach, Springer.*
6. *Cliff T. Ragsdale, Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics, Thomson South-Western*
7. *Avinash K. Dixit and Barry J. Nalebuff, The Art of Strategy, Norton, 2008.*

INTERNET RESOURCES

1. *E. Triantaphyllou, B. Shu, S. Nieto Sanchez, and T. Ray: Multi-Criteria Decision Making: An Operations Research Approach. Encyclopedia of Electrical and Electronics Engineering, (J.G. Webster, Ed.), John Wiley & Sons, New York, NY, Vol. 15, pp. 175-186, (1998).*
2. *Mark Velasquez1and Patrick T. Hester, An Analysis of Multi-Criteria Decision Making Methods. International Journal of Operations Research Vol. 10, No. 2, 56?66 (2013)*
3. *Vyas S. &MisalCheta S. Comparative Study of different Multi-criteria Decuision*

   Making methods. International Journal on Advanced Computer Theory and Engineering (IJACTE), 2319 - 2526, Volume-2, Issue-4, 2013

17MDC84 - BUSINESS INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
17MDC64, 17MDC66

ASSESSMENT : LABORATORY

COURSE OUTCOME

- *Can understand and transform given data in any form to a suitable standard form for performing analysis using tools.*
- *Able to construct appropriate data warehouse model for a given decision making problem.*
- *Apply various techniques and tools to perform operations on multidimensional data.*
- *Generate various levels of analysis reports of data in different forms for inference.*
- *Design and develop dashboards and scoreboards to present the analysed data in a format that help the decision makers to do the prediction.*

CONCEPTS TO BE COVERED

1. Perform ETL processes using large datasets of CSV, XML, XLS, ARFF and other formats.
2. Build Data warehouse using appropriate schema for various business scenarios.
3. Perform OLAP operations using multidimensional data.
4. Perform Exploratory data analysis using Views, concept hierarchies and data cubes.
5. Create BI dashboards and scoreboards to turn insights into actions for various business scenarios.
6. Present the analysed data using maps,plots, graphs and other visualization formats.
7. Generate a powerful, multi-step alert engine that can trigger workflows.

TOOLS REQUIRED

Tableau /Kibana / Business intelligence development studio /SQL Server data tools (SSIS, SSAS, SSRS)

17MDC85 - DECISION ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
17MDC81

ASSESSMENT : LABORATORY

COURSE OUTCOME

- *Design game model to describe the issue using game theory strategies*
- *Analyze and derive decisions using decision tree and analysis methods*
- *Design and perform decision analysis using 6 Sigma Concepts*

CONCEPTS TO BE COVERED

1. Solving Game Theory Problems using MS-Excel: Maxmin and Minmax criteria
2. Solving Game Theory Problems using MS-Excel: Principle of dominance
3. Solving Game Theory Problems by Linear Programming using MS-Excel's Solver
4. Repeating Exercises 1,2 using R
5. Repeating Exercises 3 using R
6. Solving Game Theory Problems using Gambit software
7. Solving Decision Analysis problems using MS-Excel
8. Using Spreadsheets to Perform Sensitivity Analysis on Decision Trees
9. Construction of Decision Trees using R Packages
10. Construction of Random Forest using R Packages
11. Analysing Decision Trees using TreePlan software
12. Solving MCDM problems using software packages like DEFINITE, MCDA package for R
13. Solving MCDM problems using software packages
14. Computing n-step probabilities using MS-Excel and R
15. Computing steady state probabilities using MS-Excel and R
16. Six Sigma Methodology using Software Packages

17MDC86 - ENTREPRENEURSHIP DEVELOPMENT

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Have the ability to discern distinct entrepreneurial traits*
- *Know the parameters to assess opportunities and constraints for new business ideas*
- *Understand the systematic process to select and screen a business idea*
- *Design strategies for successful implementation of ideas*
- *Evaluate the procedures and prepare a business plan*

UNIT I : Introduction to Entrepreneurship : Meaning, Theories, Categories, Significance. Entrepreneurial India: Evolution over centuries, Current trends. Myths about Entrepreneurship: Myths about passion, surety in riches, financial backing, influential people. Entrepreneur: Definition, Characteristics, Types, Challenges. Entrepreneurship Ecosystem: Context, Positive influencers, Players.-Case Study **(6)**

UNIT II : Intrapreneurship : Meaning, Need, Difference from entrepreneurship, Hurdles, Successful practices. Entrepreneurial Motivation: Key drivers, Mindset, Theories. Entrepreneurial Competencies: Identification & development of competencies, Role of EDPs-Case Study. **(6)**

UNIT III : Business Idea Generation : Approach, Techniques. Opportunity Analysis: Opportunity sighting, evaluation, Mapping ideas to opportunities. Business Modelling: Meaning, Functions, Types, Design & interpretation. Business Planning: Types, Myths, Sections, Documentation Tips. Business Plan Review: Business Model review, Financial review, Technical feasibility Review-Case Study. **(6)**

UNIT IV : Business Creation : Entity types, Steps in setting up a unit, Compliances &approvals.Evolution of a start-up: Key factors, Evolution modelling, Dimensions of maturity. Innovation for Business Growth: Concept, Process, Challenges. Business Sickness: Symptoms, Causes, Remedial measures & rehabilitation-Case Study. **(6)**

UNIT V : Women Entrepreneurship : Need, Development, Benefits, Challenges. Rural Entrepreneurship: Opportunities, Benefits, Role of Government. Social Entrepreneurship: Need, Types & characteristics of social enterprise, Measures of success, Benefits, Sociopreneur-Case Study. **(6)**

Total : 30

REFERENCE BOOKS :

1. *Raj Shankar, "Entrepreneurship: Theory & Practice", 1st Edition, Tata McGraw Hill, New Delhi, 2009.*
2. *Robert D. Hisrich, Michael P. Peters Dean A. Shepherd, "Entrepreneurship", 9th Edition, McGraw Hill/Irwin, 2012.*
3. *Rajeev Roy, "Entrepreneurship", 2nd Edition, Oxford University Press, New Delhi, 2011.*
4. *S. S. Khanka, Entrepreneurial Development, S.Chand and Co, New Delhi, 2012.*

17MDC91 - PRINCIPLES OF INFORMATION SECURITY

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC33, 17MDC45

ASSESSMENT : THEORY

COURSE OUTCOME

Upon Completion of the course, the students shall be able to:

- *Illustrate the principles of information security and employ them to secure the information.*
- *Identify and prioritize assets and threats to secure the assets in the event of attacks.*
- *Practice professional, and ethical attitude and aware of legal issues in the context of information security.*
- *Choose suitable risk management strategies for the organization's information security requirements.*
- *Discuss policies, standards, models and technologies for the given scenario related to information security.*

INTRODUCTION

Information Security Concepts, Critical Characteristics of Information, CNSS Security Model,Components of an Information System, Security in the Systems Development Life Cycle **(3)**

SECURITY ANALYSIS

Need for Security : Business Needs, Threats and Attacks.

Legal, Ethical and Professional Issues in Information Security: Law and Ethics, Ethics and Information Security **(9)**

SECURITY PLANNING

Information Security Policy, Standards and Practices. The Information Security Blueprint. Security Education, Training and Awareness, Continuity Strategies **(6)**

RISK MANAGEMENT

Overview, Risk Identification, Risk Assessment, Risk Control, Quantitative Versus Qualitative Risk Control Practices **(9)**

SECURITY TECHNOLOGY

Security Technolog**y :** Access Controls, Firewalls and VPNs, Intrusion Detection and Prevention Systems and Other Security Tools

Cryptography : Foundations of Cryptology, Cipher Methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communication. **(12)**

IMPLEMENTATION AND MAINTENANCE

Implementing Information Security : Information Security Project Management, Technical Aspects of Implementation, Nontechnical Aspects of Implementation

Security and Personnel : Positioning and Staffing, Credentials for Information Security Professionals, Employment Policies and Practices

Information Security Maintenance **:** Security Maintenance Models, Digital Forensics

Case Study **:** Latest Practices and Impact of Emerging Technologies **(6)**

Total : 45

TEXT BOOK

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning, 6th Edition, 2017.*

REFERENCE BOOKS

1. *Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC PressLLC, 2004.*
2. *Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2003*
3. *Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.*

17MDC92 - PROJECT MANAGEMENT

L	T	P	C
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PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *The selection and initiation of projects in the enterprise*
- *Conduct project planning activities that accurately forecast project costs, timelines and quality .*
- *Implement the project for successful resource communication and risk management.*
- *Demonstrate effective project execution and control techniques that result in successful projects.*
- *Demonstrate effective organisation leadership skills for managing projects, project teams and stakeholders.*

BASICS OF PROJECT MANAGEMENT : Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Project Management Principles. **(9)**

PROJECT IDENTIFICATION AND SELECTION : Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point **(9)**

PROJECT PLANNING : Introduction, Project Planning, Need of Project Planning, Project Life Cycle - PERT and CPM: Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model, Measures of variability, CPM Model, Network Cost System **(9)**

RESOURCES CONSIDERATIONS IN PROJECTS : Introduction, Resource Allocation, Scheduling, Project Cost Estimate and Budgets, Cost Forecasts

PROJECT RISK MANAGEMENT : Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks **(9)**

PROJECT PERFORMANCE MEASUREMENT AND EVALUATION: Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

PROJECT EXECUTION AND CONTROL : Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control **(9)**

TOTAL: 45

REFERENCE BOOKS

1. *Prasanna Chandra, "Projects: Planning, Analysis. Selection. Implementation and Review", Tata McGraw- Hill: New Delhi, 2002.*
2. *Gopalakrishnan, Ramamoorthy, "Project Management", Macmillan: New Delhi, 1993.*
3. *Harold Kerzner, "Project Management : A Systems Approach to Planning, Scheduling and Controlling", 2009.*
4. *Larson, E.W. and Gray, C.F., "Project management the managerial process", Seventh Edition, McGraw-Hill, 2018.*
5. *"UNIDO - Guidelines for Project Evaluation", USA: Oxford, IBH, 1972.*
6. *Prasanna Chandra, "Projects: Planning, Analysis. Selection. Implementation and Review", Tata McGraw- Hill: New Delhi, 2002.*
7. *Gopalakrishnan, Ramamoorthy, "Project Management", Macmillan: New Delhi, 1993.*
8. *UNIDO - Guidelines for Project Evaluation, USA: Oxford, IBH, 1972.*

17MDC93 - HUMAN COMPUTER INTERFACE AND INTERACTION

L	T	P	C
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PRE-REQUISITES
17MDC53

ASSESSMENT : THEORY

COURSE OUTCOME

- *Gain knowledge in the foundations of Human Computer Interface and Interaction*
- *Investigate emerging human computer interfaces and paradigms and implement them into prototype and products with original interfaces and interactions for web, PC, mobile, handheld, or next generation platforms*
- *Be familiar with the design technologies for individuals and persons with disabilities.*
- *Be aware of handheld and conventional HCI.*
- *Learn the guidelines for user interface.*

FOUNDATIONS OF HCI

The Human: I/O channels - Memory - Reasoning and problem solving; The computer: Devices - Memory -processing and networks; Interaction: Models - frameworks - Ergonomics - styles - elements - interactivity- Paradigms. **(9)**

DESIGN & SOFTWARE PROCESS

Interactive Design basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in software process- software life cycle - usability engineering - Prototyping in practice - design rationale. Design rules - principles, standards, guidelines, rules. Evaluation Techniques - Universal Design. **(9)**

MODELS AND THEORIES

Cognitive models -Socio-Organizational issues and stake holder requirements -Communication and collaboration models- Hypertext, Multimedia and WWW. **(9)**

MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. **(9)**

WEB INTERFACE DESIGN

Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 5th Edition, Pearson, Education 2004.*
2. *Brian Fling, "Mobile Design and Development", First Edition,O'Reilly Media Inc., 2009.*
3. *Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009*

17MDC94 - HUMAN COMPUTER INTERFACE AND INTERACTION LAB

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PRE-REQUISITES
17MDC38, 17MDC53

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Analyse and evaluate interaction with computer artifacts from human perspective*
- *Investigate and implement human centered models for usability, utility and satisfaction.*
- *Develop basic prototypes with a range of interaction styles and technologies*

CONCEPTS TO BE COVERED

1. Study the trouble of interacting with machines - Redesign interfaces of home appliances.
2. Design a system based on user-centered approach for any home appliance.
3. Study the features of various handheld systems and computer system.
4. Study of the principles of good screen design.
5. Implement screen design for home appliance
6. Redesign existing Graphical User Interface with screen complexity
7. Design Web User Interface based on any standard theory.
8. Implementation of Different Kinds of Menus
9. Implementation of Different Kinds of Windows
10. Design a system with proper guidelines for icons

*Design and implementation of the above systems to be done for desktop, web based, and handheld interfaces as applicable.

17MDC95 - MINOR PROJECT - DECISION TOOL DEVELOPMENT

L	T	P	C
0	0	8	4

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Investigate the business problem in detail*
- *Identify the logical and ordered process to address all the critical elements of the business problem*
- *Analyze various alternatives and select the best alternative for the problem*
- *Develop the decision tool with the help of the analysis*

Effectiveness in managing the business decision making will ultimately determine the success of the company. But this is a problem for companies of all sizes particularly with the companies that are growing rapidly. At this point a clear mechanism for managing, communicating and confirming decision implementation is essential. Hence this minor project concentrates on developing a decision tool for the Chosen business process.

In this minor project students have to :

- Choose a business problem and develop a decision tool for to address the same.

17MDC96 - BUSINESS ETHICS

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Understand the inhereent conflicts in being ethical*
- *Analyse the ethical dilemmas in common business situations and the ways to solve them.*
- *Broaden the understanding of the way to act rightly in different business situations*
- *Learn to commit to mutual ethical treatment of the human person and do ethical business and ethical leadership.*
- *Make ethical decisions effectivelu and decisively based on ethical thinking and decision making frameworks.*

UNIT I

Introduction to Ethics - Moral Development in human theories and Concepts- Definitions of ethics- theories of Ethics and Ethics Projects -Case Study. **(6)**

UNIT II

Decision Making Model : Ethics as Making Decisions and Choices - Decision Making frameworks-Conflicts and Ethical Dilemmas - Moral and Ethical dilemmas-Case Study. **(6)**

UNIT III

Ethics and Business : A sense of Business Ethics - Ethics and International Business - Ethics issues beyond borders- Ethics and economics: Ethical concerns of economic individuals and societies. **(6)**

UNIT IV

Business Disciplines : Ethics of Marketing and advertising - Ethics of Finance and accounting- Ethics of HR and related aspects-Production and related issues -Ethics of IT. **(6)**

UNIT V

Ethics and Environment : Environmental Ethics awareness-Business and Social Responsibility-Business response to environmental problems and ethics-International standards-Global Impact. **(6)**

Total : 30

REFERENCE BOOKS

1. *William. H. Shaw, "Business Ethics", Cengage Advantage Books, 2013.*
2. *Stephen. M. Byars and Kurt Stanberry, "Business Ethices", 2018.*
3. *Das Gupta, Anandha, "Business Ethics", Springer, 2014.*
4. *Denis Collins, "Business Ethics", Second Edition, Sage Publications, 2018*

17MDC101 - PROJECT WORK AND VIVA VOCE - II

L	T	P	C
			18

PRE-REQUISITES

Should have undergone all courses

ASSESSMENT : PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- *Perform quantitative and qualitative data analytics in functional areas of business*
- *Analyze business problems using mathematical and statistical modeling and enable data driven decision making.*
- *Analyze the issues in software solutions*
- *Develop enterprise applications applying software engineering principles and business domain knowledge*
- *Visualize and infer meaningful insights to facilitate strategic and operational decisions*
- *Apply and demonstrate software development standards in the software industry*
- *Work in a team to develop solutions for real time applications and solve research issues*

MANAGEMENT STREAM - FINANCE

Course Code	Course Name
17MDCE01	Security Analysis And Portfolio Management
17MDCE02	Equity Valuation
17MDCE03	Derivatives And Risk Management
17MDCE04	Credit Risk Analytics And Management

17MDCE01 - SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC32, 17MDC43

ASSESSMENT : THEORY

COURSE OUTCOME

- *Evaluate the various investment alternatives available and select the best security for investment*
- *Analyse the nuances of Stock Market operations*
- *Evaluate the economy, industry and company to select the instrument for investment*
- *Assess the trend patterns for investment in securities*
- *Practice the techniques involved in analysing upon purchase or sales of secuirities.*

INVESTMENT SETTING : Financial and Economic meaning of investment - Characteristics and objectives of investment - Types of investment - Investment alternatives choice and evaluation - Risk and return concepts. **(9)**

SECURITIES MARKETS : Financial Market - Segments - Types - Participants in financial market - Regulatory environment - Primary market - Methods of floating new issues, Book building - Role of Primary market - Regulation of primary market - Stock exchanges in India - BSE, OTCEI, NSE, ISE and Regulation of Stock exchanges - Trading system in stock exchanges - SEBI. **(9)**

FUNDAMENTAL ANALYSIS **:** Economic analysis: Economic Forecasting an Stock investment decisions. Industry Analysis : Industry classification - Industry Life Cycle. Company Analysis: Measuring Earnings - Forecasting Earnings - Applied Valuation Techniques - Graham and Dodd investor ratios. **(9)**

TECHNICAL ANALYSIS : Fundamental Vs Technical Analysis - Charting methods - Market Indicators: Trend, Trend reversals, Patterns, Moving average, Exponential Moving average - Oscillators - Market Indicators - Efficient Market Theory. **(9)**

PORTFOLIO MANAGEMENT : Portfolio Analysis - Portfolio Selection - Portfolio Revision - Portfolio Evaluation. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Prasanna Chandra, "Investment Analysis and Portfolio Management", Tata Mc.Graw Hill, 2011.*
2. *Donald. E. Fischer and Ronald. J. Jordan, "Security Analysis and Portfolio Management", PHI learning, New Delhi, 8th Edition, 2011.*
3. *Bhalla.V.K, "Investment Management", Sultan Chand and Company Ltd, 2012.*
4. *Kevin.S, "Security Analysis and Portfolio Management", PHI Learning,2012.*

17MDCE02 - EQUITY VALUATION

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC32, 17MDC43

ASSESSMENT : THEORY

COURSE OUTCOME

- *Assess valuation and intrinsic value and explain sources of perceived mispricing;*
- *Evaluate definitions of value and justify which definition of value is most relevant to public company valuation;*
- *Apply techniques learned in the course as these are being used in practice by stock market participants .*
- *Analyse the environmental context of the company being valued.*
- *Apply critically various theories of valuation and forecasting.*

Introduction to Valuation and Common Valuation Methodologies - Why Valuation, Various Methods of Valuation, Introduction to Discounted Cash Flow Valuations, Relative Valuations and Other Methods, Advantages and Disadvantages of the various Methods. **(9)**

Discounted Cash Flow Valuation - Introduction to Dividend Discount Model, Free Cash Flow to Firm and Free Cash Flow to Equity Model, Cost of Equity, Cost of Capital, Practical Methods of Cost of Capital Calculations, Interpretation of Capital Asset Pricing Model and other methods of calculating cost of equity, Cash Flow Calculations and Interpretations, Usage of methods based on industries and companies **(9)**

Relative Valuations - Relative Valuation Metrics - Price to Earnings Ratio, Price to Book Ratio, Price to Sales Ratio, Enterprise Value ratios, Exercise on Relative Valuation using Banking Sector. **(9)**

Advanced Valuation Techniques - Introduction to distressed company valuation, Valuation and its applications in Mergers and Acquisitions, Transaction Comparable Methods. **(9)**

