COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE - 641 014, TAMILNADU, INDIA

DIAMOND JUBILEE
(1956 - 2016)

DEPARTMENT OF INFORMATION TECHNOLOGY
B.Tech. INFORMATION TECHNOLOGY
Curriculum and Syllabi
Under Choice Based Credit System

(For the students admitted during the academic year 2019 - 2020 and onwards)

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COIMBATORE INSTITUTE OF TECHNOLOGY

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VISION AND MISSION OF THE INSTITUTE

VISION

The Institute strives to inculcate a sound knowledge in Engineering along with realized social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

MISSION

The Mission of the institute is to impart high quality education and training to its students to make them world-class Engineers with a foresight to the changes and problems and pioneers to offer innovative solutions to benefit the nation and the world at large.

DEPARTMENT OF INFORMATION TECHNOLOGY
COIMBATORE INSTITUTE OF TECHNOLOGY

VISION AND MISSION OF THE DEPARTMENT

VISION

To evolve as Centre of Excellence in teaching, learning, research and consultancy, integrating computer and information sciences with engineering concepts to develop products and services for the benefits of the industry and society at large.

MISSION

- To impart value based technical education and entrepreneurial skills to the graduates through state of art infrastructure.

- To educate graduates, towards the design and development of intelligent products and services meeting global demands and standards.

- To promote collaborative learning and research with industry, government and International organizations for continuous knowledge transfer and enhancement.

- To develop globally competent engineers capable of providing secure and "Out-of-the Box" computing and information technology solutions

- To enable the graduates to adapt to the rapidly changing technology with strong fundamentals

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DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates will acquire sound knowledge in mathematical, scientific and engineering fundamentals and knowledge in Information and Communication Technology to analyze, formulate and solve the real-life problems.

PEO2 Graduates will encompass entrepreneurship skills and ability to develop, implement innovative, integrated and secure information technology solutions for meeting the global challenges and changing requirements.

PEO3 Graduates will possess professional and ethical attitude, leadership qualities, desire for lifelong learning, and ability to work in multidisciplinary teams in meeting the broader societal needs.

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DEPARTMENT OF INFORMATION TECHNOLOGY

B.Tech. INFORMATION TECHNOLOGY

PROGRAM OUTCOMES

PO1 : **Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 : **Problem analysis :** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 : **Design/development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 : **Conduct investigations of complex problems :** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 : **Modern tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 : **The engineer and society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : **Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 : **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 : **Project management and finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 : **Life-long learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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B.Tech. INFORMATION TECHNOLOGY
CHOICE BASED CREDIT SYSTEM

Curriculum from the academic year 2019-2020 onwards

SUBJECTS OF STUDY

Semester III

Course Code	Course Name	L	T	P	C	Category
19CIM31	Linear Algebra, Complex Variables and Transform Techniques	3	1	0	4	BS
19CI31	Data Structures and Algorithms - I	3	1	0	4	PC
19CI32	Digital Design	3	0	0	3	ES
19IT31	Discrete Mathematics And Automata Theory	3	0	0	3	PC
19CI33	Object Oriented Programming and Java	3	0	0	3	PC
19HSS01	Science Of Creativity and Professional Ethics	1	0	0	1	HS
19CIL34	Digital Design Laboratory	0	0	3	1.5	ES
19CIL35	Object Oriented Programming Laboratory	0	0	3	1.5	PC
	One Credit Course	0	0	2	1	OCC
19HOC31	Communication Skills for Engineers - I*	0	0	2	1	EEC
	TOTAL CREDITS				**23**	

Semester IV

Course Code	Course Name	L	T	P	C	Category
19CI41	Data Structures and Algorithms II	3	0	0	3	PC
19CI42	Database Management Systems	3	0	0	3	PC
19CI43	Computer Architecture	3	0	0	3	PC
19CI44	Operating Systems	3	0	0	3	PC
19CI45	Software Engineering	2	1	0	3	PC
19CIL46	Database Management Systems Laboratory	0	0	3	1.5	PC
19CIL47	Data Structures and Algorithms Laboratory	0	0	3	1.5	PC
19CIL48	Operating Systems Laboratory	0	0	2	1	PC
	One Credit Course	0	0	2	1	OCC
19HOC41	Communication Skills for Engineers -II*	0	0	2	1	EEC
	TOTAL CREDITS				**21**	

* Not to be counted for GPA. Pass is required.

Semester V

Course Code	Course Name	L	T	P	C	Category
19CI51	Computer Networks	3	0	0	3	PC
19CI52	Data Warehousing and Data Mining	3	0	0	3	PC
19CI53	Embedded Systems	3	0	0	3	PC
19IT51	Economics for Engineers	2	0	0	2	HS
	Elective-I	3	0	0	3	PE/OE
	Elective-II	3	0	0	3	PE/OE
19ITL52	Embedded Systems Laboratory	0	0	2	1	PC
19CIL54	Computer Networks Laboratory	0	0	2	1	PC
	One Credit Course	0	0	2	1	OCC
19HOC51	Employability and Personality Development Skills - I*	0	0	2	1	EEC
19IT65	Mini Project	0	0	3	-	EEC
19INT51	Internship-I	0	0	0	1	EEC
	TOTAL CREDITS				**22**	

Semester VI

Course Code	Course Name	L	T	P	C	Category
19CI61	Artificial Intelligence	3	0	0	3	PC
19IT61	Mobile Computing	3	0	0	3	PC
19IT62	Internet Technology	3	0	0	3	PC
	Elective-III	3	0	0	3	PE/OE
	Elective-IV	3	0	0	3	PE/OE
19ITL63	Data Analytics and Artificial Intelligence Laboratory	0	0	3	1.5	PC
19ITL64	Internet Technology & Software Engineering Laboratory	0	0	3	1.5	PC
	One Credit Course	0	0	2	1	OCC
19HOC61	Employability and Personality Development Skills - II*	0	0	2	1	EEC
19IT65	Mini Project	0	0	3	3	EEC
19INT61	Internship -II	0	0	0	1	EEC
	TOTAL CREDITS				**24**	

• Internship/Project to be completed during 4th and 5th semester vacation

* Not to be counted for GPA. Pass is required.

Semester VII

Course Code	Course Name	L	T	P	C	Category
19CI71	Cryptography and Network Security	3	1	0	4	PC
19IT71	Distributed Systems	3	0	0	3	PC
19IT72	Internet of Things	3	1	0	4	PC
	Elective-V	3	0	0	3	PE/OE
	Elective-VI	3	0	0	3	PE/OE
19ITL73	Internet of Things Laboratory	0	0	3	1.5	PC
19ITL74	Mobile Application Development Laboratory	0	0	3	1.5	PC
19IT75	Project Phase-I	0	0	6	3	EEC
	TOTAL CREDITS				**23**	

Semester VIII

Course Code	Course Name	L	T	P	C	Category
	Elective-VII	3	0	0	3	PE/OE
	Elective-VIII	3	0	0	3	PE/OE
19IT81	Project Phase-II	0	0	10	5	EEC
	TOTAL CREDITS				**11**	

Total Credits : 164 (4 years B.Tech (IT))

Total Credits : 126 (Lateral B.Tech (IT))

122* Credits for Laterals + 4 Credits - Bridge

Course (Engineering Mathematics - 2 Credits & Physical - Sciences - 2 Credits)

LIST OF PROFESSIONAL ELECTIVES (PE)