Valuation Exercises - Valuation model building using Microsoft Excel for a services company in India, Valuation model building using Microsoft Excel for a manufacturing company in India, including concepts of DCF Valuations and Relative Valuations. Other Exercises - Students to build a detailed model on their own **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Aswath Damodaran, "Investment Valuation", John Wiley & Sons, Inc., 3rd edition, 2012.*
2. *Benjamin Graham David Dodd, "Security Analysis", Sixth Edition, 2008.*
3. *John D Stowe et al., "Equity Asset Valuation", John Wiley & Sons, Inc., 2nd edition, 2007.*
4. *James Valentine, "Best Practices for Equity Research Analysts: Essentials for Buy-Side and Sell-Side Analysts", Mc Graw Hill, 2011.*

17MDCE03 - DERIVATIVES AND RISK MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC43, 17MDCE111

ASSESSMENT : THEORY

COURSE OUTCOME

- *Understand the operations of Derivatives market.*
- *Analyse and price diverse derivatives products to generate an optimal risk management strategy.*
- *Demonstrate critical thinking, analytical and problem solving skills in the context of derivatives pricing and hedging practice*
- *Understand the procedures followed in the binomial model Black-scholes model in fixing option prices.*
- *Demonstrate an understanding of pricing forwards, futures and option contracts.*

UNIT I : Introduction to derivatives : Derivative markets and instruments, underlying asset, concepts in derivative markets, linkages between spot and derivative markets, Role of Derivative markets. Growth and Development of derivative markets: commodity derivatives, financial derivatives, globalization of derivatives and derivatives in India, Users of derivatives. **(9)**

UNIT II : Structure of Forward and Future contracts : Development of Forward and Future markets, Over the Counter and Futures exchanges, Mechanics of future trading, Futures price quotations, Types of future contracts, Transaction costs. Principles of Pricing : Generic carry arbitrage, carry arbitrage with cash flows. Future arbitrage strategies: short term, intermediate and long term interest rate arbitrage, Stock index arbitrage, Foreign exchange arbitrage. **(9)**

UNIT III : Structure of option markets: Development of options markets, Call options, Put options, Over the Counter option markets and organized exchanges, Option Traders, Mechanics of trading and Types of options. Principles of Pricing: Notation and Terminology, Principles of call option Pricing and Principles of put option pricing. Option Pricing Models: Option Greeks, Binomial model and Black-Scholes option pricing model. **(9)**

UNIT IV : Risk Management applications of option Strategies : Notation and terminology, Stock Transactions, Call option Transactions, Put option Transactions, Covered Call, Productive Put, Synthetic puts and calls. Advanced Risk Management applications of option Strategies: Option spreads, Collar, Butterfly spread, Straddles and Strangle. **(9)**

UNIT V : Interest Rate Swaps : Structure, Valuation, Strategies. Currency swaps: Structure, Valuation, Strategies. Equity swaps: Structure, Valuation, Strategies, Caps, Floor and Swaptions: LM Model and SM Model **(9)**

Total : 45

REFERENCE BOOKS

1. *Don M.Chance and Robert Brooks, "Derivatives and Risk Management Basics", 5th Edition, South-Western Cengage Learning, USA, 2011.*
2. *Jayanth Rama Varma, "Derivatives and Risk Management", 3rd Edition, Tata McGraw Hill, New Delhi, 2010.*
3. *Schwesernotes, CFA Level 1 Book 5 : "Fixed Income, Derivatives and Alternatives Investments", Kaplan Inc., USA, 2014.*
4. *Sundaram Janakiramanan, "Derivatives and Risk Management", Pearson, 2011.*

17MDCE04 - CREDIT RISK ANALYTICS AND MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC32, 17MDC43

ASSESSMENT : THEORY

COURSE OUTCOME

- *Identify the different types of credit risk and how they arise in a financial institution's various activities.*
- *Understand how credit risk can be quantified, monitored and controlled, exploring the role of credit portfolio management tools such as collateral, documentation and credit derivatives*
- *Apply best practice tools and techniques for fundamental credit analysis .*
- *Understanding of businesses, their borrowing needs, making robust risk assessments and making good credit decisions.*
- *Make detailed credit analysis of any company (finance/ non-finance)*

Meaning of Credit - Risk of Credit - Credit Market -Advantages and disadvantages of Credit - Credit Research and analysis - Importance of Credit Research. **(9)**

Rating Methodology and players - Different credit rating companies and credit rating scales - Risks in Fixed income and Terminology - Understanding auditors report - Understanding Management Risk - Debt Schedule understanding and interpretation Self sustainable understanding and interpretation - Bank Basel Report. **(9)**

Advance Ratios for Credi**itt** anal**l**ysi**i**s **:** Cash flow, Debt specific, Liquidity - Adjustment in ratios -Credit Rating companies Procedures for comparing financials - CRISIL, ICRA, CARE - Additional comparison between CRISIL,ICRA and CARE. **(9)**

Term sheet understanding for SME and Education rating - SME rating process - Content and structure of credit rating report - Retail credit assessment - Working capital assessment (fund and non-fund based) - Cash flow/fund flow analysis - Credit Pricing. **(9)**

Rating Methodology of different sector : Banking sector, Infrastructure sector,Two wheeler sector and other sectors. **(9)**

Total : 45

REFERENCE BOOKS:

1. *Ken Brown and Peter Moles, "Credit Risk Management", Edin burgh Business School, Heriot Watt University, 2013.*
2. *Ciby Joseph, "Advanced Credit Risk Analysis and Management", Wiley, First Edition, 2013.*
3. *Arnold Ziegel, "Fundamentals of credit and Credit analysis", Create Space Independant Publishing, 2015.*
4. *Andrew Fight, "Credit Risk Management", Elsevier Butterworth-Heinemann, 2004.*
5. *Harold Scheule, Daniel Rosch and Bart Baesens, "Credit Risk Analysis - The R Companion", Wiley Publishers, 2016.*

MANAGEMENT STREAM - MARKETING

Course Code	Course Name
17MDCE11	Consumer Behaviour
17MDCE12	Services Marketing
17MDCE13	Customer Relationship Management
17MDCE14	Brand Management

17MDCE11 - CONSUMER BEHAVIOUR

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *Identify the major influences in consumer behaviour*
- *Distinguish between different consumer behaviour influences and their relationships*
- *Establish the relevance of consumer behaviour theories and concepts to marketing decisions*
- *Recognise social and ethical implications of marketing actions on consumer behaviour*
- *Use most appropriate techniques to apply market solutions*

Introduction to Consumer Behavior : Definition, Concepts, Model. Consumer Motivation: Dynamics of Motivation, Types and System of Needs, Measurement of Motives. Consumer Personality: Theories, Personality and understanding Consumer Behaviour, Brand Personality, Self and Self-image -Predicting consumer behavior with data analytics. **(9)**

Consumer Perception : Sensory dynamics, Elements, Consumer Imagery. Consumer Learning: Elements of Consumer learning, Behavioural learning, Information Processing and Cognitive Learning, Consumer Involvement and Passive Learning, Outcomes and Measures of Consumer learning - Understand consumer perception using marketing anaytics. **(9)**

Consumer Attitude : Concept, Structural Models of Attitude, Attitude Formation, Strategies of Attitude Change, Cognitive Dissonance Theory, Attribution Theory - Analyzing consumer attitude using Marketing analytics. **(9)**

Social Class : Socialization and Roles of family members, Family Decision Making, Family lifecycle, Social Class, Measurement of Social Class. Influence of culture on Consumer Behavior: Dynamics of Culture, Indian Core Values. **(9)**

Diffusion of Innovations : Diffusion Process, Adoption Process, A profile of the Consumer Innovator. Marketing Ethics and Social Responsibility: Exploitive Targeting, Manipulating Consumers, Social Responsibility. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Leon G. Schiffman, Leslie Lazar Kanuk& S. Ramesh Kumar, "Consumer Behaviour", 10th Edition, Pearson Education, New Delhi, 2010.*
2. *David L. Loudon & Albert J. Della Bitta, "Consumer Behaviour", 4th Edition, Tata McGraw Hill: New Delhi, 2013.*
3. *Del I Hawkins, "Consumer Behaviour", 12th Edition, Tata McGraw Hill: New Delhi, 2013.*
4. *Roger D Blackwell, Paul WMiniard and James F Engel, "Consumer Behaviour", 10th Edition, Thomson/ South-Western College Publication, Ohio, 2005.*

17MDCE12 - SERVICES MARKETING

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *Identify the special management issues and unique challenges involved in marketing and managing services*
- *Assess the expectations of customers and know how to translate this knowledge into genuine value for customers*
- *Interpret service behaviour and service consumption in the light of service-dominant marketing logic and articulate the outcome to service marketing management*
- *Appreciate, modify, and/or extend new theories and concepts pertaining to explaining the characteristics of customers' purchasing and consumption behaviour of services and service firms' marketing behaviour*
- *Apply new approaches to managing customer satisfaction and loyalty*

Introduction to Services : Introduction and Growth of service sector, Characteristics of services, Classification of Services, Service Marketing mix.Service Quality: SERVQUAL dimensions, the gaps Model of Service Quality - Case Study. **(9)**

Focus on the consumer : Consumer Behaviour in Services: Types of consumer expectations, Zone of tolerance. Consumer Expectations of service: Factors influencing customer expectations of service. Customer Perceptions of services: Customer perceptions, Customer satisfaction, Service Encounters- Case Study. **(9)**

Understanding Customer requirements : Building Customer relationships: Relationship Marketing, Relationship value of customers, Relationship Development Strategies. Service Recovery: Service failure and Recovery, Customers' response to service failures, Services Recovery strategies, Service Guarantees- Case Study. **(9)**

Service design and Standards : Service Blueprinting: Service blueprint and its components. Physical Evidence and servicescape: Types of Servicescapes, roles of Servicescape, Guidelines for Physical Evidence strategy. Employee role in Service Industry: Boundary spanning roles, Strategies for delivering service quality through people- Case Study. **(9)**

Delivering Service through intermediaries and electronic channels : Types ofChannels. Managing demand and capacity: Strategies for matching capacity and demand. Integrated service marketing communications: Categories of strategies to match service promises with delivery. Pricing of services: Approaches to Pricing Strategies, Pricing Strategies- Case Study. **(9)**

TOTAL : 45

TEXT BOOK

1. *Zeithaml. A. Valarie, Gremler D Dwayne, Bitner Jo Mary, Ajay Pandit, "Services Marketing- Integrating customer focus across the firm", 4th edition, Tata McGraw-Hill Publishing, New Delhi.*

REFERENCES BOOKS

1. *Lovelock Christopher, JochenWirtz and JayantaChatterjee, "Services Marketing", Pearson Education: New Delhi, 2011.*
2. *Woodruffe Helen, "Services Marketing", McMillan: New Delhi, 2003.*
3. *C Bhattacharjee, "Services Management", Excel Books: New Delhi, 2006.*
4. *Jha S.M., Services Marketing, Himalaya: Mumbai.*
5. *Ravi Shanker, "Services Marketing", Excel Books: New Delhi, 2008.*

17MDCE13 - CUSTOMER RELATIONSHIP MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *Critically review and interpret the theoretical aspects of CRM across the main areas of Sales, services and marketing.*
- *Investigate, analyse, demonstrate and present the salient aspects of a CRM implementation in work related environment*
- *Evaluate internal data about customers and analyse for decision making*
- *Conduct data analysis and generate insights about how to better meet the needs of target segments and individual customers*
- *Deliver a marketing mix tailored to the needs and interests of target segments and individual customers.*

CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs-Case Study. **(9)**

CRM in Marketing - One-to-one Relationship Marketing - Cross Selling &Up Selling - Customer Retention, Behaviour Prediction - Customer Profitability & Value Modeling, - Channel Optimization - Event-based marketing.

CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement-Case Study. **(9)**

Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM)-Case Study. **(9)**

Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use- Customer Relationship Analytics in customer service evaluation and supply chain management. **(9)**

CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement-Case Study. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Alok KumarRai, "Customer Relationship Management Concept & Cases", Prentice Hall of India Private Limited, New Delhi. 2011*
2. *S. Shanmugasundaram, "Customer Relationship Management", Prentice Hall of India Private Limited, New Delhi, 2008*
3. *Kaushik Mukherjee, "Customer Relationship Management", Prentice Hall of India Private Limited, New Delhi, 2008*
4. *Jagdish Seth, et al, "Customer Relationship Management"*
5. *V. Kumar & Werner J., "Customer Relationship Management", Willey India, 2008*

17MDCE14 - BRAND MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *Demonstrate knowledge of the nature and processes of branding and brand management.*
- *Evaluate the scope of brand management activity across the overall organisational context and analyse how it relates to other business areas.*
- *Appraise the key issues in managing a brand portfolio and making strategic brand decisions*
- *Formualte and justify brand development decisions*
- *Analyse and Discuss contemporary brand related problems and develop appropriate strategies and initiatives.*

INTRODUCTION

Basics Understanding of Brands - Definitions - Branding Concepts - Functions of Brand -Significance of Brands - Different Types of Brands - Co branding - Store brands-Case Study. **(9)**

BRAND STRATEGIES

Strategic Brand Management process - Building a strong brand - Brand positioning -Establishing Brand values - Brand vision - Brand Elements - Branding for Global Markets -Competing with foreign brands-Analytics in Brand marketing strategy. **(9)**

BRAND COMMUNICATIONS

Brand image Building - Brand Loyalty programmes - Brand Promotion Methods - Role of Brand ambassadors, celebraties - On line Brand Promotions-Case Study. **(9)**

BRAND EXTENSION

Brand Adoption Practices - Different type of brand extension - Factors influencing Decision for extension - Re-branding and re-launching-Case Study. **(9)**

BRAND PERFORMANCE

Measuring Brand Performance - Brand Equity Management - Global Branding strategies -Brand Audit - Brand Equity Measurement - Brand Leverage -Role of Brand Managers- Branding challenges & opportunities - Case Studies. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Kevin Lane Keller, "Strategic Brand Management: Building, Measuring and Managing", Prentice Hall, 2012.*
2. *Moorthi.YLR, "Brand Management", Vikas Publishing House, 1st Edition, 2012.*
3. *LanBatey, "Asain Branding - A Great way to fly", PHI, Singapore, 2002.*
4. *Paul Tmepoal, "Branding in Asia", John Willy, 2000.*
5. *Ramesh Kumar, "Managing Indian Brands", Vikas Publication, India, 2002.*
6. *Jagdeep Kapoor, "Brandex", Biztranza, India, 2005*

MANAGEMENT STREAM - HR

Course Code	Course Name
17MDCE21	Strategic Human Resource Management
17MDCE22	Organisational Development
17MDCE23	Performance Management
17MDCE24	Compensation Management

17MDCE21 - STRATEGIC HUMAN RESOURCE MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC51

ASSESSMENT : THEORY

COURSE OUTCOME

- *Evaluate the differing strategic contributions of particular HR disciplines*
- *Analyse organisational and human resource strategies, and perform a strategic gap analysis*
- *Measure and quantify the contribution of HR activity at an organisational level*
- *Align HR activities with overall organisational strategy by developing, planning and applying contextualised strategic solutions to specific organisational human resource challenges*
- *Gain the ability to manage global HR and manage and train the international employees.*

Strategic Role of HRM - Planning and Implementing Strategic HR Policies - HR Strategies to increase firm performance - Case Study. **(9)**

Investment perspectives of HR - Investment Considerations - Investment in Training and Development - Investment Practices for improved Retention - Investments Job Secure work courses - Non traditional investment approaches - Case Study. **(9)**

Managing Strategic Organisational Renewal - Managing change and OD - Instituting TQM Programmes - Creating Team Based Organisations - HR and BPR - Flexible work arrangement - Case Study **(9)**

Establishing Strategic Pay plans - Determining periods - Establishing Periods - Pricing Managerial and Professional Jobs - Compensation trends - Objectives of international compensation - Approaches to international compensation - Issues related to double taxation - Case Study. **(9)**

Managing Global Human Resources - HR and the internationalization of business - Improving international assignments through selections - Training and maintaining international employees - Developing international staff and Multinational teams - Strategic alliances -Sustainable global competitive advantage - Location of production facilities - Repatriation process- Case Study. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Gary Dessler, "Human Resource Management", PHI, New Delhi, 2003.*
2. *Charles R. Greer, "Strategic Human Resource Management", Pearson Education, 2003.*
3. *Luis R. Gomez-Mejia, David B. Balkin, Robert L. Cardy, "Managing Human Resources", PHI, 2001.*
4. *Peter J. Dowling, Denice E. Welch, Randall S. Schuler, "International Human Resource Management", Thomson South-Western, 2002.*

17MDCE22 - ORGANISATIONAL DEVELOPMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *Assess the organisation development process from a historical, theoretical and practical perspective.*
- *Analyse the various organisation development practices, models, and approaches.*
- *Evaluate the value of organisation development interventions to business performance and productivity.*
- *Analyse the value of human resource intervention to the organisational development*
- *Assess the impact of technology on the organisational development*

Organisational Development - An introductio**n :** Organisational Development - Meaning and Definition, History of OD, Relevance of Organisational Development for Managers, Characteristics of OD, Assumptions of OD. Change Process and Models: Organisational Change, Strategies for Change, Theories of Planned Change (Lewin's change model, Action research model, the positive model), Action Research as a Process, Resistance to Change- Case Study. **(9)**

Role of OD Practitioner : OD Practitioner, Role of OD Professional in Organisations, Competencies Required for an OD Professional, Scope of the Role of an OD Professional.Process of OD: Process of OD, Components of OD program, OD program phases, Making an Entry, Developing Contract, Launch, Situational Evaluation, Closure- Case Study. **(9)**

Designin**g** Intervention**s :** OD Interventions, Characteristics of OD Interventions, Levels of Diagnosis in Organisations, OD Map, Factors Affecting Success of Interventions. Human Process Interventions: Introduction, Team Development Interventions, Interpersonal Development Interventions. Human Resource Interventions: HRM Interventions, Goal Setting, Performance Appraisal, Reward Systems, Career Planning and Development, Managing Workforce Diversity, Employee Wellness- Case Study. **(9)**

Structural Interventions : Socio-Technical Systems, Techno-Structural Interventions, Physical Settings and OD, Types of Techno-Structural Interventions. Strategic Interventions: Integrated Strategic Change, Trans-organisation Development, Merger and Acquisition Integration, Culture Change, Self-Designing Organisations, Organisation Learning and Knowledge Management, Confrontation Meetings, System 4 Management, Learning Organisations- Case Study. **(9)**

Technology and OD : Technology & OD: Basic Concept, Impact of Technology in Organisations, Benefits of Using Technology in OD, Guidelines for Integrating Technology in OD Interventions, Tools used in ODIssues Faced in OD: Introduction, Issues Related to Client Relationships, Power, Politics and Organisational Development. Evaluating OD interventions: Evaluation, Importance of Evaluating Interventions, Types of Evaluation, Methods of Evaluating Interventions- Case Study. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Bewnet, Roger cd, "Improving Training Effectiveness", Aldershot, Gower 1988.*
2. *Buckley R & Caple, Jim, "The Theory & Practice of Training", London, Kogan & Page 1995.*
3. *Lynton R & Pareek U, "Training to Development", New Delhi, Vistaar, 2nd Edition, 1990.*
4. *Pepper, Allan D, "Managing the Organisational Development Function", Aldershot, Gower, 1984.*
5. *Rae L etc., "Hon to Measure Training Effectiveness", Aldershot, Gower, 1986.*
6. *Reid M.A. etc., "Training interventions, Managing Employee Development", London IPM, 3rd Edition, 1992.*
7. *Serge P "The Fifth Discipline: The Art and Practice of the Learning Organization", London Century, 1992.*
8. *Huse.F.E. and Cummings.T.C, "Organisational Development and Change", West New York, 1985.*

17MDCE23 - PERFORMANCE MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *Design an organisation's performance management process that is compliant with law and supports organisational mission and strategy.*
- *Define attributes of effective performance management systems.*
- *Devise and sustain arguments for using appropriate performance management techniques, rewards and sanctions to improve performance.*
- *Identify the necessary characteristics of accurate performance management tools.*
- *Plan effective performance management policies and practices to improve organisational and employee performance*