Course Code	Course Name	L	T	P	C
19ITE01	Advanced Algorithms	3	0	0	3
19CIE01	Ad-hoc Networks	3	0	0	3
19ITE02	Advanced Computer Architecture	3	0	0	3
19ITE03	Advanced Operating Systems	3	0	0	3
19CIE02	Big Data Analytics	3	0	0	3
19CIE03	Bioinformatics	3	0	0	3
19CIE04	Block Chain Technology	3	0	0	3
19CIE05	Cloud and Virtualization	3	0	0	3
19ITE04	Customer Relationship Management	3	0	0	3
19ITE05	Cyber Security	3	0	0	3
19ITE06	Data Communications	3	0	0	3
19CIE06	Digital Forensics	3	0	0	3
19ITE07	Digital Image Processing	3	0	0	3
19CIE07	Entrepreneurship Skill Development	3	0	0	3
19CIE08	Graph Theory	3	0	0	3
19CIE09	Graphics and Multimedia Systems	3	0	0	3
19ITE08	Human Computer Interaction	3	0	0	3
19ITE09	Information Retrieval	3	0	0	3
19CIE10	Information Security	3	0	0	3
19CIE11	Information Storage Management	3	0	0	3
19CIE12	Information Theory and coding	3	0	0	3
19CS62	Machine Learning	3	0	0	3
19ITE10	Multi-Agent Intelligent System	3	0	0	3
19CIE13	Neural Networks and Deep Learning	3	0	0	3
19CIE14	Object Oriented Analysis and Design	3	0	0	3
19CIE15	Open Source Systems	3	0	0	3
19CS71	Principles of Compiler Design	3	0	0	3
19CIE16	Parallel Architecture and Programming	3	0	0	3
19ITE11	Real Time Systems	3	0	0	3
19CIE17	Resource Management Techniques	3	0	0	3
19ITE12	Semantic Web	3	0	0	3
19CIE18	Service Oriented Architecture and Web Services	3	0	0	3
19ITE13	Soft Computing	3	0	0	3
19ITE14	Software Agents	3	0	0	3
19CIE19	Software Metrics and Measurement	3	0	0	3
19CIE20	Software Testing and Quality Assurance	3	0	0	3
19CIE21	Wireless Sensor Networks	3	0	0	3
19CS51	UNIX internals	3	0	0	3
19ITE15	Full Stack Development	3	0	0	3
19ITE16	Virtual and Augumented Reality	3	0	0	3

HUMANITIES AND SOCIAL SCIENCES (HS)

Course Code	Course Name	L	T	P	C	Semester
19FYE11	Technical English	2	0	1	2	I
19FYE21	Language Elective	2	0	1	2	II
19FYC21	Environmental Science and Engineering	3	0	0	1	II
19HSS01	Science of Creativity and Professional Ethics	1	0	0	1	III
19IT51	Economics for Engineers	2	0	0	2	V

BASIC SCIENCES(BS)

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 SCIENCES (ES)

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 (PC)

Course Code	Course Name	L	T	P	C	Semester
19CI31	Data Structures and algorithms-I	3	1	0	4	III
19IT31	Discrete Mathematics and Automata Theory	3	0	0	3	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
19CIL46	Database Management Systems Laboratory	0	0	3	1.5	IV
19CIL47	Data Structures and Algorithms Laboratory	0	0	3	1.5	IV
19CIL48	Operating Systems Laboratory	0	0	2	1	IV
19CI51	Computer Networks	3	0	0	3	V
19CI52	Data Warehousing and Data Mining	3	0	0	3	V
19CI53	Embedded Systems	3	0	0	3	V
19ITL52	Embedded Systems Laboratory	0	0	2	1	V
19CIL54	Computer Networks Laboratory	0	0	2	1	V
19CI61	Artificial Intelligence	3	0	0	3	VI
19IT61	Mobile Computing	3	0	0	3	VI
19IT62	Internet Technology	3	0	0	3	VI
19ITL63	Data Analytics and Artificial Intelligence Laboratory	0	0	3	1.5	VI
19ITL64	Internet Technology and Software Engineering Laboratory	0	0	3	1.5	VI
19CI71	Cryptography and Network Security	3	1	0	4	VII
19IT71	Distributed Systems	3	0	0	3	VII
19IT72	Internet of Things	3	1	0	4	VII
19ITL73	Internet of Things Laboratory	0	0	3	1.5	VII
19ITL74	Mobile Application Development Laboratory	0	0	3	1.5	VII