Introduction to Performance Management : Definition of performance evaluation-Evolution of Performance management-Definitions and differentiation of terms related to performance management- Importance of performance management-Linkage of performance management to other HR processes-Case Study. **(9)**

An Overvie**w of** Performanc**e** Managemen**t :** Aim and Purpose of Performance Management-Employee engagement and performance management - Principles of Performance management - Overview of performance management as a system - Dimensions of Performance management-Case Study. **(9)**

Theoretica**l** Framewor**k** o**f** Performanc**e** Managemen**t :** Goal Theory, Control theory, Social Cognitive theory, Organisational justice theory and its applications in Performance Management-Case Study. **(9)**

Process of Performance Management : Overview of performance management process-Performance management process-Performance management planning process-Mid-cycle review process-End cycle review process-Performance management cycle at a glance. Planning and Development: Introduction - Performance management planning - The planning process-Performance agreement-Drawing up the Plan-Evaluating the Performance Planning process-Case Study. **(9)**

Mechanics of Performance Management Planning and Documentation : The need for structure and documentation - Manager's responsibility in performance management planning and creation of performance management-Performance management process through automation-Issues in Performance management-Predictive analytics in identifying and analyzing lead and lag indicators for performance management. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Herman Aguinis, "Performance Management", Pearson Publication, Third Edition, 2013.*
2. *R.K.Sahu, "Performance Management System", Excel Books, 2009.*
3. *Elaine.D.Pulakees, "SHRM Foundation".*
4. *Linda Ashdown, "Performance Management", 2014.*
5. *PremChandha, "Performance Management", Macmillan Insia, New Delhi, 2003.*
6. *Michael Armstrong and Angela Baron, "Performance Management:The New Realities", Jaico Publishing House, New Delhi, 2002.*
7. *T.V. Rao, "Appraising and Developing Managerial Performance", Excel Books, 2003.*

17MDCE24 - COMPENSATION MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC52

ASSESSMENT : THEORY

COURSE OUTCOME

- *To promote knowledge in the issues related to the compensation in the organisation.*
- *To analyse the pay relationship with job, skills, competencies in an organisation*
- *To evaluate the legal framework and the pay structure of the organisation in comparison to the competitors.*
- *To get a clear idea in fixing the remuneration principles in the company.*
- *To understand the financial and non-financial compensation fixed for executives in an organization*

UNIT I : Introductio**n :** Compensation Defined, Goals of Compensation System, Compensation Strategy Monetary & Non-Monetary Rewards, Intrinsic Rewards Cafeteria Style Compensation, Fringe Benefits and Supplementary Compensation-Case Study **(9)**

UNIT II : Internal Alignment : Definition of internal alignment, Internal pay Structures, Strategic choices in internal alignment design, choosing the best internal structure - Job evaluation: Major decisions in job evaluation, Job Evaluation Methods, Final result-Person-based structures: Salary Slabs, Flexible Structure, Salary Trends-Case Study. **(9)**

UNIT III : Determining External Competitiveness : Definition of Competitiveness, Factors influencing compensation level - Legal framework: Payment of Wages Act, 1936, Minimum Wages Act, 1948, Payment of Bonus Act, 1965, Equal Remuneration Act, 1976-Case Study. **(9)**

UNIT IV : Reward and Compensation St**rategies :** Performance based pay, Skill based pay, Team based pay,Broad banding, Profit sharing -Compensation& Payroll: Basic, HRA, Variable pay, Designing PF Plans -Case Study. **(9)**

UNIT V : Executive Compensation : Concepts, components, incentives, executive compensation in Indian context - Leave Policy: Scope, Types, Process-Personal income tax implications of salary: sec 88, 54E, 80C, Companies Act provisions relating to remuneration for senior executives-Analytics in identifying Lead and Lag indicators for compensation management. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *C.B. Mamoria and S.V. Gankar, "Personnel Management", Himalaya Publishing House, Mumbai, Twenty-fifth Edition, 2005*
2. *Tripathi, P. C. 1995, "Personnel Management and Industrial Relations", Sultan Chand : New Delhi*
3. *Venkatratnam, C.S. (2002). "Rethinking Rewards and Incentive Management", Excel:New Delhi.*

MANAGEMENT STREAM - OPERATIONS & LOGISTICS

Course Code	Course Name
17MDCE31	Total Quality Management
17MDCE32	Logistics Strategy and Planning
17MDCE33	Supply Chain Management
17MDCE34	Warehouse and Distribution Management

17MDCE31 - TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC44

ASSESSMENT : THEORY

COURSE OUTCOME

- *Develop an understanding on quality management philosophies and frameworks*
- *Gain an in-depth knowledge on various tools and techniques of quality management.*
- *Learn the applications of quality tools and techniques in both manufacturing and service industry*
- *Develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those.*
- *Design the quality framework for a company*

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality - Case Study. **(9)**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating - Case Study. **(9)**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types- Case Study. **(9)**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures - Case Study **(9)**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, QualityAuditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors - Case Study. **(9)**

Total : 45

REFERENCE BOOKS

1. *Senthil Arasu.B and Praveen Paul. J, "Total Quality Management", Scitech Publications (India) PVT Ltd, Second Edition, 2006.*
2. *Dale.H.Besterfield, et al, "Total Quality Management", Pearson Edn, Asia, Third Edition, Indian Reprint, 2006.*
3. *James. R. Evans and William. M. Lindsay, "The Management and Control of Quality", Cengage Learning, Eighth Edition, 2012.*
4. *Suganthi. L and Anand Samuel, "Total Quality Management", Prentice Hall(India) Pvt Ltd, 2006.*

17MDCE32 - LOGISTICS STRATEGY AND PLANNING

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC44

ASSESSMENT : THEORY

COURSE OUTCOME

- *Design a logistical planning and Strategy framework*
- *Analyse and design the optimal logistics customer services levels*
- *Compute optimal batch sizes and propose optimal transport routes*
- *Assess different modes of transportation and inter-modals*
- *Design and allocate storage location for products in the warehouse*

Introduction to Logistics : Introduction to Logistics - Scope of logistics in business, Logistics and Supply Chain Management, Core and support activities of logistics; Logistical integration hierarchy; Integrated Logistics; Operating objectives; Barriers to internal integration; Logistical performance cycles; Supply chain relationships - Channel participants, Channel structure, Basic functions, Risk, power and leadership-Case Study. **(9)**

Logistics Systems Design : Logistics system design -Logistics reengineering, Logistical environmental assessment, Time based logistics, Anticipatory and Response based strategies, Alternative strategies, Logistical operational arrangements, Time based control techniques; Integration theory - Location structure, Transportation economies, Inventory economies, Formulating logistics strategy-Case Study. **(9)**

Logistics Strategy and Planning **:** Logistics strategy and planning - Logistics planning triangle, Network appraisal; Guidelines for strategy formulation - Total cost concept, Setting customer service level, Setting number of warehouses in logistics system, Setting safety stock levels, Differential distribution, Postponement, Consolidation, Selecting proper channel strategy-Case Study. **(9)**

Inventory, Purchasing and Location Decisions : Inventory and purchasing decisions; Multi facility location problems - Exact method, Heuristic methods, other methods; Logistics planning and design - Feasibility analysis, Project planning, Assumptions and data collection, Analysis, Development of recommendation, Implementation-Case Study. **(9)**

Logistics planning and design : Planning and design techniques - Logistics adhoc analysis, Location analysis, Inventory analysis, Transportation analysis-Logistics Analytics. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Bowersox & Closs, "Logistical Management", McGraw-Hill Companies, 1996.*
2. *Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran and Parasuram Balasubramanion, "Analytics in Operations/Supply Chain Management", I.K. International Publishing House Pvt Ltd., 2015.*
3. *R.H. Ballou, "Business Logistics Management", Prentice-Hall International, 2004.*
4. *David J Bloomberg, "Logistics", Pearson Education, 1st Ed, 2015.*
5. *Ganapathi SL, Nandhi SK, "Logistics Management", Oxford University Press India, 2015.*

17MDCE33 - SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC44

ASSESSMENT : THEORY

COURSE OUTCOME

- *Understand fundamental supply chain management concepts*
- *Evaluate and manage an effective supply chain*
- *Align the management of supply chain with corporate goals and strategies*
- *Analyse and improve supply chain process*
- *Understand the importance of the supply chain analytics and optimization*

Concepts of Supply Chain : Understanding supply chains - Supply chain decisions - Enablers and Drivers of Supply Chain Performance - Assessing and Managing Supply chain Performance - Supply chain metrics and Financial metrics relationship - Supply chain Processes and Strategies - Importance of Supply Chain Management-Service and manufacturing supply chain dynamics - Manufacturing supply chains - Bullwhip effect. **(9)**

Forecasting Drivers of Supply chain Performance : Forecasting introduction - Framework for a forecast system - Choosing right forecasting technique - Judgment methods (Composite Forecasts, Surveys, Delphi Method, Scenario Building, Technology Forecasting, Forecast by Analogy) - Causal methods (Regression Analysis -Linear & Non-Linear Regression, Econometrics) - Time series analysis (Autoregressive Moving Average (ARMA), Exponential Smoothing, Extrapolation, Linear Prediction, Trend Estimation, Growth Curve, Box-Jenkins Approach) - CPFR. **(9)**

Inventory management methods in supply chain **:** Decision framework for inventory management - Preliminary modelling, Two critical and ABC analysis -Single item, Single period problem - Single item, multi period problem - Multi item inventory models - Multi-echelon inventory system. Transportation Decision in Supply Chain: Motor carrier freight - Truck load mode - Steeping back - Building A Rate Model using LTL service - Rail and Cargo. Location and Distribution Decision in Supply Chain : Modelling with binary variables - Supply Chain network optimization - Risk pooling - Continuous location models: Gravity, iterative method - Multiple facility location. **(9)**

Supply Chain Processes and Strategies : Integrated supply chains design - Customer relationship process - Order fulfillment process - Supplier relationship process - Supply chain strategies - Strategic focus - Mass customization - Lean supply chains - Outsourcing and offshoring - Virtual supply chains.Resource planning and scheduling: Enterprise resource planning - Planning and control systems for manufacturers - Materials requirement planning - Drum - Buffer - Rope system - Scheduling - Scheduling service and manufacturing processes - Scheduling customer demand - Scheduling employees - Operations scheduling-Analytics for sequencing and scheduling. **(9)**

Supply Chain Analytics : Understanding and defining supply chain analytics- Importance of analytics in supply chain management - Supply chain analytics in the flow involving material, money, information and ownership - Key issues in supply chain analytics. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Ravi Ravindran.A and Donald.P.Warsing, "Supply Chain Engineering Models and Applications", CRC press:Taylor and Francis Group*
2. *Sunil Chopra, Peter Meindl & D.V. Kalra, "Supply Chain Management: Strategy, Planning and Operation", Pearson Education; 5th Ed.. 2012*

3. *Lee Krajewski, Larry P. Ritzman, Malhotra, "Operations Management 8e", Pearson Education; 11th edition2015*
4. *Christopher Martin, "Logistics and Supply Chain Management", Pearson Education Asia,2002.*
5. *David Simchi-Levi, Ravi Shankar, "Designing and Managing Supply Chain concepts, Strategies and Case Studies", McGraw Hill Publication, 3rd Edition, 2011.*
6. *Janat Shah, "Supply Chain Management - Text and Cases", Pearson Education, 2nd Edition, 2016.*

17MDCE34 - WAREHOUSE AND DISTRIBUTION MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
17MDC44

ASSESSMENT : THEORY

COURSE OUTCOME

- *Apply the concepts and principles used in warehousing and distribution management.*
- *To analyse the various operational activities of warehouse and distribution management.*
- *To analyse and quantify warehouse and distribution system performance*
- *To understand the challenges faced in complex warehousing and distribution operations.*
- *To understand the processes in unitization,shipping and packaging of warehouse.*

Introduction To Warehousing, Issues and Processes : Warehouse rationale and material flow - Need for a warehouse - Types of warehouses - Fluid model of the product flow - Storage decisions - Functions, Systems, Storage and handling equipment's - Material flow and warehouse layout : Pallets and cartons, Fast pick area, Slotting-Case Study **(9)**

Managing Warehouse Efficiency **:** Order picking - Picking by 'Bucket brigade', Pick paths, Cross docking - Measuring warehouse efficiency: Activity profiling and Benchmarking - Warehouse workforce design and development: Safety and Ergonomics-Case Study. **(9)**

Unitization : Container Optimization - Container loading - Dock Management - Labelling and its essentials -Case Study. **(9)**

Shipping and Packagi**i**ng **:** Packaging : Design, Materials and kinds, Preparation for packaging - Packing for transportation - Packing procedures, cost, Marking - Packaging of hazardous goods -Case Study. **(9)**

Distribution Facilities Management : Material handling system design -Material Handling Technologies- Modern warehousing: Automatic identification and communication system, AS / RS - Warehousing around the world-Case Study. **(9)**

Total : 45

REFERENCE BOOKS

1. *Frazelle, "World Class Warehousing & Material Handling", Tata McGraw-Hill, 2008.*
2. *Satish K. Kapoor and Purva Kansa, "Basics of Distribution Management - A Logistical Approach", Prentice Hall, 2003.*
3. *Satish K. Kapoor and PurvaKansal, "Marketing Logistics - A Supply Chain Approach", Pearson Education, 2003.*
4. *Vinod V Sople, "Logistics Management", Pearson Education, 2004.*
5. *Arnold, "Introduction to Materials Management", Pearson Education, 2009.*

MANAGEMENT STREAM - GENERAL MANAGEMENT

Course Code	Course Name
17MDCE41	Business Environment
17MDCE42	Legal Aspects of Business
17MDCE43	Information Technology for Managers
17MDCE44	Direct and Indirect Tax
17MDCE45	Technology and Innovation Management
17MDCE46	Business Process Management

17MDCE41 - BUSINESS ENVIRONMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Differentiate between the needs and wants of a society and can identify how these are satisfied through business activity.*
- *Distinguish between the primary, secondary and tertiary sectors of the economy.*
- *Evaluate the difference between the public and private sectors of an economy and can identify their differing objectives.*
- *Assess the differing objectives of private and public sector businesses.*
- *Assess the various constituents of business environment and their impact in the globalized scenario.*

Business Environment : Meaning, Types of Environment. Environmental Analysis: Stages, Approaches, Techniques. Nature and Scope of Business: Business System, Classification of business, Characteristics of business, classification of industries. Economic Environment: Nature, Structure, Economic Policies, Economic conditions- Case Study **(9)**

Consumerism and Business : Consumer Rights, Exploitation of Consumers, Consumer Protection, UN Guidelines for Consumer Protection, Consumer Protection and consumerism in India, Consumer Protection Act 1986. Corporate Governance: Meaning, Importance, Reasons for the growing demand for CG- Case Study **(9)**

Industrial Policies & Regulations : Industrial Policy, Industrial Licensing. Competition Law: Competition Act 2002. Patents & Trademarks: Patent Protection in India, The Trade Marks Act 1999. Technological Environment: Innovation, Product and Process innovation, Technology and Competitive advantage- Case Study. **(9)**

Societal Environment : Business Ethics, Business and Culture, Cultural Traits, Technological developments and Social change. Social Responsibility of Business: Meaning, Classical and contemporary views, Social Orientations of Business, Factors affecting Social Orientation. Responsibility to different Sections.Social Audit.- Case Study. **(9)**

Globalisation **:** GATT/ WTO/The Uruguay Round, WTO & Developing Countries, WTO and India .MNCs: Definition and Meaning, MNCs & International Trade, MNC's in India. Globalisation of World Economy, Globalisation of Business, Stages of Globalisation, Foreign Market Entry Strategies- Case Study. **(9)**

TOTAL : 45

TEXT BOOK

1. *Francis Cherunilam, "Business Environment: Text & Cases", Himalaya Publishing, Mumbai, 18th Edition, 2014.*

REFERENCE BOOKS

1. *Justin Paul, "Business Environment", Tata McGraw Hill, New Delhi, 2nd Edition, 2006.*
2. *SubbaRao P, "International Business: Text & Cases", Himalaya Publishing, Mumbai, 4th Edition, 2014.*
3. *Aswathappa K, "Essentials of Business Environment", Himalaya Publishing, Mumbai, 4th Edition, 2014.*
4. *Philip R. Cateora, "International Marketing", Irwin McGraw Hill, 9th edition.*

17MDCE42 - LEGAL ASPECTS OF BUSINESS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Create knowledge about the legal perspective of the business*
- *Understand the implications of legal laws in improving business practices*
- *Analyse the situation of business environment and make business decisions*
- *Develop the best tax practices for the business in the legal perspectives*
- *Analyse the various Legal business case problems make decisions.*

COMMERCIAL LAW

The Indian Contract Act 1872: Definition of contract, essentials, elements and types of a contract, Formation of a contract, performance of contracts, breach of contract and its remedies, Quasi contracts - Contract of Agency: Nature of agency, Creation and types of agents, Authority and Liability of Agent and principal; Rights and duties of principal and agents, termination of agency. Case Study **(9)**

The Sale of Goods Act 1930: Nature of sales contract, documents of title, risk of loss, Guarantees and Warranties, performance of sales contracts, conditional sales and rights of an unpaid seller - Negotiable Instruments Act 1881: Nature and requisites of negotiable instruments, Types of negotiable instruments, liability of parties, holder in due course, special rules for cheque and drafts, discharge of negotiable instruments-Case Study. **(9)**

COMPANY LAW

Major principles- Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of directors, winding up of companies, Corporate Governance-Case Study. **(9)**

INDUSTRIAL LAW

An Overview of Factories Act - Payment of Wages Act- Payment of Bonus Act - Industrial Disputes Act-Case Study. **(9)**

Income Tax Act and Sales Tax Act

Corporate Tax Planning, Overview of central sales tax act 1956 - Defiitions, Scope, Incidence of CST and GST, Practical issues of CST and GST, Value Added Tax - Concepts, Scope, Methods of VAT Calculation, Practical Implications of VAT-Case Study. **(9)**

Total : 45

REFERENCE BOOKS

1. *N.D. Kapoor, "Elements of Mercantile Law", Sultan Chand and Company, India, 2006.*
2. *P.K. Goel, "Business Law for Managers", Biztantatara Publishers, India, 2008*
3. *Akhileshwar Pathack, "Legal Aspects of Business", Tata McGraw Hill, 2009*
4. *P.P.S. Gogna, "Mercantile Law", S. Chand & Co Ltd, India, Fourth Edition, 2008.*
5. *Dr. Vinod, K.Singhania, "Direct Taxes Planning and Management", 2008.*
6. *Richard Stim, "Intellectual Property - Copy Rights, Trade Marks and Patents", Cengage Learning, 2008.*

17MDCE43 - INFORMATION TECHNOLOGY FOR MANAGERS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Develop an understanding about the use of business analytics*
- *Understand the application of business analytics in industries like banking, insurance, retail and media & communication*
- *Analyse and make decisions using business analytics in the major industrial domains*
- *Gain knowledge with case studies and the impact of business analytics*
- *Evaluate the use of business analytics in the major industrial domains*

Introduction to Business Analytics for Industries and open standards : Understanding briefly - Banking Industry, Insurance Industry, Retail & CPG Industry and Media & Communication (Telecom) Industry: Briefly understanding Business Analytics applications with respect to banking, insurance: retail & CPG and social media and communication industry: Introduction to Industry Vertical Open Standards: Advantages of Open Industry standards: Healthcare, Retail, Insurance verticals-Case Study. **(9)**

Business Analytics for Banking Industry : Banking Industry Overview: IT Landscape / Business Applications: Key Issues/Pain points: Business Analytics solutions & Use case Scenarios for below Business Areas/Organization Units: Marketing, Product Management, Channel Management, Risk Management, Finance Treasury, Payments. Case Studies. **(9)**