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

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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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19ECEOE01	Signal Processing and its Applications	3	0	0	3	Chemical, Mechanical & Civil
19ECEOE02	Smart Sensors and IoT	3	0	0	3	All Branches
19ECEOE03	Consumer Electronics	3	0	0	3	Mechanical & Civil
19ECEOE04	Robotics	3	0	0	3	Mechanical, CSE & IT
19ECEOE05	Information Theory and Coding Techniques	3	0	0	3	All Branches
19ECEOE06	Wireless Sensor Networks	3	0	0	3	All Branches
19ECEOE07	Automotive Embedded Systems	3	0	0	3	All Branches
19ECEOE08	5G Technologies and Applications	3	0	0	3	All Branches
19ECEOE09	Vehicular Communication	3	0	0	3	All Branches
19ECEOE010	Sensing for Automotive Systems	3	0	0	3	All Branches

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CSOE01	Customer Relationship Management	3	0	0	3	All Branches
19CSOE02	Fundamentals of Software Engineering	3	0	0	3	All Branches
19CSOE03	Internet Programming	3	0	0	3	All Branches
19CSOE04	Introduction to Data Warehousing and Data Mining	3	0	0	3	All Branches
19CSOE05	Introduction to Embedded Systems	3	0	0	3	All Branches

DEPARTMENT OF INFORMATION TECHNOLOGY

Course Code	Course Name	L	T	P	C	Eligible Branches
19ITOE01	Digital Computer Basics	3	0	0	3	Civil, Mech, Chem
19ITOE02	Programming in Java	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE03	Fundamentals of Database Systems	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE04	Cloud Computing Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE05	Information Security Fundamentals	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE06	Introduction to Human Computer Interaction	3	0	0	3	EEE, ECE, Mech, Civil & Chemical
19ITOE07	Enterprise Resource Planning Concepts	3	0	0	3	EEE, ECE, Mech, Civil & Chemical

DEPARTMENT OF CHEMICAL ENGINEERING

Course Code	Course Name	L	T	P	C	Eligible Branches
19CHOE01	Industrial Safety Engineering	3	0	0	3	All Branches
19CHOE02	Risk Analysis and Hazop	3	0	0	3	All Branches
19CHOE03	Green Technology	3	0	0	3	All Branches
19CHOE04	Corrosion Science and Engineering	3	0	0	3	All Branches
19CHOE05	Introduction to Chemical Engineering	3	0	0	3	All Branches
19CHOE06	Nanomaterial Synthesis and Characterization Laboratory	0	0	6	3	All Branches
19CHOE07	Multivariate Statistics Laboratory	0	0	6	3	All Branches

DEPARTMENT OF MATHEMATICS

Course Code	Course Name	L	T	P	C	Eligible Branches
19MOE01	Graph Theory & its Applications	3	0	0	3	All Branches
19MOE02	Methods of Applied Mathematics	3	0	0	3	All Branches
19MOE03	Linear and Non - Linear Programming	3	0	0	3	All Branches
19MOE04	Probability and Random Processes	3	0	0	3	All Branches

DEPARTMENT OF PHYSICS

Course Code	Course Name	L	T	P	C	Eligible Branches
19POE01	Introduction to Nanoscience and Nanotechnology	3	0	0	3	All Branches except IT
19POE02	Physics and Technology of Thin Films	3	0	0	3	Mechanical, EEE, Chemical & ECE
19POE03	Solar Cell Fundamentals and Materials	3	0	0	3	EEE, ECE & Chemical
19POE04	Advanced Material Processing Technologies	3	0	0	3	Mechanical & Chemical

DEPARTMENT OF CHEMISTRY

Course Code	Course Name	L	T	P	C	Eligible Branches
19COE01	Medical Nanotechnology	3	0	0	3	Chemical
19COE02	Advanced Drug Delivery Systems	3	0	0	3	Chemical
19COE03	Biosensors	3	0	0	3	Chemical, ECE & EEE
19COE04	Nanocomposites	3	0	0	3	Mechanical, Chemical & Civil
19COE05	Biorefinery	3	0	0	3	Mechanical & Chemical