Business Analytics for Insurance Industry : Insurance Industry Overview: IT Landscape / Business Applications: Key Issues/ Pain points: Business Analytics solutions & Use case Scenarios in below are as: Finance, Sales and marketing distribution, Risk, Claims: Case Studies. **(9)**

Business Analytics for Retail & Consumer Products : Retail & CPG Industry Overview; IT Landscape / Business Applications; Key Issues/Pain points; Business Analytics solutions & Use case Scenarios; Case Studies - Merchandising, Operations, Marketing, Store Managers, Brand Managers, Distribution, Finance, HR Case Studies. **(9)**

Business Analyticsfor Media & Communication : Media & Communication (Telecom) Industry Overview; IT Landscape/ Business Applications: Key Issues/Pain points: Business Analytics solutions & Use. Case Scenarios: Finance, Marketing, Product development, Customer care Case Studies. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Sesil, J.C., "Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives, and Improving", Pearson FT Press, 2013.*
2. *PavelRyzhov, "Haskell Financial Data Modeling and Predictive Analytics", Packt Publishing, 2013.*
3. *Chuck Hemann& Ken Burbary, "Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World (Que Biz-Tech)", 2013.*

17MDCE44 - DIRECT AND INDIRECT TAX

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Apply the critical thinking and problem solving skills related to taxation.*
- *Understand and apply the ethical principles and Professional standards in taking decision related to tax.*
- *Describe how the provisions in the corporate tax laws can be used for tax planning.*
- *Evaluate the practical cases of tax planning as an important managerial decision-making process.*
- *Compare the real life situations involving taxation and make tax-sensitive decisions.*

Tax **:** Meaning, Characteristics, Objectives, and Canons of Taxation Effects of Taxation, Direct and Indirect Taxes, Merits and Demerits. **(9)**

Direct Tax **:** Income Tax Act, Principles of Income, Computation of Total Income (Problems), Assess, Assessment year, previous year, Residential Status. **(9)**

Theoretical Concepts related to Salaries - Income from House Property - Capital Gains - Deductions. **(9)**

Indirect Tax: Central Excise Act 1944 - Basic Concepts and Definitions - Customs Act 1962. **(9)**

Service Tax and Value Added Tax (VAT): Service tax - concept, computing methods - Sales tax concept - VAT- Concept, computing methods - GST - Concept, Computing Methods - Filing Procedures of GST. **(9)**

TOTAL : 45

REFERENCE BOOKS

1. *Gaurishankar. V, "Principles of Taxation", Eastern Book Company: New Delhi, 2007*
2. *Gaur and Narang, "Income Tax Law and Practice", Kalyani Publications: New Delhi.*
3. *Balachandran V., "Indirect Taxes", Sultan Chand & Sons: New Delhi.*
4. *P.Radha Krishnan, "Indirect Taxation", Kalyani Publishers: New Delhi.*
5. *Richard A. Musgrave, "The Theory of Public Finance", McGraw Hill Book Company, INC, New York.*
6. *Vinod Singhania, "Income Tax Law and Practice", Taxman's: New Delhi.*
7. *Datey V.S. "Indirect Taxes, Law and Practice", Taxmann Publications: New Delhi*

17MDCE45 - TECHNOLOGY AND INNOVATION MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Develop Conceptual Knowledge and Practical skill regarding technological innovation*
- *Understand how technological innovation diffuse overtime*
- *Analyse the support of the organisation for technology innovation*
- *Integrate external and internal technologies and innovations*
- *Apply the knowledge of Technology and Innovation to real business cases.*

Introduction **:** The Importance of Technological Innovation - The Impact of Technological Innovation and Society - Innovation by Industry-Case Study. **(9)**

Industry Dynamics of Technological Innovation : Sources of Innovation - Types and Patterns of Innovation - Standards Battles and Design Dominance - Timing of entry-Case Study. **(9)**

Formulating Technological Innovation Strategy : Defining the organisations strategic direction - Choosing innovation projects - Collaboration strategies - Protecting Innovation-Case Study. **(9)**

Implementing Technological Innovation Strategy : Organising for Innovation - Managing the New Product Development Process - Managing New Product Development Teams-Crafting a Deployment strategy-Case Study. **(9)**

Technology Based Entrepreneurship - Knowledge Spill over Entrepreneurship - Innovation in Large and Small Firms-Case Study. **(9)**

Total : 45

REFERENCE BOOKS

1. *Melissa Schilling, "Strategic Management of Technological Innovation", Mc.Graw Hill Publications, New York, Fourth Edition, 2012.*
2. *Scott Shane, "Handbook of Technology and Innovation Management", Wiley Publications.*
3. *Chesbrugh, "Open Innovations", Harvard Business School Press, USA, First Edition, 2003.*
4. *Osterwalder and Pigneur, "Business Model Generation", Wiley Hoboken, NI, USA, First Edition, 2010.*

17MDCE46 - BUSINESS PROCESS MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Discover the processes associated with the given business problem*
- *Analyze the business process and identify the issues of the process.*
- *Design the business process by applying the necessary changes.*
- *Develop the IT solution to automate the business process*
- *Infer Business Process Management as a cross-disciplinary field, striking a balance between business management and IT aspects*

INTRODUCTION TO BUSINESS PROCESS MANAGEMENT (BPM)

Business Process Definition - Origin and History of BPM - The BPM Lifecycle **(7)**

PROCESS IDENTIFICATION AND MODELING

Focusing on Key Processes - Designing a Process Architecture - BPMN Initiation - Branching and Merging - Information Artifacts Resources. **(9)**

ADVANCED PROCESS MODELING

Process Decomposition - Process Reuse - Rework and Repetition - Handling Events - Handling Exceptions - Processes and Business Rules. **(10)**

PROCESS DISCOVERY

The Setting of Process Discovery - Discovery Methods - Process Modeling Method - Process Model Quality Assurance. **(9)**

PROCESS ANALYSIS AND REDESIGN

Qualitative Process Analysis : Value-Added Analysis - Root Cause Analysis - Issue Documentation and Impact Assessment. Quantitative Process Analysis : Performance Measures - Flow Analysis - Queues - Simulation. Redesign: Definition and Need - Heuristic Process Redesign - The Case of a Health Care Institution - Product-Based Design. **(10)**

TOTAL : 45

TEXT BOOK

1. *Marlon Dumas, Marcello La Rosa, Jan Mendling and Hajo A. Reijers, "Fundamentals of Business Process Management", Springer-Verlag Publication, 2013.*

REFERENCE BOOK

1. *Forrest W. Breyfogle III, "The Business Process Management Guidebook: An Integrated Enterprise Excellence BPM System", Citius Publishing, 2013.*

17MDCE51 - DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

- *Elucidate the foundations and issues of distributed systems*
- *Understand the various synchronization issues and global state for distributed systems.*
- *Understand the Mutual Exclusion and Deadlock detection algorithms in distributed systems*
- *Describe the agreement protocols and fault tolerance mechanisms in distributed systems.*
- *Describe the Architecture of a Distributed System*

INTRODUCTION

Definition, Goals, Types of Distributed Systems **(4)**

ARCHITECTURES

Architectural Styles, System Architectures - Centralized Architectures, Decentralized Architectures, Hybrid Architectures, Architectures Versus Middleware **(6)**

PROCESS AND COMMUNICATION

Threads, Virtualization, Clients, Servers, Layered Protocols, Types of Communication, Remote Procedure call, Message Oriented Communication, Stream Oriented Communication, Multicast communication. **(10)**

SYNCHRONIZATION : CLOCK SYNCHRONIZATION, LOGICAL CLOCKS, MUTUAL EXCLUSION

Distributed Transactions: Consistency and Replication - Introduction ,Data Centric Consistency Models, Client Centric Consistency Models, Replica Management, consistency Protocols **(8)**

Distributed Computing Paradigm - Paradigm for distributed Applications - Basic Algorithms in Message Passing Systems, Leader Election in Rings, Mutual Exclusion in shared Memory, Fault-Tolerant Systems - Synchronous systems with Crash failures, Synchronous systems with Byzantine failures, Impossibility in Asynchronous Systems **(12)**

EXAMPLES OF DISTRIBUTED SYSTEMS

CORBA, Jini. **(5)**

TOTAL : 45

TEXT BOOKS

1. *Distributed Systems - Principles and Paradigms, Andrew S. Tanenbaum, Maarten van Steen, Prentice Hall of India, 2007 (Para I to Para IV)*
2. *HaggitAttiya and Jennifer welch - Distributed Computing - Fundamentals, Simulation and Advanced Topics, Second Edition, Wiley 2012 (Para V)*
3. *Distributed Object Architectures with CORBA , Henry Balen, Mark Elenko, Jan Jones and Gordon Palumbo, 1st Edition, Kindle Edition*

REFERENCE BOOKS

1. *Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004*
2. *Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.*
3. *Kshemkalyani, Ajay D., and MukeshSinghal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.*
4. *George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.*

17MDCEL1- MINOR PROJECT IN BUSINESS / DATA ANALYTICS

L	T	P	C
0	0	4	2

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *Identify a business problem existing in an organization that needs to be addressed.*
- *Analyse the business environment with respect to the identified problem.*
- *Design an appropriate solution considering economic, technical and implementation feasibility.*
- *Justify the designed solution in terms of its pros and cons.*

ACTIVITIES TO BE CARRIED OUT

1. Identify a business issue in a certain organization
2. Report the detailed study of the problem and its environment
3. Perform Literature Survey
4. Develop a suitable strategy
5. Prepare detailed feasibility study report
6. Present the solution
7. Submit complete report

17MDCEL2- MODELING AND SIMULATION LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES
17MDC81

ASSESSMENT : PRACTICAL

COURSE OUTCOME

- *To simulate Manufacturing systems using R software*
- *To simulate Material Handling systems using R software*
- *To estimate linear and non-linear models to observed data using R software*
- *To apply simulation techniques to real world problems using R software*

TOPICS:

1. Modeling and simulating a Queuing system
2. Modeling and simulating an Inventory system
3. Simulation of a Poisson process.
4. Comparison of Transient and steady state solutions of a Queuing model
5. Generation of random numbers and testing them.
6. Generation of discrete random variates
7. Generation of continuous random variates.
8. Simulation of Manufacturing systems.
9. Simulation of Material Handling systems.
10. Sensitivity analysis of simulation outputs.

TEXT BOOKS

1. *Simulation Model Design and Execution : Building Digital Worlds ,Fishwick, P.A. New Jersey: Prentice Hall Int'l Inc.(1995)*

REFERENCE BOOKS

1. *John M Chambers, "Software for Data Analysis:Programming with R", Springer, 2008*
2. *NarsinghDeo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004,ISBN : 0-87692-028-8.*
3. *G.James,D.Witten, T.Hastie and R.Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2015.*

19MAM11 - TECHNICAL ENGLISH

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Apply the rules of Grammar and Construct right sentences.*

CO2 *: Categorize the Barriers to communication and formulate solutions.*

CO3 *: Interpret the Technical Graphical representation and compose passages.*

CO4 *: Listen and specify appropriate responses for conversations and monologues.*

CO5 *: Comprehend presentation Strategies and speak confidently.*

FOCUS ON LANGUAGE: GRAMMAR & VOCABULARY

Changing Words from one form to another - Word Formation: Prefixes & Suffixes - Synonyms and Antonyms - Idioms - Phrasal Verbs - Nouns-Compound Nouns & Noun Phrases - Gerunds & Infinitives - Subject-verb Agreement- Tenses - Adjectives - Expressions of Quantity - Degrees of Comparison - Relative Clause - Modal Verbs - Wh Questions - Sequence Words. **(6)**

TECHNICAL COMMUNICATION

Importance of Technical Communication- General and Technical Communication -Objective & Characteristics of Technical Communication - Process of Communication - Levels of Communication - Flow of Communication -Visual Aids in Technical Communication - Barriers to Communication: Noise - Classification of Barriers -Non-verbal Communication: Kinesics - Proxemics- Chronemics- Correlating Verbal and Non-verbal Communication- Cultural Variations. **(4)**

READING

Reading & Interpreting Ideas - Interpreting Graphics in Technical Writing - Intensive & Extensive Reading- Reading Comprehension - Techniques for Good Comprehension - Skimming & Scanning - Sequencing of Sentences- Reading text on different topics. **(4)**

WRITING

Techniques for Good Writing - Right Words and Phrases - Sentences: Sentence Patterns- Salient Point of Sentence Construction - Paragraph Construction - Paragraph Patterns - Kinds of Paragraph - Writing a First Draft, Revising & Finalizing - Steps to Effective Précis Writing - Process Description - Dialogue Writing - Essays. **(6)**

LISTENING

Meaning and Art of Listening-Importance of Listening & Empathy in Communication - Reasons for Poor Listening - Traits of a good listener - Listening modes - Short Dialogues and Conversation- Listening to monologues. **(4)**

SPEAKING

Introducing oneself - Exchanging personal information - Asking for and giving information - Expressing likes and dislikes - Making requests - Agreeing and Refusing Requests - Complaining, apologizing - Giving excuses, instructions and suggestions- Describing positive and negative features, favourite snacks, vacation plans, technology, holidays, festivals, customs and special events - - Making comparisons - Talking about food - giving step by step instructions, travel advice - Achieving Confidence, Clarity & Fluency

- Vocal Cues - Barriers to Speaking - Types of Speaking - Persuasive Speaking - Public Speaking - Effective Presentation Strategies - Planning - Outlining & Structuring - Nuances of Delivery - Controlling Nervousness & Stage Fright - Visual Aids in Presentation - Applications of MS Power Point. **(6)**

Practical sessions based on the above syllabus

TOTAL : 30

TEXT BOOKS

1. *Jack C Richerds, 'Interchange - 2', CUP, Fourth Edition, Chennai, 2015.*
2. *Meenakshi Raman, Sangeeta Sharma, 'Technical Communication - Principles and Practice', Oxford University Press, New Delhi, 2015.*

EXTENSIVE READING

1. *Abhijit Acharjee & Rakesh Ramamoorthy, 'Frontiers of Communication - An Anthology of Short Stories and Prose', CUP, 2018. (Only Essay Questions)*

REFERENCES

1. *Sudharshana N. P. and Savitha C, 'English for Technical Communication', CUP, 2016.*
2. *Sudharshana N. P. and Savitha C, 'English for Engineers', CUP, 2018*
3. *Ronald Carter, Michael Mc Carthy, 'Cambridge Grammar of English', Cambridge University Press, 2011.*
4. *Michael Mc Carthy and Felicity O'Dell, 'English Vocabulary in Use', Cambridge University Press, 2012.*
5. *Mark Ibbotson, 'Cambridge English for Engineering', Cambridge University Press, 2012.*

19MAM12 - APPLIED ALGEBRA

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Gain knowledge in sequences and series to analyse and study their area of applications*

CO2 *: Become familiar in linear algebra concepts for data analysis in economics*

CO3 *: Identify and understand linear algebra techniques which are applied in AI and ML*

CO4 *: To incorporate the concepts of numerical solutions of linear systems which are widely used in Computer Applications.*

CO5 *: Apply difference equation concepts in data modelling.*

SEQUENCES AND SERIES

Arithmetic, geometric, and harmonic sequences-Finite and infinite series. Convergence and divergence of infinite series-Simple examples-nth term test for divergence and p-series convergence. Applications of series in financial mathematics: Simple and Compound Interest-Nominal and Effective Interest Rates-Continuous Compounding -Future Value and Present Value-Annuities-Ordinary Annuity: Future and Present Value, Annuity Payment, Principal Sum, Period and Interest Rate, Annuity Due, Deferred Annuity and Perpetuity. **(11)**

VECTOR SPACES

Definition of vector spaces-linearly dependent and independent-subspaces-basis and dimension-of vector space-rank and nullity of linear transformation. Inner product, properties- Cauchy Schwarz-inequality, norm and its properties, introduction of orthogonal basis and Gram-Schmidt orthogonalization process. **(11)**

MATRIX ALGEBRA

Eigen Values and Eigen Vectors: Eigenvalues and eigenvectors-Cayley-Hamilton theorem (without proof)-Diagonalization-Quadratic form reduction in three variables-applications.

Matrix factorization techniques-special matrices-permutation matrix (non-negative elements)-Hessenberg matrix-sparse matrix-sparse matrix-band width-Linear system of equations-Gauss elimination-Gauss Jordan-Inverse of a matrix-Gauss-seidal-iteration method. Application of Linear systems: A homogeneous system in economics- non homogenous system by inversion-Applications of Matrices in Input-Output Analysis in Economics. **(12)**

DIFFERENCE EQUATIONS

Finite differences-operators and their interrelations-Solutions of finite difference equations with constant coefficients-Solution of first order equation (Iterative Method)-General method of solving first order difference equation-simple applications in economics. **(11)**

TOTAL : 45

TEXT BOOKS

1. *Srimanta pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press India, 1st Edition, 2015. (Para I, Para IV).*
2. *Biswa Nath Datta, "Numerical Methods for Linear Control Systems Design and Analysis", Elsevier Academic press, 2004. (Para III).*
3. *David. C. Lay, "Linear Algebra and its Applications", Addision Wesley, 2003. (Para II).*

4. *Curtis F Gerald and Patrick O Wheatly, "Applied Numerical Analysis", Pearson Education, 2002. (Para V).*
5. *Mehta B.C, and G.M.K. Madani, "Mathematics for Economists", Sultan Chand & Sons, New Delhi, 2006. (Para III)*

REFERENCES

1. *Erwin Kreyszig, "Advanced Engineering Mathematics", Eight Edition, John Wiley & Sons Asia Private Limited, 2008.*
2. *Grewal, B.S., "Higher Engineering Mathematics", Fourth Edition, Khanna Publishers, 2007.*
3. *Piskunov, 'Differential and Integral Calculus", MIR Publisher Moscow, 1974.*
4. *Wylie C. R. & Barret L. C "Advanced Engineering Mathematics" Sixth Edition, McGraw Hill, New York, 1995.*

19MAM13 - FUNDAMENTAL STATISTICAL METHODS

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: To describe and discuss the key terminologies, concepts, statistical tools and techniques used in statistical analysis.*

CO2 *: To calculate and apply measures of central tendency and measures of dispersion for grouped and ungrouped data.*

CO3 *: To analyze probability and probability distributions and moments of random variables.*

CO4 *: To understand basic concepts in sampling.*

CO5 *: To analyze bivariate data using correlation and simple regression.*

INTRODUCTION TO STATISTICS

Definition -Data -Qualitative and Quantitative - Measurement of Data -Nominal and Ordinal - Raw data and grouped data - Primary and Secondary Data - Methods of Collection -Classification of Data - Tabulation -Frequency Distribution and Various Diagrammatic and Graphical Representations of Data. **(8)**

SUMMARY STATISTICS

Measures of Central Tendency: Arithmetic Mean, median, mode, geometric mean and harmonic mean - Merits and demerits- Relationship between mean, median and mode-Relationship AM, GM and HM, computation of the measures for grouped and ungrouped data-Weighted arithmetic mean

Measures of Dispersion: Range, Mean Deviation and Standard Deviation - Coefficient of Variation and its Use- Quartiles and inter quartile range-Quintiles deciles and percentiles- Moving averages -Skewness and Kurtosis and their uses. **(10)**

PROBABILITY

Deterministic and Random Experiments -Definition of Sample Space and Events- Classical and Axiomatic Definitions- Properties of Probability- Addition Theorem- Conditional Probability and Multiplication Theorem of Probability- Definition of Independent Events - Random Variables and their Probability Distributions-Discrete and Continuous Random Variables Probability Mass Function and Cumulative Distribution Functions -Definition - Mathematical Expectation-Mean and Variance - Mean and Variances of Linear Combination of Random Variables - Chebyshev's Theorem - Important Discrete Distributions-Discrete Uniform Distribution, Binomial, Poisson-Continuous Distributions: Probability Density Functions and Cumulative Probability Distributions-Normal Distribution and its Properties and Applications. **(12)**

SAMPLING

Population and Sample- Sampling and its need -Sampling vs. Complete Enumeration -Parameter and Statistics-Probability Sampling and - Random Sampling- Simple Random Sampling, Lottery Method and Random Number Table Method- Stratified Random Sampling- Sampling distribution and standard error of a statistic. **(8)**

CORRELATION AND REGRESSION

Definition of correlation - Scatter plot -Karl Pearson's correlation coefficient its properties- Definition of Regression - Simple Regression-Regression of x on y and y on x. **(7)**

TOTAL : 45

TEXT BOOK

1. *S.C. Gupta, 'Fundamentals of Statistics', 7th and Enlarged Edition, Himalaya Publishing House, 2014.*

REFERENCES

1. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye , 'Probability and Statistics for Engineers and Scientists', Seventh Edition, Pearson Education, Inc., 2002.*
2. *D M Levine T C Krehbiel and M L Berensen, 'Business Statistics: A First Course', Pearson Education, 2003.*

19MAM14 - DATA STRUCTURES

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the basics programming constructs of C language and write C programs to solve problems.*

CO2 *: Recognize the representation of arrays, stacks, queues and linked list in memory and demonstrate its use in algorithms.*

CO3 *: Solve computational problems using data structures such as arrays, stacks, queues and singly linked list.*

CO4 *: Compare and use appropriate data structures in programming real world applications.*

CO5 *: Learn and apply basic searching and sorting techniques in applications.*

INTRODUCTION TO C

Overview of C - Basic data types - Identifier Names - Variables and Initialization - Constants - Operators - Expressions - Input/ Output. **Control Statements:** Selection statements - Iteration statements - Branch statements - Expression statements. **Functions:** General form of a function - Accessing a function - Scope of a function - Passing Arguments to function - function prototype - Call by value - Call by reference - Recursion. **Arrays :** Single Dimensional arrays - Multi Dimensional arrays - Passing arrays to a function - Arrays and Strings. **Pointers :** Definition - Pointer type declaration - Pointer assignment - Pointer initialization - Pointer variables - Pointer operators - **Structures :** Defining and Accessing Structures. **(12)**

BASIC CONCEPTS

Algorithm Specification - Data Abstraction - Primitive Data Structures - Iterative and Recursive algorithms - Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notation. **(6)**

ARRAYS

Array as an Abstract Data Type (ADT) - Implementation of One-Dimensional Array, Two Dimensional Arrays - Sparse Matrices- Applications- Representation of Multidimensional Arrays -String ADT. **(8)**

STACKS AND QUEUES

Stack Primitive Operations- Array Representation and Implementation-Applications: Subroutine Handling, Recursion and Expression Processing. Queue Operations-Sequential Implementation - Circular Queues - Dequeues-Applications. **(8)**

LINKED LISTS

Singly linked lists- Operations- Applications **(4)**

SEARCHING AND SORTING

Linear Search and Binary Search-Selection Sort-Insertion Sort and Bubble Sort. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Ellis Horowitz, Sartaj Sahni, Anderson-Freed, 'Fundamentals of Data Structures in C', University Press, Second Edition, 2008.*
2. *Yashavanth Kanetkar, 'Let Us C', BPB Publications, Fifteenth Edition, 2002. (Para I)*

REFERENCES

1. *Byron Gottfried, 'Schaum's Outline of Programming with C', McGraw-Hill, Fourth Edition, 2018*
2. *Mark Allen Weiss, 'Data Structures and Algorithm Analysis in C', Pearson Edition, 2014.*
3. *Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J.Augenstein, 'Data structures using C & C++', Prentice Hall, 2012.*
4. *Krishnamoorthy R, 'Data Structures using C', Mc Graw-Hill Education Pvt. Ltd, 2010.*

19MAM15 - THEORY OF PROGRAMMING LANGUAGES

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Identify the paradigms of programming languages and apply the concepts of imperative programming in program development*

CO2 *: Analyze various components of object-oriented programming and apply them to real-world applications.*

CO3 *: Understand the concepts of functional, programming and relate them to apply in various programming languages.*

CO4 *: Understand the concept of logical programming and implement them using PROLOG.*

CO5 *: Comprehend Assembly level language programming and gaining knowledge in writing assembly language programs.*

PROGRAM CONSTRUCTS AND THEIR TYPES

Introduction to program constructs: Program units and Program types. **(4)**

IMPERATIVE PROGRAMMING

Programming Paradigms- Statements: Structured Programming- Syntax-Directed Control Flow. Design Considerations: Syntax. Special Cases in Loops. Invariants. Partial Correctness. Control flow. Types: Data Representation-Role of Types- Basic Types Arrays-Records-Sets-Pointers- String Tables-Types and Error Checking-Procedure Activations-Activation Records- Parameter-Passing Methods-Scope Rules for Names-Nested Scopes in Source Text-Lexical Scope. **(8)**

OBJECT-ORIENTED PROGRAMMING

Groupings of Data and Operations-Constructs for Program Structuring-Information Hiding- Design with Modules-Modules and Defined Types-Class Declarations-Dynamic Allocation. Templates: Parameterized Types-Object-Oriented Programming-Object-Oriented Thinking- Inheritance-Derived Classes and Information Hiding-Objects in Smalltalk. **(8)**

FUNCTIONAL PROGRAMMING

Elements of Functional Programming. Types: Values-Operations-Function Declarations. Approaches to Expression Evaluation-Lexical Scope-Type Checking- Functional Programming in a Typed Language-Exploring a List-Functions as First-Class Values-Functional Programming with Lists- Structure of Lists- List Manipulation. **(10)**

LOGICAL PROGRAMMING

Connectives - Conditional and Bi-conditional statements -Statement formulae and Truth tables -Tautologies and Tautological Implications -Normal forms -Disjunctive and Conjunctive Normal Forms - The Theory of Inference for the Statement Calculus - Consistency of Premises - The Predicate Calculus - Variables and Quantifiers - Special variable formulae involving Quantifiers-Theory of Inference for the Predicate Calculus. **(6)**

Computing with Relations. Prolog: Data Structures-Programming Techniques-Control. **(3)**

ASSEMBLY LANGUAGE PROGRAMMING

Introduction to 8085 Instructions: Data Transfer Operations-Arithmetic Operations-Logic Operations-Branch Operations-Writing Assembly Language Programs. **(6)**

TOTAL : 45

TEXT BOOKS

1. *Ravi Sethi, 'Programming languages: Concepts and Constructs', Second Edition, Addison Wesley 1995. (Para II-VI: Chapters 1, 3 to 11).*
2. *E.V. Krishnamoorthy, 'Introduction to Theory of Computation', East West Press, 1983. (Para I).*
3. *Ramesh Gaonkar, 'Microprocessor Architecture, Programming and Applications with the 8085', 2002, Sixth Edition, PENRAM International Publishing Pvt. Ltd. (Para VII)*

REFERENCES

1. *Ellis Horowitz, 'Fundamentals of Programming Languages', Springer-Verlag, 1983.*
2. *Terrence W Pratt, Marvin Zelkowitz, 'Programming Languages Design and Implementation', Pearson Education, Fourth Edition, 2003.*

19MAM16 - ALGEBRA AND STATISTICS LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Solve problems in linear algebra using Scilab / R scripts and commands*

CO2 *: Compute measures of central tendency and dispersion using Spreadsheets in built functions*

CO3 *: Graphically represent statistical data using Spreadsheet tools*

CO4 *: Analyze Bi-variate data using Spreadsheet's Data Analysis Tools*

CO5 *: Develop skills in writing script files and analyze data using R and Spreadsheet's Data Analysis Pack*

CONCEPTS TO BE COVERED

1. Scilab/R Fundamentals
2. Algebraic operations on matrices, Transpose of a matrix, Determinants, inverse of a matrix,
3. Solving System of linear equations and consistency,
4. Row reduced echelon form and normal form.
5. Eigen values, Eigen vectors, Rank of a matrix.
6. Solving algebraic and system of equations.
7. Estimating numerical values for given data by means of interpolation.
8. Perform data manipulation using spreadsheet.
9. Perform graphical and diagrammatic representation of statistical data, like bar diagram, pie, histogram and line diagram
10. Construct the pivotal tables and apply statistical functions to calculate the descriptive statistics
11. Practice the theory behind the descriptive statistics, like measures of central tendency, dispersion, skewness and kurtosis
12. Apply and implement the theory of probability in various applications
13. Simple probability and random sampling
14. Practicing the simple correlation and regression techniques.

Software/Tools : Scilab or R & Spreadsheet

TOTAL : 60

REFERENCES

1. *K.N.Berk and P.Carey, Data Analysis with Microsoft Excel, Brooks/Cole, USA,2010*
2. *Gilberto E.Urroz, Matrices and Linear Algebra with SCILAB, http://www.tf.uns.ac.rs/~omorr/radovan_omorjan_003_prII/s_examples/Scilab/Gilberto/scilab5a.pdf*
3. *Graeme Chandler and Stephen Roberts, Scilab Tutorials for Computational Science, http://paginapessoal.utfpr.edu.br/previero/calculo-numerico-ma64a-em41-e-em42/informacoes-da-disciplina/Scilab_Tutorials.pdf*

19MAM17 - DATA STRUCTURES LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Solve the given problem by devising an algorithm and implementing it into a program.*

CO2 *: Develop reusable and efficient solutions using functions, pointers and structures.*

CO3 *: Write programs to perform operations on strings using library functions.*

CO4 *: Implement stacks, queues and singly linked list using Arrays*

CO5 *: Write programs to implement linear search, binary search and sorting algorithms like selection, insertion and bubble sort.*

CONCEPTS TO BE COVERED

Basic Programming

1. Programs to understand the concepts of data types.
2. Writing algorithms and converting them to programs to get familiarity on using conditional, control and Iterative statements.
3. Programs on recursion
4. Programs on string manipulations
5. Programs on one- and two-dimensional arrays
6. Declaring and defining functions, passing arguments, calling functions
7. Programs using pointers-variables and expressions
8. Creating and accessing structures

Data Structures

1. Sparse and dense matrix operations using arrays.
2. Stack implementation and operations using arrays.
3. Queue implementation and operations using arrays.
4. Singly linked list implementation and operations using arrays
5. Programs on linear search and binary search
6. Programs on selection sort, insertion sort and bubble sort

TOTAL : 60

REFERENCES

1. *Yashavanth Kanetkar, 'Let Us C', BPB Publications, Fifteenth Edition, 2002.*
2. *Richard F. Gilberg and Behrouz A. Forouzan, 'Data Structures- APseudocode Approach with C', Cengage Learning, Second Edition, 2005.*
3. *Deitel H. M. and Deitel P. J., 'C - How to Program', Prentice-Hall, Fifth Edition, 2006.*

19MAM18 - PYTHON PROGRAMMING LAB

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: To write, test, and debug simple Python programs.*

CO2 *: To implement Python programs using conditional, control and repetition statements.*

CO3 *: Use functions and recursive functions for structuring Python programs.*

CO4 *: Represent compound data using lists, tuples, dictionaries.*

CO5 *: Read and write data from or to files in Python and use of libraries.*

CONCEPTS TO BE COVERED

1. Naming conventions, basic operators, data types
2. Use of conditional, control and repetition statements
3. String operations and using string functions
4. Demonstrate use of Lists and Tuples
5. Demonstrate use of Dictionaries
6. Implement simple search and sort techniques
7. Demonstrate usage of basic regular expression
8. Demonstrate use of advanced regular expressions for data validation.
9. Implement linear data structures - arrays, stack and queue
10. Read and write into a file.
11. Create Comma Separate Files (CSV), Load CSV files into internal Data Structure
12. Demonstrate Exceptions in Python
13. Use of Python Libraries such as numpy, pandas, matplotlib, etc.

TOTAL : 75

19FYEL11 - EMPLOYABILITY SKILLS

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Demonstrate, command over conversations using appropriate functional expressions.*

CO2 *: Generate Ideas and speak confidently for speaking tasks.*

CO3 *: Solve objective questions on Logical Reasoning and Verbal ability.*

CO4 *: Comprehend the text correctly and perform the speaking activity.*

CO5 *: Listen to monologues, conversations and produce appropriate responses.*

INTRODUCTION TO SPOKEN ENGLISH

Self-Introduction - Barriers to Speaking and Listening - Introduction to Spoken English, Greetings, Thanking - Apologizing, Congratulating - Giving Directions, Shopping - Role Play. **(6)**

VOCABULARY

Activity based on newspaper articles - Word Building - A picture and a few words activity - Current Events. **(4)**

VERBAL APTITUDE

Alphabet test - Alphabet Order, Alphabet Series - Letter Word Problem, Word Formation and Scramble - Series Completion -Para Jumbles- Synonyms and Antonyms- Types and Exercises- Sentence Completion -Types and Exercises. **(8)**

READING

Reading Comprehension- Skimming and Scanning - Reading Prose - Bacon's Essays (Speaking Activity based on the essays) - Story Building- Extempore - Movie Reviews. **(4)**

LSRW SKILLS

Speech Sounds - Word Vocabulary - Reading Comprehension - Listening Practice- I -Dialogue Writing - Conversational Exercise - I - Focus on Language - Creative Writing - Conversational Exercise - II - Listening Practice - II. **(8)**

TOTAL : 30

19MAMLE01 - PROFESSIONAL ENGLISH

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Apply the rules of Grammar and write grammatically correct sentences.*

CO2 *: Acquire Telephonic skills and Negotiation skills.*

CO3 *: Perceive the text, make notes and summaraize.*

CO4 *: Compose Business Letters and prepare a Job Application Letter with Resume.*

CO5 *: Identify the Barriers to Listening and produce correct responses for Listening tasks.*

CO6 *: Acquire Interview skills and Group Discussion skills.*

FOCUS ON LANGUAGE : ENGLISH GRAMMAR & VOCABULARY

One Word Substitutes - Homophones - Homonyms - Eponyms - Direct Indirect Speech - Active Passive Voice - Conditional Sentences - Adverbs - Conjunctions - Prepositions - Articles - Relative Clause - Pronouns - Cause and Effect Expressions - Purpose and Function - Modals. **(6)**

BUSINESS ENGLISH

Telephoning Skills: Understanding Telephone communication - Telephonic Conversations and Etiquettes - Handling Calls - Leaving a Message - Making Requests -Asking for and Giving Information - Giving Instructions - Negotiations: Types of Negotiation -Six Basic Steps of Negotiations - Informal and formal Negotiations. **(4)**

READING

Summarizing - SQ3R Reading Technique - Note Making: Outline/Linear Method- Sentence Method - Schematic/Mapping Method - Understanding Discourse Coherence - Cloze Comprehension - Critical Reading: Creative and Critical Thinking- Reading proverbs, online advice forum. **(4)**

WRITING

Letter Writing - Business Letters - Cover Letters - Resumes - Memos - Emails - Reports - Technical Proposals - Instructions & Recommendations - Technical Description - Checklist - Writing a paragraph - Writing a description of a person's past present and future, recent experiences, movie review, list of roles - Writing a job application letter, Advice column list - Writing a guide book introduction - Writing about people response to a survey. **(6)**

LISTENING

Stress and Intonation -Types of Listening - Barriers of Effective Listening - Listening for Generic Content and Specific Information - Listening & Note Taking - Intensive Listening - Listening to Descriptions - Listening to predicaments, call in radio show and excuses. **(4)**

SPEAKING

Group Communication: Forms of Group Communication - Using Body Language in Group - Discussions - Group Discussions - Organizational GD - GD as a Part of Selection Process - Meetings - Conferences - Symposia & Seminars - Interviews: Objectives of Interviews - Types of Interviews - Job Interviews -Media Interviews - Press Conference - Describing abilities and Skills, acceptable and prohibited behaviour in different situations, Personality Traits, Countries, a predicament, Recent past

events and experiences, movies and books - Giving Advice and suggestions- Making polite requests - Making invitations and excuses- Speculating about past and future events. **(6)**

Practical sessions based on theory

TOTAL : 30

TEXT BOOKS

1. *Jack C Richerds, 'Interchange - 2', Fourth Edition, Cambridge University Press, 2015.*
2. *Meenakshi Raman, Sangeeta Sharma, 'Technical Communication - Principles and Practice', Oxford University Press, 2015.*

REFERENCES

1. *Sudharshana N. P and Savitha C, 'English for Technical Communication', CUP, 2016.*
2. *Sudharshana N. P and Savitha C, 'English for Engineers', CUP, 2018.*
3. *Ronald Carter and Michael Mc Carthy, 'Cambridge Grammar of English', Cambridge University Press, 2011.*
4. *Michael Mc Carthy and Felicity O'Dell, 'English Vocabulary in Use, Cambridge University Press, 2012.*
5. *Mark Ibbotson, 'Cambridge English for Engineering', Cambridge University Press, 2012.*

19FY22F - BASIC FRENCH

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the basics of the Language*

CO2 *: Write simple narration and description and speak to communicate idea.*

CO3 *: Demonstrate confidence in Social Interactions.*

INTRODUCTION **(2)**

UNITÉ-1

Faire connaissance - inviter et répondre à une invitation - décrire les personnes- articles définis et indéfinis - genre etnombre des noms et des adjectifs- interrogation et négation - conjugaison du présent. Paris monuments et lieux publics - la vie de quatre parisiens de professions différentes. **(7)**

UNITÉ-2

Exprimer l' ordre et l'obligation demander et commander - evaluer et apprécier- féliciter et remercier - articles partitifs -adjectifs démonstratifs et possessifs prépositions et adverbes de quantité et de l'imperatif verbes pronominaux - une région deFrance la Bourgogne - vie quotidienne à la compagne. **(6)**

UNITÉ-3

Raconter et rapporter - donner son avis - se plaindre et réprimander - expliquer et justifier - pronoms compléments -futur proche - passé composé et imparfait. Plusieurs régions de France - différents univers sociaux. **(7)**

UNITÉ-4

Demander l'autorisation - interdire - formuler des projects - discuter et débattre. Pronoms < en > et < y > - pronoms relatifs et superlatifs - conjugaison du futur - présent continu et passé récent.La vie administrative et régionale - problems economiques et écologiques - traditions et modernit. **(8)**

Practical sessions based on theory **(15)**

TOTAL : 45

TEXT BOOK

1. *Le Nouveau Sans Frontières - Philippe Dominique, Jacky Girardet Michèle Verdelhan, Michel Verdelhan*

REFERENCES

1. *Dondo Modern French Course - Mathurin Dondo.*
2. *Modern French Grammar - Margaret Lang and Isabelle Perez.*

19FY22G - BASIC GERMAN

[redacted]

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the fundamental concepts of the Language*

CO2 *: Write simple narration and description and speak to communicate idea.*

CO3 *: Demonstrate confidence in Social Interactions.*

EINFUHRUNG

BegrU ung - Name - Vorname - Familienname - Anrede **(5)**

THEMA

Hallo ! Wie geht's?

Begegnungen

Guten Tag, ich suche...,

Im Supermarkt

Arbeit und Freizeit

Familie und Haushalt **(7)**

GRAMMATIK-I

Position des Verbs : Aussage, W - Frage und

Ja/Nein - Frage; Artikel die der das.