DEPARTMENT OF HUMANITIES

Course Code	Course Name	L	T	P	C	Eligible Branches
19HOE01	Principles of Management	3	0	0	3	Common to all branches
19HOE02	Current Trends in Indian Economy	3	0	0	3	Common to all branches
19HOE03	Monetary Economics	3	0	0	3	Common to all branches
19HOE04	English for Academic Purposes	3	0	0	3	Common to all branches
19HOE05	English for Competitive Exams	3	0	0	3	Common to all branches
19HOE06	Life and Literature	3	0	0	3	Common to all branches

19CIM31 - LINEAR ALGEBRA, COMPLEX VARIABLES AND TRANSFORM TECHNIQUES

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *To discuss linear transformations, matrix operations for solving linear systems*

CO2 : *To discuss vector spaces and their properties.*

CO3 : *To find infinite and finite Fourier transforms of standard functions and study the properties.*

CO4 : *To find Laplace transforms of standard functions and study the properties.*

VECTOR SPACES

Vector Spaces and Subspaces, Null Spaces, Column Spaces and Linear Transformations, Linearly Independent Sets and Bases- Inner Product(definitions and examples only)- Orthogonality - orthonormal basis using Gram-Schmidt Process. **(9)**

ANALYTIC FUNCTIONS

Analytic functions - Necessary and sufficient conditions -Cauchy-Riemann equations - Properties of analytic functions- Harmonic conjugates - Construction of analytic function - Conformal mapping - Bilinear transformation **(9)**

COMPLEX INTEGRATION

Line integral - Cauchy's integral theorem - Cauchy's integral formula - Taylor and Laurent series - Singularities - Residues - Cauchy's Residue theorem - Applications-Contour integration using circular and semi circular contours. **(9)**

LAPLACE TRANSFORM

Conditions and properties -Transform of standard functions -Transform of unit step, dirac - delta, and periodic functions -Initial and final value theorems -Inverse transforms -Convolution theorem -Applications to solve ordinary differential equations and integral equations. **(9)**

FOURIER TRANSFORMS

Fourier transform pair - Sine and Cosine transforms -Properties (Without proof) -Applications to evaluate simple real integrals- Transforms of simple functions - Parseval's identity- Finite Fourier sine and cosine transforms. **(9)**

TOTAL : 60

TEXT BOOKS

1. *David C.Lay, "Linear algebra and its applications", Third Edition, Pearson Education, 2010.*

2. *B.V.Ramana, "Higher Engineering Mathematics", 6th Edition (2014), Tata MC Graw-Hill Publishing Company Limited, New Delhi.*

REFERENCES

1. *Grewal B.S,"Higher Engineering Mathematics",42nd Edition, Khanna Publishers-(2012).*

2. *Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition (2010), JohnWiley & Sons.*

3. *Gilbert Strang, "Introduction to Linear Algebra", 5th Edition (2016),Wellesley Cambridge Press and SIAM.*

19CI31 - DATA STRUCTURES AND ALGORITHMS - I

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Learn the fundamental data structures such as lists, stacks, queues, trees, graphs and associated algorithms*

CO2 : *Choose the Data Structures and Algorithms that are appropriate for different applications*

CO3 : *Analyze the computational complexity of computer algorithms*

DATA, INFORMATION AND ALGORITHM ANALYSIS

Data Vs Information - Representation of Numbers: Integer, Real, Representation of Characters - Definition of an Algorithm - Basic Steps in Development of an Algorithm - Algorithm Notations - Sparks - Algorithm Complexity - Space and Time Complexity - Order Notations - Definition of NP Hard - NP Complete. **(6)**

LINEAR LIST

Definition - Arrays: Representation and Characteristics - Array of Structures - Polynomial Representation-Multidimensional Arrays. **(3)**