W - Frage; Konjugation in Prasens;

Nominativ : bestimmter, unbestimmter und negative Artikel

Akkusativ : unbestimmterundnegativer Artikel

Adjektive : Akkusativ-Erganzung **(10)**

GRAMMATIK-II

Artikel als Pronomen Dative - Erganzung : Personalpronomen und Ortsangaben; Imperativ Modalverben; Ortsangaben; Richtungsangaben; Zeitangaben; Ordinalzahlen Possessiv - Artikel; trennbare und nicht trennbareVerben; Wechselprapositionen **(8)**

Practical sessions based on theory **(15)**

TOTAL : 45

TEXT BOOK

1. *Studio d A1: Kurs - und Ubungsbuch (Deutsch alsFremdsprache) CornelsenVerlag.*

REFERENCE

1. *Tangarmaktuell1 : Kursbuch + Arbeitsbuch (Deutsch alsFremdsprache) Max HueberVerlag*

19MAM21 - APPLIED CALCULUS

PRE-REQUISITES

19MAM12

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Become familiar in calculus tools to solve problems in optimization*

CO2 *: Understand the concepts of integral calculus with a view towards applications.*

CO3 *: Apply differential equations modeling.*

CO4 *: Gain knowledge in Fourier series to analyze and study pattern recognition.*

CO5 *: Get in-depth knowledge in numerical methods which are widely used in computer applications.*

DIFFERENTIAL CALCULUS

Rate of change and limits-rules for finding limits-extensions of the limit concept-continuity-tangent lines-the derivative of function--related rates of change-extreme values of functions-the mean value theorem-first derivative test for local extreme values. **(7)**

APPLICATIONS OF DIFFERENTIAL CALCULUS

Curvature-Evolutes-Envelopes-partial differentiation-Jacobians-Functions of several variables--Hessian Matrix-Expansions and extreme values- Constrained extrema using Lagrange's multiplier method. **(8)**

INTEGRAL CALCULUS

Integration-definition and geometrical meaning-double integrals as volumes-changing the order of integration, triple integrals in rectangular coordinates-applications to areas and volumes--compound interest. Special Functions: Beta and Gamma Functions-Double and triple integrals - Applications: Area - Volume. **(7)**

FOURIER SERIES

Dirichlet's conditions-Full range series-Half range series-Complex form of series-Parseval's identity -Harmonic analysis. **(8)**

ORDINARY DIFFERENTIAL EQUATIONS

Formation of differential equations-geometrical interpretation of ODE- Higher order differential equations with constant coefficients-Euler Cauchy Type-Applications in microeconomics. **(7)**

NUMERICAL METHODS

Solution of Algebraic and transcendental Equations-Bisection Method and Newton Raphson Method--Real World Applications of Newton Raphson Method: Finding the Break Even Point of a Firm and finding the interest rates of Annuities -Interpolations-Newton's and Lagrange's method. Numerical solution of system of Equations. Numerical Integration-Numerical solution of ordinary differential equation of First order - RK method of order four-Milne Thomson method. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Thomas & Finney, 'Calculus', Pearson Education, Ninth Edition, 2006. (Para I,II, & III).*
2. *Srimanta Pal and Subodh C. Bhunia, 'Engineering Mathematics', Oxford University Press India, First Edition, 2015. (Para IV, Para V).*
3. *Mehta B.C, and G.M.K. Madani, 'Mathematics for Economists', Sultan Chand & Sons, 2006. (Para II, Para III, Para V)*
4. *Kandasamy P.et.al., 'Numerical Methods', First Revised Edition, Tata McGraw Hill Publishing Company Ltd., 2008. (Para VI)*

REFERENCES

1. *Erwin Kreyszig, 'Advanced Engineering Mathematics', Eighth Edition, John Wiley & Sons Asia Private Limited., 2008.*
2. *Grewal, B.S., 'Higher Engineering Mathematics', Fourth Edition, Khanna Publishers, 2007.*
3. *Piskunov, 'Differential and Integral Calculus, MIR Publishers, Moscow 1974.*
4. *Wylie C.R. & Barret L.C, 'Advanced Engineering Mathematics', Sixth Edition, Mc Graw Hill, New York, 1995.*
5. *Steven C. Chapra and Raymond P. Canale, 'Numerical Methods for Engineers', Sixth Edition, McGraw Hill, 2002.*

19MAM22 - PROBABILITY DISTRIBUTIONS AND APPLICATIONS

[redacted]

PRE-REQUISITES

19MAM13

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: To understand the properties and applications of advanced probability distribution.*

CO2 *: To determine the moments and moment generating functions of important probability distributions and to impart knowledge on the functions of random variables.*

CO3 *: To provide a good knowledge on the various methods of estimation of parameters.*

CO4 *: To apply various tests of statistical hypothesis on a given statistical data.*

CO5 *: Demonstrate the use and applications of Bayesian Analysis*

PROBABILITY DISTRIBUTIONS

Discrete Random Variables : Geometric, negative binomial distributions and hyper geometric distributions. Continuous Probability Distributions : Uniform, Exponential, Gamma, Beta, Chi-square Log Normal and Weibull distributions and their properties. **(8)**

FUNCTIONS OF RANDOM VARIABLES

Moments and Moment Generating functions of important distributions-Transformations of Variables and finding their distributions -method of direct transformation and method of moment generating functions - Joint and Marginal Probability mass functions (for discrete) and density functions(for continuous) - Conditional probability distributions-conditional mean and variance-Independence of random variables. **(10)**

ESTIMATION

Estimation of parameters using method of moments- Maximum Likelihood Point Estimation(MLE) -Properties of estimators-Unbiasedness, minimum variance consistency, efficiency and sufficiency-Mean Square Error-Asymptotic properties-consistency-Fisher Information and Cramer-Rao's Inequality - Interval Estimation. **(8)**

SAMPLING AND TESTS OF HYPOTHESIS

Derivation of sampling distribution of mean and S^2- t-distribution and F-distribution-Central limit theorems- Test of significance - Basic concepts - null hypothesis - alternative hypothesis - level of significance - Standard error and its importance - steps in testing-One and two tailed tests-The use of p-values for Decision making - Large sample tests and Small sample tests for : Single sample: Testing on a single mean with variance known and variance unknown-Two samples-tests on means -One sample test on a single proportion-two sample tests of two proportions-Goodness of Fit tests, One and two sample tests concerning variances-Tests of independence for categorical data, tests for homogeneity. **(12)**

BAYES THEOREM AND BAYESIAN STATISTICS

Partition of a sample space and Bayes Theorem (with proof)-Simple applications -Bayesian Concepts-Subjective Probability-Conditional Perspective-Bayesian Inferences-Prior and posterior distributions- Point Estimation Using the Posterior Distribution-Bayesian Interval Estimation-Bayes Estimates using Decision Theory framework: Bayes estimate under squared error loss function and absolute error loss function. **(7)**

TOTAL : 45

TEXT BOOKS

1. *S.C. Gupta, 'Fundamentals of Statistics', Seventh and Enlarged Edition, Himalaya Publishing House, 2014. (Para I-IV).*
2. *Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, 'Probability and Statistics for Engineers and Scientists', Seventh Edition, Pearson Education, Inc., 2002. (Para V).*

REFERENCES

1. *S.C.Gupta and V.K.Kapoor, 'Fundamentals of Mathematical Statistics', Tenth Revised Edition, Sultan Chand & Sons, 2002.*
2. *Meyer, Paul L., 'Introductory Probability and Statistical Applications', Addison Wesley, Second Edition, 1970.*
3. *Anthony O'Hagan and Bryan R. Luce, 'A Primer on Bayesian Statistics in Health Economics and Outcomes Research', MEDTAP International, Inc., 2003.*
4. *Michael Baron, 'Probability and Statistics for Computer Scientists', CRC Press, 2014.*
5. *Gianluca Bontempi, 'Handbook Statistical Foundations of Machine Learning', 2017.*

19MAM23 - COMPUTER SYSTEM ARCHITECTURE

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Understand the basic structure and operation of digital computer*

CO2 *: Perform arithmetic operation on the various number systems and conversions among them*

CO3 *: Apply Boolean algebra to solve logic functions.*

CO4 *: Understand the basics of pipelining and I/O interfaces.*

CO5 *: Evaluate the performance of memory systems.*

CO6 *: Understand parallel processing architectures and GPUs.*

BASIC COMPUTER SYSTEM

Introduction-Technologies for Building Processors and Memory - Performance - Instructions: Language of the Computer-Operations, Operands - Instruction Representation. **(4)**

NUMBER SYSTEMS AND CODES

Decimal, Binary, Octal and Hexadecimal Systems - Number base conversions-BCD (8421) code - Gray code and conversion-ASCII code - Error detecting and correcting codes: parity bit, block parity, Hamming code. **(7)**

BINARY ADDITION AND SUBTRACTION

1's, 2's, 9's, 10's, 15's, 16's Complement representation - 1's and 2's Complement subtraction - unsigned and signed numbers - BCD addition - 9's and 10's BCD subtraction - Binary Multiplication and Division. **(8)**

BOOLEAN ALGEBRA AND LOGIC GATES

Laws of Boolean algebra - Basic theorem and properties - Boolean expression and function - Canonical and Standard forms - Minimization of Boolean expression - Karnaugh Map and Quine Mc-Cluskey Method- Basic logic gates and truth tables - universal gates implementation. **(8)**

PROCESSOR AND CONTROL UNIT

Building a Data path - Control Implementation Scheme - Pipelining - Handling Data Hazards & Control Hazards - Exceptions. **(6)**

MEMORY & I/O SYSTEMS

Memory Hierarchy - Memory Technologies - Cache Memory - Measuring and Improving Cache Performance - Virtual Memory: Page Faults, Translation Lookaside Buffer. **(5)**

PARALLELISIM

Parallel Processing Challenges - Flynn's classification: SISD, MIMD, SIMD, SPMD, and Vector Architectures - Multi-Core Processors and other Shared Memory Multiprocessors - CUDA Basics-GPU versus CPU-Overview of GPU Architecture-GPU as a Co-processor. **(7)**

TOTAL : 45

TEXT BOOKS

1. *David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014. (Para I,V,VI).*
2. *A.P.Godse and Dr. D.A. Godse, 'Digital Electronics', Technical Publications, Pune, 2008. (Para II, III, IV).*
3. *William Stallings, Computer Organization and Architecture - Designing for Performance, Tenth Edition, Pearson India Education Services Pvt. Ltd., 2017. (Para VII)*

REFERENCES

1. *Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, 'Computer Organization and Embedded Systems', Sixth Edition, Tata McGraw Hill, 2012.*
2. *John P. Hayes, 'Computer Architecture and Organization', Third Edition, Tata McGraw Hill, 2012.*

19MAM24 - ADVANCED DATA STRUCTURES

[redacted]

PRE-REQUISITES

19MAM14

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Implement the linked representation and traversal operations on singly and doubly linked list.*

CO2 *: Gain knowledge on non-linear data structures such as trees and graphs and use them in programming applications.*

CO3 *: Solve problems using data structures such as AVL search trees, heaps and m-way search trees.*

CO4 *: Apply appropriate sorting techniques for solving real-time problems.*

CO5 *: Understand the working principle of hashing and collision resolution techniques*

LINKED LISTS

Doubly Linked List-Circular Linked List-Traversals-Applications: Addition of Polynomials, Sparse matrix Representation-Linked Stacks-Linked Queues. **(4)**

TREES AND BINARY SEARCH TREES

Representation of Trees-Binary Trees: Representation, Operations, Traversals, -Threaded Binary Trees. Binary Search Trees: Searching, Insertion and Deletion of elements, Analysis-Forests. **(6)**

GRAPHS

Graphs - Introduction - Isomorphism - Sub graphs - Walks, Paths, Circuits- Euler Graphs -Hamiltonian Paths and Circuits. Elementary Graph Operations: Depth First Search, Breadth First Search, Connected Components, Spanning Trees. Minimum Cost Spanning Trees: Kruskal's Algorithm-Prim's Algorithm-Shortest Paths Algorithms: Single Source, Bellman Ford algorithm, All Pairs Shortest Paths. **(8)**

HEAPS AND FORESTS

Priority Queues-Max Heap-Transforming a Forest into Binary Tree-Forest Traversals. **(5)**

ADVANCED BINARY SEARCH TREES

AVL Trees: Balancing Trees- Searching, Insertion and Deletion of Elements-AVL Rotations, Analysis. Splay Trees: Notations, Analysis. **(7)**

MULTIWAY TREES

M- Way Search Trees - B Trees - Red Black Trees - B+ Trees. **(5)**

SORTING

Shell Sort-Quick Sort-Merge Sort-Heap Sort-Radix Sort-Time Complexity Analysis. **(6)**

HASHING

Static Hashing: Hash Tables, Hash Functions-Dynamic Hashing-Collision Resolution: Open addressing - Linear Probing and Quadratic Probing. **(4)**

TOTAL : 45

TEXT BOOK

1. *Ellis Horowitz, Sartaj Sahni, Anderson-Freed, 'Fundamentals of Data Structures in C', University Press, Second Edition, 2008.*

REFERENCES

1. *Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivert, Clifford Stein, 'Introduction to Algorithms', Second Edition, Prentice Hall of India, Publications, New Delhi, 2007.*
2. *Mark Allen Weiss, 'Data Structures and Algorithm Analysis in C++', Addison Wesley, 2014.*
3. *Anany Levitin, 'Introduction: The Design & Analysis of Algorithm', Pearson Education Inc., 2003.*
4. *S.K.Basu, 'Design Method & Analysis of Algorithm', PHI, 2005.*

19MAM25 - CALCULUS AND PROBABILITY LAB

[redacted]

PRE-REQUISITES

19MAM21,19MAM22

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 *: Solve differential equations of first and second order using R commands*

CO2 *: Understand properties of probability distributions using R programming and MS-Excel Tools*

CO3 *: Calculate definite integrals numerically using Trapezoidal and Simpson's methods*

CO4 *: To perform statistical hypothesis testing using R programming.*

CO5 *: To analyze the data using Bayesian data analysis technique with the aid of R programming.*

CONCEPTS TO BE COVERED

1. Extreme Value of functions-finding local extrema
2. Numerical differentiation based on Newton's formula, Lagrange's formula.
3. Functions of several variables--Hessian matrix-Expansions and extreme values- Constrained extrema using Lagrange's multiplier method-applications
4. Numerical integration-Trapezoidal and Simpson's 1/3 rules.
5. Solution of Ordinary Differential Equations,
6. Discrete and Continuous probability distributions
7. Joint Probability Distributions
8. Estimation of population parameters
9. Statistical Hypothesis testing- Large Sample tests
10. Statistical Hypothesis testing - Small Sample tests
11. Bayesian Data Analysis

Software / Tools used : R Studio

TOTAL : 60

19MAM26 - PROGRAMMING PARADIGM LAB

[redacted]

PRE-REQUISITES

Consent of the Instructor

COURSE OUTCOMES

CO1 *: Understand the usage of different programming constructs of procedural programming*

CO2 *: Apply the principles of object oriented programming to solve problems*

CO3 *: Implement the concepts of logic programming and solve real world problems.*

CO4 *: Develop solutions for problems using the concepts of functional programming paradigm.*

CO5 *: Given a problem, develop solutions for it by applying all the four programming paradigms and compare it.*

CONCEPTS TO BE COVERED

1. Illustrate concepts of :

- Structured programming,
- Data and control abstractions,
- Programming with assertions (Programing with invariants)

2. Illustrate ideas of

- Typing, expressions,
- Pure functions,
- Recursion,
- Higher order functions,
- Encapsulation,
- Inheritance

Using

- Applicative programming and Python
- Object oriented programming paradigm

Softwares : C, Python, Java, PROLOG

TOTAL : 60

19MAM27 - ADVANCED DATA STRUCTURES LAB

[redacted]

PRE-REQUISITES

19MAM14

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Implement linked representation of linked list and its operations.*

CO2 *: Implement and compare the complexities of various sorting algorithms including bubble sort, heap sort and quick sort.*

CO3 *: Ability to define and apply tree data structures and binary search trees for real time applications.*

CO4 *: Perform operations on graphs and heaps for real time problems.*

CO5 *: Implement shortest path algorithms and hashing techniques for a given application.*

CONCEPTS TO BE COVERED

1. Linked Lists Implementation -Singly linked lists, Doubly linked lists and Circular linked lists.
2. Programs on linked stacks.
3. Programs on linked queues.
4. Sorting algorithms, Quick sort, Heap sort and Radix sort.
5. Implementation of tree data structure and traversals
6. Applications of Binary search trees and its operations
7. Operations on AVL tree
8. B-Tree and its operations
9. Problems related to graphs and graph traversals
10. Construction of heap & its operation
11. Construction of minimum spanning tree algorithm.
12. Implementation of shortest path algorithms
13. Implementation of hashing techniques.

Softwares : Linux GCC, Putty, C

TOTAL : 60

19FYEL21 - ENGLISH FOR EMPLOYABILITY

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *: Formulate ideas and speak confidently on any topic.*

CO2 *: Use appropriate functional language to communicate effectively.*

CO3 *: Identify the errors in English and write correctly.*

CO4 *: Interpret the text appropriately and speak fluently on the given text.*

CO5 *: Acqiure professional communication skills.*

SPEAKING SKILLS

Ice Breakers - Just a Minute - Book Reviews - Describing an object - Extempore - Paraphrasing. **(6)**

FUNCTIONAL ENGLISH

Spoken English - Travel and Transport, Complaining - Giving Instructions, Advising and Sympathizing - Requesting and warning people. **(5)**

VERBAL APTITUDE

Logical Sequence of Words- Exercises - Sequential Order of Things - Comparison Type Questions - Introduction and Exercises - Idioms and Phrases - Types and Exercises - Vocabulary through Mythology - One-word Substitutes, Word Power Exercises - Common Errors in English - Sentence Correction. **(7)**

VOCABULARY IN CONTEXT

Activity based on newspaper articles - Vocabulary - Homophones and Homonyms - Reading Prose - Reading Comprehension Activity. **(4)**

GROUP DISCUSSION AND INTERVIEW SKILLS

Professional Communication - Mock Group Discussion - Mock Interview - Telephoning Skills - Personality Development Activities. **(8)**

TOTAL : 30

19MCEE18 - PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

CATEGORY : Professional Elective

COURSE OUTCOMES

On completion of the course the students will be able to:

CO1 *: Explain the need of prefabricated systems and materials.*

CO2 *: Apprehend the design principles and the technologies used in fabrication.*

CO3 *: Describe the prefabricated components.*

CO4 *: Analysis and design of various members and the connections for the joints of Prefabricated Structures.*

CO5 *: Apprehend production process, handling and installation of elements.*

INTRODUCTION

Prefabrication- Need of prefabrication - Comparison with monolithic construction - Advantages and Disadvantages - Methods of prefabrication - site and plant prefabrication -Types of precast systems, Precast concrete - Materials- Cement, SCM, Aggregate, Water, chemical Admixtures, Pigments, reinforcement, Prestressing Tendons, Concrete and properties, Grout and mortars.**(9)**

DESIGN PRINCIPLES

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Tolerance. safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls. **(9)**

PREFABRICATED COMPONENTS

Beams-Columns- Roof units -types of roof slabs and insulation requirements, - Floor units- Types of floor slabs, one way and two way prefabricated slabs - Staircase slab - Wall panels- Types of wall panels, Curtain, Partition and load bearing walls, Eccentricity and stability of wall panels, sandwich wall panels. Prefabricated structures - Long wall and cross wall large panel buildings, framed buildings with partial and curtain walls- footings. **(9)**

ANALYSIS, DESIGN AND JOINTS IN STRUCTURAL MEMBERS

Loads-Load combination, - load transfer between different components, vertical loads - Analysis of precast frames - Ultimate strength calculations in shear and flexure. Connection in precast building - Description of joints, their behaviour and reinforcement requirements, Leak prevention, joint sealants - Floor to Beam Connections, Beam to Column Connections, Column to column Connections, Column to foundation connections. **(9)**

PRODUCTION TECHNOLOGY, HANDLING AND ERECTION

Choice and planning of production setup - Manufacturing methods - Production process-Moulds - Acceleration of concrete hardening, Curing, Storage of precast elements, Handling Equipments and Handling Devices, transportation, erection, Equipments for hoisting and erection - Vacuum lifting pads - Installation of precast elements - Column, Wall, Beam and Slab. **(9)**

TOTAL : 45

TEXT BOOKS

1. *L. Mokk, "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.*
2. *K.M. Elliott, "Precast concrete structures", Butterworth Heinmann, 2002.*

19MCEOE02 - ENERGY EFFICIENT BUILDINGS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

At the end of the course the student will be able to:

***CO1** : Perform energy audits in any type of building and suggest the conservation measures.*

***CO2** : Identify energy efficient landscape and building envelopes*

***CO3** : Understand natural heating and cooling system for efficient buildings CO4:Acquire knowledge about heat transmission and estimation of building loads CO5: Integrate the renewable energy systems in the buildings*

INTRODUCTION

Conventional versus Energy Efficient buildings - Historical perspective - Water - Energy - IAQ- requirement analysis - Future building design aspects - Criticality of resources and needs of modern living. **(9)**

LANDSCAPE AND BUILDING ENVELOPES

Energy efficient Landscape design - Micro-climates - various methods - Shading, water bodies- Building envelope: Building materials, Envelope heat loss and heat gain and its evaluation, paints, Insulation, Design methods and tools. **(9)**

HEATING, VENTILATION AND AIR-CONDITIONING

Natural Ventilation, Passive cooling and heating - Application of wind, water and earth for cooling, evaporative cooling, radiant cooling - Hybrid Methods - Energy Conservation measures, Thermal Storage integration in buildings. **(9)**

HEAT TRANSMISSION IN BUILDINGS

Surface co-efficient : air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; Heat transfer due to ventilation/infiltration, internal heat transfer; Sol-air temperature; Decrement factor; Phase lag. Design of day lighting; Estimation of building loads: Steady state method, network method, numerical method, correlations; Computer packages for carrying out thermal design of buildings and predicting performance. **(9)**

PASSIVE COOLING & RENEWABLE ENERGY IN BUILDINGS

Passive cooling concepts : Evaporative cooling, radiative cooling; Application of wind, water and earth for cooling; Shading, paints and cavity walls for cooling; Roof radiation traps; Earth air tunnel. Introduction of renewable sources in buildings, solar water heating, small wind turbines, stand-alone PV systems, Hybrid system - Economics. **(9)**

Total : 45

TEXT BOOKS

1. *Krieder J. and Rabi A., "Heating and Cooling of buildings: Design for Efficiency", Mc Graw Hill,1994.*
2. *Ursala Eicker, "Solar Technologies for buildings", Wiley publications, 2003.*

REFERENCES

1. *Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)*

19MCM16 - DATA ANALYSIS LABORATORY FOR CONSTRUCTION MANAGEMENT

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : The student will be able to interpret the data using various statistical analysis methods with charts and graphs using spreadsheets.

CO2 : The student will be able to formulate Simulation models for project risk analysis.

CO3 : The student will be able to design simple information systems.

LIST OF EXERCISES

1. Descriptive Statistics: Types of data, frequency distribution, Applications (Charts, Graphs etc.)
2. Tests to find frequency and percentage of levels of dataset.
3. Inferential analysis - t- test for single mean, t -test for independent samples, ANOVA.
4. Simple regression and multiple regression.
5. Design of a simple equipment information system for a construction project.
6. Simulation models for project risk analysis.

19MCM24 - PROJECT PLANNING LABORATORY FOR CONSTRUCTION MANAGEMENT

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : The students will able to prepare Bid for a construction projects using spread sheets programs.

CO2 : The students will able to structure the project and schedule the project, allocate the resources and optimize the project plan.

CO3 : The student will be able to track, update and control a construction project and report its performance.

LIST OF EXERCISES

TENDER, CONTRACTS & SPECIFICATION PREPARATION

Quantity takeoff, Preparation and delivery of the bid or proposal of an engineering construction project.

STRUCTURING PROJECTS

Optimize the project plan, understand data structures, Overview about EPS and OBS, Calendars, Creating a Project, Creating a work breakdown structure, Adding activities, creating relationships, scheduling, Adding constraints, Maintaining the project documents library, Formatting scheduled data.

RESOURCE MANAGEMENT

Codes for Activities and Resources, Roles, Resources, Assigning Resources and costs, Base lining the project plan.

PROJECT EXECUTION AND CONTROL

Update Progress date, Record the actual effort involved, Monitor the project, Reporting performance, user defined fields, project expenses, duration type, percent complete type, earned value analysis.

ELECTIVE SYLLABUS

19MCME01 - ADVANCED CONSTRUCTION MATERIALS AND EQUIPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

- *To understand the properties of construction materials and its application in Civil Engineering.*
- *To provide a knowledge on production and construction equipments.*

COURSE OUTCOMES

CO1 : The students are expected to apply new special concretes in the construction field.

CO2 : The students will be able to handle the smart materials and metals efficiently.

CO3 : The students will gain information regarding green materials, structural applications of FRP and geotextiles.

CO4 : The student will be able to be familiar with the operation of various earthwork equipments and materials handling equipments.

***CO5** : The student will be able to explore the working of production and construction equipments.*

SPECIAL CONCRETE

Behaviour of concrete- high strength and high performance concrete-SIMCON, SIFCON- lightweight concrete - Ferrocement - Self compacting concrete - Geo polymer concrete - Nano concrete - Self healing concrete - self-cleaning concrete -Bacterial concrete. **(9)**

METALS AND SMART MATERIALS

Types of steel and its properties -grades- New alloy steel and its application -Types of coating and coating to reinforcement- properties and advantages of aluminium- applications - Types of smart materials and its applications. **(9)**

COMPOSITES AND GREEN MATERIALS

Types of plastics - properties - Types of fibres - Fibre Reinforced Polymers (FRP) -Structural applications of FRP - Geo-textiles and applications- Green building concepts and materials - LEED. **(9)**

EQUIPMENT FOR EARTHWORK AND MATERIALS HANDLING

Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end loaders, Earth Movers -Forklifts and related equipment - Portable Material Bins - Conveyors. **(9)**

PRODUCTION AND OTHER CONSTRUCTION EQUIPMENTS

Crushers - Feeders - Screening Equipment- Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment - Transporters - Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Pile Driving Equipment. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Gambhir, M. L. and Neha Jamwal, "Building Materials - Products, Properties and Systems", Tata McGraw Hill Education Pvt. Ltd. New Delhi, 2011.*
2. *Siddique, R "Special Concretes" Galgotia Publications, New Delhi, 1st Edition 2000.*
3. *Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2006.*

19MCME02 - QUALITY MANAGEMENT FOR CONSTRUCTION PROJECTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

To study the concepts of total quality management and International standards.

COURSE OUTCOMES

CO1 : The students will able to understand the concepts of quality Assurance and quality control.

CO2 : The students will able to understand the methods and techniques in quality standards.

CO3 : The students will able to understand the International standards used in quality management in construction Industry.

INTRODUCTION

Quality: Necessity for improving Quality in the context of Global Challenges - Concept of Quality Control, Quality Assurance, Quality Management and Total Quality Management (TQM). **(9)**

QUALITY STANDARDS, METHODS & TECHNIQUES

Study of various Quality Standards in Construction Related to building materials and other inputs for construction processes, methods and techniques for construction outputs, products and services. **(9)**

QUALITY MANAGEMENT

Managing Quality in various projects stages from concept to completion by building quality into design of structures, Inspection of incoming material and machinery, in process quality inspections and tests. **(9)**

QUALITY CONTROL & ASSURANCE

Designing of quality manuals, checklists and inspection reports, installing the quality assurance System, monitoring and control - Quality Assurance Department and quality control responsibilities of the line organization. Quality in foundations and piling work, structural work, concreting, electrical system building facilities, waste recycling and maintenance. **(9)**

INTERNATIONAL STANDARDS

Developing quality culture in the organization - Training of people, Bench - marking quality. Quality circles - Study of ISO 9000, ISO 14000 and QS 9000 standards and certification procedures - BIS, BS, Indian standards, British, American, German & Japanese standards. **(9)**

TOTAL: 45

REFERENCES

1. *Quality Planning and Analysis - J M Juran and Frank Gryna, Tata McGraw Hill Book Co. Ltd., Delhi, 2014, 6th Edition.*
2. *Managerial Breakthrough - J M Juran, Tata McGraw Hill Book Co. Ltd., Delhi, 1995, 3rd Edition.*
3. *Total Quality Control - A V Fiegenbaum, Tata McGraw Hill Book Co. Ltd., Delhi, 2004, 4th Edition.*
4. *The Six Sigma Way - Peter Pande and others, Tata McGraw Hill Book Co. Ltd., Delhi, 2014.*
5. *Quality is Free - Phil Crosby, Tata McGraw Hill Book Co. Ltd., Delhi, 2001, 4th Edition.*

19MCME06 - CONSTRUCTION RISK MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- *To develop the understanding of strategic and operational risk in construction industry.*

COURSE OUTCOMES

CO1 : The students will be able to discover various risk management principles and to implement risk management program in construction projects.

CO2 : TheStudents will be able to identify, analyze and mitigate project risk in construction industry.

RISK CONCEPTS

Definitions of risk - Importance and types of risk - Elements of risk management - Causes of risk - Principles of risk management - Risk management process - Risk identification and assessment - Aspects of risk management - Risk management plan and evaluation - Risk treatment - Role of Human Resource Management in risk Management **(9)**

PLANNING FOR RISK

Components of risk management - Planning for risk management - Project charter - Risk management policies - roles and responsibilities - examining stakeholder tolerance - risk management plan template - revisiting the work breakdown structure - risk management plan - risk registers - creating the risk management plan - risk analysis - tracking **(9)**

RISK IDENTIFICATION

Identifying risk - preparing for risk identification - risk categories - referring to historical information - identifying the project risks - reviewing project documents - brainstorming - the Delphi technique - analyzing SWOT - diagrammatic techniques **(9)**

RISK RESPONSE

Preparing for risk response - creating risk response - result of risk response planning - risk monitoring and control - risk communication - informing public about risk and responding to express concerns - education **(9)**

RISK MANGEMENT ASPECTS

Risk planning and management case studies - engineering contracts, project delivery -strategies and international project risk - management of risk in construction industry - dealing with uncertainties - risk mitigation - by elimination, reducing, transferring, avoiding, absorbing or pooling. **(9)**

TOTAL: 45

REFERENCES

1. *Joseph Phillips, McGraw - Hill, PMP Project Management Professional Study Guide*
2. *Bruce Barkley, Project risk management (Project Management)*
3. *John R Schuyler, Risk and decision analysis in projects (Cases in project and program management series)*
4. *Chris Chapman and Stephen Ward, Project risk management: Process, Techniques and Insights*

19MCME12 - LEAN CONSTRUCTION CONCEPTS, TOOLS AND PRACTICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- *To study and understand the basics of lean construction, principles, tools and techniques, especially how they are applied in the construction industry.*

COURSE OUTCOMES

CO1 : The students will be able to identify the salient aspects of the contemporary management techniques and address the problems with present management techniques.

CO2 : The students will be able to apply core concepts of lean and its principles in construction industry.

CO3 : The students will be able to use various lean construction tools and techniques to achieve better productivity in construction projects.

CO4 : The students will be able to implement lean concepts in design to achieve sustainability in construction projects.

INTRODUCTION

Introduction and overview of the construction project management -Review of Project Management & Productivity Measurement Systems - Productivity in Construction- Daily Progress Report-The state of the industry with respect to its management practices -construction project phases - Essential features of contemporary construction management techniques - The problems with current construction management techniques- Current production planning. **(9)**

LEAN MANAGEMENT

Introduction to lean management - Toyota's management principle-Evolution of lean in construction industry - Production theories in construction -Lean construction value - Value in construction - Target value design - Lean project delivery system- Forms of waste in construction industry - Waste Elimination. **(9)**

CORE CONCEPTS IN LEAN

Concepts in lean thinking - Principles of lean construction - Variability and its impact - Traditional construction vs lean construction - Traditional project delivery - Lean construction and workflow reliability - Work structuring - Production control. **(9)**

LEAN CONSTRUCTION TOOLS AND TECHNIQUES

Value Stream Mapping - Work sampling - Last planner system - Flow and pull based production - Last Planner System - Look ahead schedule - Constraint analysis - Weekly planning meeting- Daily Huddles - Root cause analysis - Continuous improvement - Just in time. **(9)**

LEAN CONSTRUCTION IMPLEMENTATION

Lean construction implementation- Enabling lean through information technology - Lean in design - Design Structure Matrix - Location Based Management System-BIM (Building Information Modeling) - IPD (Integrated Project Delivery) - Sustainability through lean construction approach.. **(9)**

TOTAL : 45

REFERENCES

1. *Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.*
2. *Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.*
3. *Dave, B., Koskela, L., Kiviniemi, A., Owen, R., and Tzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.*
4. *Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.*
5. *Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.*

19MCMOE01- LANDSCAPE AND ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Present architectural designs associated with spaces, mass, visual and emotional effects and design components.

CO2 : Familiarize students with various elements landscape architecture and the principle of landscape design.

CO3 : Provide an overview of ecological balance and impacts of human activities and stress the need for environmental protection and landscape consideration.

CO4 : Develop and strengthen the competency in dealing with the analytic, artistic and technical aspects of designing open spaces at different scales.

OVERVIEW OF ARCHITECTURE

Definition of architecture - Introduction to architecture - Elements of architecture - - Need and fulfillment - Architecture design - An analysis - Integration of aesthetic and function - Mass and space, visual and emotional effects of geometric forms and their derivatives - Space - Form - Composition - Dimension - Proportion, scale, Balance, Rhythm, Symmetry, Hierarchy, Pattern and axis with building examples - Concept development. **(9)**

ELEMENTS IN LANDSCAPE DESIGN

Ecology, ecological balance - Hard and soft landscape elements; Plant materials - Classification, Characteristics, use and application in landscape design; Water and landform. **(9)**

GARDEN DESIGN

Landscape and garden design in history - Japanese, Italian Renaissance and Moghul gardens in India, Study of notable examples, spatial development in landscape design. **(9)**

SITE PLANNING

Organization of spaces - Circulation, built form and open spaces, site planning and micro climate, site planning of neighborhood parks, children's play area and campus development. **(9)**

LANDSCAPING OF FUNCTIONAL AREAS

Urban open spaces and principles of urban landscape; Street landscaping; Landscape design for waterfront areas and functional areas in urban centers; Green roofs and walls. **(9)**

Total : 45

TEXT BOOKS

1. *Michael Laurie, "An Introduction to Landscape Architecture", Elsevier, 1986*
2. *Geoffrey and Susan Jellico, "The Landscape of man", Thames and Hudson, 1987*
3. *Ven Meiss, "Elements of Architecture", Van Nostrand Publications, London 1986*

REFERENCES

1. *Ching, Francis D. K. Architecture--form, Space, & Order. Hoboken, NJ: John Wiley & Sons, 2007. Print.*
2. *TSS for Landscape Architecture, Mc Graw Hill Inc., 1995*
3. *Grant W Reid, Form concept, form in landscape design, Van Nostrand Reinhold Company, 1993*

19MMA E12 – PRODUCT DESIGN AND DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- To create the abilities to create a new product.
- Competence with a set of tools and methods for product design and development.

COURSE OUTCOME

On Completion of the course, the students will be able to:

1. Identify and analyze the product design and development processes in manufacturing industry.
2. Apply product specification through a methodical approach to the management of product development to satisfy customer needs.
3. Build product architecture and conceptualize industrial design for the product.
4. Be familiar with the design protection and Intellectual property.

INTRODUCTION:

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development.Identifying opportunities, evaluate and prioritize projects, allocation of resources. (9)

IDENTIFYING CUSTOMER NEEDS&PRODUCT SPECIFICATIONS AND CONCEPT SELECTION

Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs.Establish target specifications, setting final specifications. Activities of concept generation, clarifying problem, search both internally and externally, explore the output. Overview, concept screening and concept scoring, methods of selection. (9)

INDUSTRIAL DESIGN& CONCEPT TESTING:

Assessing need for industrial design, industrial design process, management, assessing quality of industrial design. Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response. (9)

THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ):

Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model based technology for generating innovative ideas. (9)

INTELLECTUAL PROPERTY AND DESIGN FOR ENVIRONMENT:

Elements and outline, patenting procedures, claim procedure. Design for Environment: Impact, regulations from government, ISO system. (9)

19MMA E14 – ADVANCED MANUFACTURING PLANNING AND CONTROL

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- To understand the various components and functions of production product planning, process planning, production scheduling and plant control.

COURSE OUTCOME

On Completion of the course, the students should be able to :

1. Describe (identify/write) the various components that make up the manufacturing planning and control system for effective plant configurations.
2. Show how (i) the material requirement plans, manufacturing resource plans, and capacity requirement plans can be developed, and (ii) lot sizing decisions can be made for a manufacturing system.
3. Describe the issues concerning Just-in-Time (JIT) manufacturing and its benefits.
4. Develop the algorithm that are appropriate for solving single machine, two machine and flow shop scheduling problems.

INTRODUCTION TO MANUFACTURING SYSTEMS ENGINEERING:

Process Planning, Logical design of process planning, Computer Aided Process Planning (CAPP), Computerization of file management; Variant (Retrieval), Generative and semi generative approaches, General remarks on CAPP developments and trends. (9)

RESOURCE PLANNING & PRODUCTION CONTROL:

Overview of production control, Forecasting, Master production schedule, Materials requirements planning, Evolution from MRP to MRP II, Evaluation of MRP approach, Order release, Shop floor control. (9)

JUST IN TIME (JST) PRODUCTION:

Introduction- The spread of JIT movement, Some definitions of JIT, Core Japanese practices of JIT, Profit through cost reduction, Elimination of over production, Quality control, Quality assurance, Respect for humanity, Flexible work force, JIT production adapting to changing production quantities, Process layout for shortened lead times, Standardization of operation, automation. (9)

JOB SEQUENCING AND OPERATIONS SCHEDULING:

Introduction- Job sequencing-n jobs, One machine-n jobs, Two machine-n jobs, Three machines-n jobs- two jobs, M machines –n jobs, M machines-sequencing jobs on parallel machines, Minimization of setup costs. (9)

19MMA E22 – ADVANCED BIOMATERIALS

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OBJECTIVE

- To develop knowledge, understanding and practical experience of synthetic used in different biomedical applications, together with a qualitative understanding of the mechanical behavior of a variety of tissues.

COURSE OUTCOME

On Completion of the course, the students should be able to:

1. Demonstrate the relationship between the structure of materials and their behavior as a basisfor material selection in biomedical applications
2. Examine biocompatibility on the relationship between natural tissue structure, function andmechanical behavior.
3. Perform mechanical testing for the determination of the mechanical behavior of differentbiomedical materials.

FUNDAMENTALS OF BIOMATERIALS AND BIOCOMPATIBILITY

Overview - Introduction - definition and their Implications – Types of Biomaterials and their applicationsfor the human body - Biocompatibility - Host response - Cell - Material interactions - Experimental Evaluation of Biocompatibility - In vitro and In vivo tests - steps for characterizations of biomaterials - Broad view of fundamentals. (9)

MATERIALS FOR ORTHOPEDIC APPLICATIONS

Overview - Introduction - Structure and properties of Hard tissues - Processing and properties of Bioceramics and Bioceramic composites - Calcium Phosphate based biomaterials - Hydroxyapatite - Ceramic composites - Glass ceramics based biomaterials - Mica based glass ceramics - other bioglass ceramics - Bio inert ceramics - Polymeric biomaterials - Polymer composites - HDPE - Hap - Al_2O_3 Hybrid Composites - Metal and Alloys in Biomedical Applications - Issues Limiting performance of metallic biomaterials - Wear of Implants - Corrosion of metallic Implants - Ti based Alloys - Co - Cr - Mo, Ni or Ta- Based Alloys - other non-ferrous metals and their alloys - Coating on metals. (9)

TITANIUM DENTAL IMPLANTS SYSTEMS

Overview - introduction - requirements for successful implants systems - Biological compatibility - Mechanical compatibility - Morphological compatibility - Osseo integration and Bone / Implant interface -Integrated Implant system (9)

19MMA E24 – SMART MATERIALS AND SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- *To gain fundamental knowledge on different types of smart materials and systems and to understand the applications of smart materials in various domains.*

COURSE OUTCOME

On Completion of the course, the students should be able to :

1. Demonstrate and analyze the various types of smart materials and systems.
2. Evaluate the characteristics of smart material with different domains.
3. Analyze and select a piezoelectric composite material according to the requirement.

INTRODUCTION AND HISTORICAL PERSPECTIVE

Classes of materials and their usage - Intelligent /Smart materials - Evaluation of materials Science - Structural material - Functional materials - Polyfunctional materials - Generation of smart materials - Diverse areas of intelligent materials - Primitive functions of intelligent materials - Intelligent inherent in materials - Examples of intelligent materials, structural materials, Electrical materials, biocompatible materials etc. - Intelligent biological materials - Biomimetics - Wolff's law - Technological applications of intelligent materials. **(11)**

SMART MATERIALS AND STRUCTURAL SYSTEMS

The principal ingredients of smart materials - Thermal materials - Sensing technologies - Micro sensors - Intelligent systems - Hybrid smart materials - An algorithm for synthesizing a smart material - Passive sensory smart structures- Reactive actuator based smart structures - Active sensing and reactive smart structures - Smart skins - Aero elastic tailoring of airfoils - Synthesis of future smart systems. (**9)**

ELECTRO-RHEOLOGICAL (FLUIDS) SMART MATERIALS

Suspensions and electro-rheological fluids - Bingham-body model - Newtonian viscosity and non-Newtonian viscosity - Principal characteristics of electro rheological fluids - The electrorheological phenomenon - Charge migration mechanism for the dispersed phase - Electrorheological fluid domain - Electrorheological fluid actuators - Electro-rheological fluid design parameter - Applications of Electrorheolgoical fluids. **(8)**

19MMA E27 – DESIGN OF EXPERIMENTS AND TAGUCHI METHODS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- *To provide details about the various techniques involved in Design of Experiments.*
- *To gain knowledge to solve complex engineering problems*
- *To acquire the essential knowledge on Multi-level experiments and Multi-response optimization.*

COURSE OUTCOME

On Completion of the course, the students should be able to :

1. Select the appropriate experimental techniques for solving the complex problems.
2. Demonstrate the acquired knowledge to solve real time problems, involving several parameters.
3. Apply the Taguchi Quality philosophy, Taguchi's Loss Function, and to assess the loss impact of process centering and variation reduction efforts.

EXPERIMENTAL DESIGN FUNDAMENTALS

Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model (9)

SINGLE FACTOR EXPERIMENTS

Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests. **(9)**

MULTIFACTOR EXPERIMENTS

Two and three factor full factorial experiments, Randomized block factorial design, Experiments with random factors, rules for expected mean squares, approximate F- tests. 2K factorial Experiments. **(9)**

SPECIAL EXPERIMENTAL DESIGNS

Blocking and confounding in 2k designs. Two level Fractional factorial design, nested designs, Split plot design, Response surface methods. **(9)**

TAGUCHI METHODS

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, Multi-level experiments, Multi-response optimization. (9)

19MMA E30 – DESIGN AND ANALYSIS OF EXPERIMENTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- To provide a thorough background into basic of design and analysis.

COURSE OUTCOME

On completion of this course the student will be able to,

1. Demonstrate different types of experimental designs and analysis of data.
2. Design experiments, carry them out and analyze the data obtained from the experiment.
3. Identify the problem, design and conduct experiments and optimize the solutions obtained

INTRODUCTION

Basic principles, guidelines for designing experiments, Basic statistical concepts, inferences about the differences in mean, randomized, paired comparison designs, Analysis of variance. **(9)**

RANDOMIZED BLOCKS, LATIN SQUARES AND RELATED DESIGNS

Completely randomized, randomized, Latin square, Graceo-Latin square and crossover designs. (**9)**

FACTORIAL DESIGN

Advantage of factorials, description, calculation of direct and interaction effects. 2k factorial designs. Blocking and confounding - principles and use of confounded designs. **(9)**

FRACTIONAL FACTORIAL DESIGN

Two- three- and mixed-level fractional factorial designs-applications. **(9)**

RESPONSE SURFACE DESIGN

Fitting regression model. Response Surfaces - first and second order designs. **(9)**

TOTAL : 45 HOURS

OE 01 – AUTOMATION AND ROBOTICS

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OBJECTIVE

- To expose the students to levels of automation and about emphasis on basics of manipulators, control techniques, sensor and devices, robot applications.

COURSE OUTCOME

After successfully completing the course students will be able to:

1. Select and identify suitable automation hardware for given applications.
2. Design / Simulate a robot which meets kinematic requirement.
3. Ability to obtain the Jacobian matrix and use it to identify singularities.

AUTOMATED MANUFACTURING SYSTEMS

History of Automation, Reasons for automation, Disadvantages of automation, Automation systems, Types of automation – Fixed, Programmable and Flexible automation, Automation strategies Components, classification and overview of manufacturing Systems, Flexible Manufacturing Systems (FMS), Types of FMS, Applications and benefits of FMS. (6)

AUTOMATION COMPONENTS

Sensors for temperature, pressure, force,displacement, speed, flow, level, humidity and pH measurement.Actuators, process control valves, power electronics devices DIAC,TRIAC, power MOSFET. Introduction of DC and ACservo drives for motion control (9)

CONTROL SYSTEM

Industrial control Systems- Process, Discrete manufacturing industries-Continuous andDiscrete Control systems-An overview of Computer process control- Fundamentals ofautomated assembly system.Actuators& Sensors, Fluid Power and Electrical ActuatorsPiezoelectric Actuator; Sensors for position,motion, force, Strain and temperature. (9)

ROBOTICS

Introduction to Robotics-Robotics System-Classification of Robots-Robot Characteristics, Kinematics formanipulator-Frames and Transformations-Forward and inverse Kinematics-DHrepresentation-Derivationof forward and Inverse kinematic equations for various types ofRobots- Applications of Robots. (9)

OE 02 – WORK STUDY AND ERGONOMICS

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OBJECTIVE

- Introduces the role of work study in the industry and how productivity issues can be addressed by the application of work study.
- Introduces the concept of conducting time study and production studies to assess time standards and production standards for achieving high efficiency of production.
- Scope of ergonomics and principles of work design for evaluating the impact of various human factors for designing safe work environment.

COURSE OUTCOME

After successfully completing the course students will be able to:

1. Conduct a method study in organization for improving the process, material, movement systems or design of a work place.
2. Develop time standards for operations, identify production bottle necks and improvise operations.
3. Evaluate the impact of various personnel attributes on proper safe working practices.

WORK STUDY

Study of operations – work content – work procedure – breakdown – human factors – safety and methodstudy – methods and movements at the workplace – substitution with latest devices – robotic concepts – applications in hazardous workplaces – productivity, quality and safety (PQS). (11)

ERGONOMICS

Definition – applications of ergonomic principles in the shop floor – work benches – seating arrangements – layout of electrical panels- switch gears – principles of motion economy – location of controls – display locations – machine foundations – work platforms, fatigue, physical and mental strain – incidents of accident – physiology of workers. (11)

PROCESS AND EQUIPMENT DESIGN

Process design – equipment – instrument – selection – concept modules – various machine tools - in-built safety – machine layout-machine guarding-safety devices and methods – selection, inspection, maintenance and safe usage – statutory provisions, operator training and supervision – hazards and prevention. (11)

OE 03 – PRODUCT LIFE CYCLE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVES

- Familiarize the current principles, practices, and applications of Product life cycle management (PLM).
- Learn integrated, information driven approach to all aspects of a products life from its design inception, through its manufacture, service and final disposal.
- Learn about effective integration of PLM technologies into the delivering innovative products.

COURSE OUTCOME

On Completion of the course, the students should be able to :

1. Understand product data, information, structures and PLM concepts.
2. Apply PLM systems in production, after sales, sales and marketing and subcontracting.
3. Measure benefits of PLM implementation in material costs, productivity of labour and quality costs.
4. Apply for service-based industry and in E – business

FUNDAMENTALS OF PLM

Product data or Product information, Product lifecycle management concept, Information models and product structures-Information model, The product information (data) model, The product model, Reasons for the deployment of PLM systems. (10)

ENTERPRISE SOLUTION WITH PLM

Use of product lifecycle management systems in different organization verticals, Product development and engineering, Impact of Manufacturing with PLM Challenges of product management in the engineering and manufacturing industry, Life cycle thinking, value added services and after sales, Case 1: Electronics manufacturer, Case 2: An engineering product. (10)

PLM FOR E-MANUFACTURING

Electronic business and PLM, Preconditions for electric business from the viewpoint of the individual company, Significance of product management, collaboration and electronic business for the manufacturing industry. (9)

INTEGRATION OF THE PLM SYSTEM WITH OTHER APPLICATIONS

Different ways to integrate PLM systems, Transfer file, Database integration, System roles, ERP, Optimization of ERP for PLM and CAD. (7)

OE 04 – IOT IN MANUFACTURING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OBJECTIVE

- Introduce the smart connected system design using Internet of Things, Cloud storage and industrial Automation.

COURSE OUTCOME

On Completion of the course, the students should be able to :

1. Design the smart connected systems
2. Apply appropriate technologies and protocols in design and automation.
3. Apply cloud storage management for smart connected system

INTRODUCTION

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.Design Principles for Connected Devices;Internet Principles.Thinking about Prototyping – Costs versus ease of prototyping, prototyping andProduction, open source versus Closed Source. (9)

PROTOTYPING

Prototyping Embedded devices – Electronics, Embedded Computing Basics, Arduino/ Raspberry Pi/ BeagleBone Black/ etc., Electric Imp and other notable platforms. Prototyping of Physical Design. Prototyping online Components – Getting Started with an API, Writing a New API, Real Time Reactions, Other Protocols. (9)

MEMORY AND STORAGE MANAGEMENT

Techniques for Writing Embedded Code – Memory Management, Performance andBattary Life, Libraries and debugging.Automatic Storage Management in a Cloud World – Introduction to Cloud, RelationalDatabases in the Cloud, Automatic Storage Management in the Cloud.Smart Connected System Design Case Study. (9)

DEVELOPMENT AND CHALLENGES IN IoT

Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python Design challenges, Development challenges, Security challenges, Other challenges (9)

OE 06 – RESEARCH METHODOLOGY AND IPR

L	T	P	C
3	0	0	3

COURSE OUTCOME

On Completion of the course, the students will be able to *:*

1. Understand and formulation of research problem.
2. Select the appropriate methodologies for carrying out the research.
3. Write effective research proposals following research ethics.
4. Understand the importance of IPR in creating, investing in R&D leading to new and better products.

DEFINING THE RESEARCH PROBLEM

Introduction, Meaning of Research, Objectives of Research, Types of Research,Research Approaches, Significance of Research, Research Methods versus Methodology, Research and ScientificMethod, Research Process, Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem,Technique Involved in Defining a Problem, (9)

RESEARCH DESIGN

Review of the literature, searching the existing literature, reviewing the selected literature, Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs (6)

METHODS OF DATA COLLECTION

Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method (6)

MEASUREMENT AND SCALING TECHNIQUES

Design of Sample Surveys:Design of Sampling: Introduction, Sample Design, Sampling and Non-samplingErrors, Sample Survey versus Census Survey, Types of Sampling Designs. Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodnessof Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools,Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale (10)

TESTING OF HYPOTHESIS

Characteristics and application of multivariate analysis, classification of multivariate analysis, classificationof multivariate analysis- important multivariate techniques, Factor analysis, path analysis

19MCS14 - ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Acquire Knowledge on intelligent agents and problem solving by using various search strategies .

CO2 : Apply planning and reasoning algorithms for solving real life problems.

CO3 : Acquire knowledge on uncertain knowledge representation and various learning techniques.

INTELLIGENT AGENTS AND PROBLEM SOLVING

Introduction- Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents. Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Avoiding Repeated States, Searching with Partial Information. **(10)**

SEARCH METHODS

Informed Search and Exploration: Informed (Heuristic) Search Strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Online Search Agents and Unknown Environments, Generic Algorithms for TSP. Constraint Satisfaction Problems: Constraint Satisfaction Problems, Backtracking Search for CSPs, Local Search for Constraint Satisfaction Problems, Structure of Problems. **(9)**

PLANNING

Representing actions, situation calculus, classical planning algorithms. The Planning Problem, Planning with State-Space Search, Partial-Order Planning, Planning Graphs, Planning with Prepositional Logic, Analysis of Planning Approaches. Planning and Acting in the Real World Time, Schedules and Resources, Hierarchical Task Network Planning, Planning and Acting in Nondeterministic Domains, Conditional Planning, Execution Monitoring and Replanning, Continuous Planning, Multi-Agent Planning. **(10)**

UNCERTAIN KNOWLEDGE AND REASONING

Acting under Uncertainty, Basic Probability Notation, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Extending Probability to First-Order Representations, Other Approaches to Uncertain Reasoning. **(10)**

LEARNING

Inductive learning for classification, decision-tree induction, neural-networks: representation and training. **(6)**

TOTAL : 45

REFERENCES

1. *Stuart Russell, Peter Norvig, "Artificial Intelligence - A Modern Approach", Pearson Publication, 3rd Edition, 2009.*
2. *Jeff Heaton, Artificial Intelligence for Humans-Fundamental Algorithms, Create space Independent Pub; 1st Edition, 2013.*
3. *Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann, International Student Edition, 1998.*

19MCS15 - ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : Analyze and formalize the problem as a state space graph, design heuristics and apply different search techniques in game playing and problem solving.

CO2 : Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.

CO3 : Formulate and solve problems with uncertain information using fuzzy inferences.

CO4 : Apply knowledge representation and natural Language processing concepts in implementing chat bot applications and semantic search.

LIST OF EXPERIMENTS

1. Implementing state space search algorithms
   - Hill climbing algorithms
   - A* Algorithm
2. Designing a Chat bot application.
3. Information retrieval using semantic search
4. Adversarial search and Game Playing
5. Knowledge representation and inference - Predicate logic
6. Reasoning with uncertainty - Fuzzy inference
7. Solving 4-Queen problem
8. Solving travelling salesman problem

19MCS21 - PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

Upon the completion of the course, students will be able to

CO1 : Assimilate ideas of probability distributions and solve natural problems using various statistical measures,

CO2 : Choose appropriate method to identify and solve computer engineering problems

CO3 : Evaluating and discussing the concepts of sampling theory

CO4 : Demonstrate accurate and efficient use of parameter estimation theory concepts to solve engineering problems.

CO5 : Incorporate the ideas of statistical process control us that are imperative for the effective understanding of scientific problems.

PROBABILITY AND ONE - DIMENSIONAL RANDOM VARIABLES

Methods of counting (combinatorics) - Axioms of probability- Conditional probability and independence. Moment generating functions. Discrete (integer valued) random variable- Continuous (real valued) random variables· Cumulative distribution functions and probability density functions. Distributions: Binomial, Poisson, Geometric, Uniform, normal (Gaussian), and exponential distributions, Independent random variables, Conditional distributions **(9)**

TWO DIMENSIONAL RANDOM VARIABLES AND CORRELATION

Joint Probability Distribution - Marginal Probability Distribution Function - Joint Probability Density Function-Marginal Probability Density Function-Conditional Probability Distribution Function- Conditional Probability Density Function- Covariance-Corelation. **(9)**

SAMPLING THEORY

Large sampll**e :** Testing of hypothesis about the population mean-difference between two means-Two Standard Deviations. Small sample: t-test-Testing of hypothesis about the population mean-difference between two means-F-test-Testing of hypothesis for equality of two Variances-Chi Square Test-Test for goodness of fit-Independence of Attributes. **(9)**

PARAMETER ESTIMATION

Point Estimation : Properties of Estimators, The Method of Maximum Likelihood-Single -Sample Confidence Interval Estimation: Confidence Interval on the mean of a Normal Distribution, Variance Known, Confidence Interval on the mean of a Normal Distribution, Variance Unknown-Two-Sample Confidence Interval Estimation: Confidence Interval on the Difference between Means of two Normal Distributions, Variances Known - Confidence Interval on the Difference between Means of two Normal Distributions, Variances Unknown **(9)**

STATISTICAL QUALITY CONTROL

Statistical Process Control : Introduction to Control Charts - Control Charts for Measurements - Control Charts for Individual Measurements - Control Charts for Attributes-CUSUM and EWMA Control Charts. **(9)**

TOTAL : 45 + 15 = 60

REFERENCES

1. *Sheldon M.Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Kindle, Fifth Edition, 2014.*
2. *William W.Hines, Douglas C.Montgomery, David M.Goldsman and Connie M.Borror, "Probability and Statistics in Engineering", John Wiley & Sons, Fourth Edition,2008.*
3. *V.K.Rohatgi and A.K. Md.E.Saleh, "An Introduction to Probability and Statistics, Athena Scientific, Second Edition, 2008.*
4. *Dimitri P. Bertsekas and John N. Tsitsiklis, "Introduction to Probability", Athena Scientific, Second Edition, 2008.*

19MCS24 - MACHINE LEARNING LABORATORY

L	T	P	C
0	0	4	2

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : Apply various classification and clustering techniques for problems using tools like R and Python.

CO2 : Implement solutions for various prediction problems using tools.

CO3 : Design and development of game and traffic control system using reinforcement learning.

LIST OF EXPERIMENTS

1. Study and usage of python and R tool.
2. Implement a classifier for the sales data.
3. Develop a predictive model for predicting house prices
4. Implement the FIND-S algorithm. Verify that it successfully produces the trace in for the Enjoy sport example.(Tom Mitchell Reference)
5. Implement a decision tree algorithm for sales prediction/classification in retail sector
6. Implement back propagation algorithm for stock prices prediction
7. Implement clustering algorithm for Insurance fraud detection
8. Implement clustering algorithm for identifying cancerous data
9. Apply reinforcement learning and develop a game of your own.
10. Develop a traffic signal control system using reinforcement learning technique.

NOTE **:** Datasets for the above exercises available in Kaggle and UCI repository mentioned below

i. https://www.kaggle.com

ii. http://archive.ics.uci.edu/ml/datasets.html

19MCSOC01 - PYTHON PROGRAMMING

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : Understand the fundamental concepts of python programming

CO2 : Apply control statements, decision making statements to solve the given problems.

CO3 : Usage of complex datatypes in python to develop an application.

CO4 : Practice problem solving using functions.

CO5 : Solve the real-world problems using file handling operations, modules and packages

INTRODUCTION TO PYTHON

Python variables, Python basic Operators, Understanding python blocks. Python Data Types, Declaring and using Numeric data types: int, float etc. **(6)**

PYTHON STATEMENTS

Assignment statements, I/O statements. Control statements: if, else and else if, for loops, foreach, while loops, Loop manipulation using pass, continue, break and else. **(6)**

PYTHON COMPLEX DATATYPES

Lists **:** list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters. **Tuples :** tuple assignment, tuple as return value; **Dictionaries :** operations and methods; Set **:** Creating Sets, Performing Set Operations: Union, Intersect and Difference. **(6)**

FUNCTIONS

Functions **:** Parameters, Local and Global scope, Return values, Recursion. **(6)**

FILES, MODULES AND PACKAGES

Files **:** Text files, reading and writing files. Modules: import Statement, from...import Statement.

Packages **:** NumPy, SciPy. **(6)**

TOTAL : 30

REFERENCES

1. *John V. Guttag, "Introduction to Computation and Programming Using Python", 2nd edition, The MIT Press, 2016.*
2. *Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/ O'Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/)*
3. *Guido van Rossum and Fred L. Drake Jr," An Introduction to Python - Revised and updated for Python 3.2", Network Theory Ltd., 2011.*