STACKS AND QUEUES

Fundamentals of Stacks, Queues and Dequeues - Application of Stacks: Recursion - Conversion of Infix to Postfix and Prefix Expressions - Evaluation of Postfix Expressions - Application of Queues: Wire Routing-Priority Queue-Multiple Stacks and Queues. **(7)**

LINKED LISTS

Singly and Doubly Linked Lists: Basic Operations - Linked Stacks and Queues - Polynomial Manipulation-Multi precision Arithmetic-Equivalence Relations. **(6)**

SPARSE MATRICES

Representation - Transpose and Multiplication of Sparse Matrices in Three Tuple Form - Sparse Matrices using Linked Lists. **(5)**

CHARACTER STRINGS

Representation: Fixed Length, Workspace Index, Linked List - Operations: Concatenation, Insertion, Deletion, Sub-String, Pattern Matching. **(4)**

TREES

Definition - Binary Trees: Representations, Traversal, Properties - Threaded Binary Trees - Copying and Equivalence of Binary Trees - Binary Tree Representation of General Trees - Application of Trees: Binary Search Trees: Principle, Addition and Deletion of Nodes, Decision Trees, Game Trees. **(7)**

GRAPHS

Terminology and Representations - Warshall Algorithm - Traversals - Bi connectivity - Connected Components - Spanning Trees -Shortest Path - Transitive Closure- Activity Networks -Topological Sort -Critical Paths-Enumerating all Paths-Euler and Hamiltonian Paths. **(7)**

Note : Algorithms will be taught in Sparks like notation

TOTAL : 60

TEXT BOOK

1. Ellis Horowitz, Sartaj Sahani, "Fundamentals of Data Structures", Galgotia Publications, Second Edition, 2008.

REFERENCES

1. Sartaj Sahni "Data structures, Algorithms and applications in C++", McGraw Hill, Second Edition, 2005.
2. Jean-Paul Tremblay and Paul G. Sorenson, "An Introduction to Data Structures with Applications",McGraw Hill, Second Edition, 2017.

19CI32 - DIGITAL DESIGN

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the basics of number systems, arithmetic operations, data representation schemes*

CO2 : *Understand the concepts of logic gates, boolean algebra and simplify the boolean expressions*

CO3 : *Acquire knowledge in combinational logic and to design combinational circuits.*

CO4 : *Ability to understand sequential logic and to design digital systems using sequential logic*

CO5 : *Understand the various types of Memory, Memory organizations and their operations*

DATA REPRESENTATION

Digital Computers and digital systems. Number system - Binary, Octal, Hexadecimal, Base Conversions. Complements-Subtraction of (unsigned) numbers using Complements. Binary Codes - BCD, Excess-3, Gray, ASCII, Error Detecting Codes- Reflected code. Fixed point Binary Data - Sign and Radix Point Representation-Signed Binary Numbers - Arithmetic Addition and Subtraction - Overflow. Decimal Data - Floating Point Data. **(9)**

BOOLEAN ALGEBRA & LOGIC GATES

Boolean Algebra - Basic Definitions - Theorems & Properties -Canonical and Standard Forms. Digital Logic gates. Simplification of Boolean Functions - Karnaugh Maps- Don't Care Conditions. NAND and NOR Implementation. Quine-McCluskey (Tabulation)Method. **(8)**

COMBINATIONAL LOGIC

Design Procedure - Adders -Half Adder - Full Adder-Binary Parallel Adder-Carry Look-ahead Adder -BCD Adder. Subtractor-Half Subtractor - Full Subtractor-Magnitude Comparator-Binary Multiplier- Code Converters. Decoders- Demultiplexers-Encoders-Priority Encoder- Multiplexers. Programmable Logic Arrays(PLA)-Programmable Array Logic(PAL). **(11)**

SEQUENTIAL LOGIC

Introduction - Flip Flops - Types -Triggering of Flip Flops. Analysis of Clocked Sequential Circuits - State Table - State Diagram - State Equation- State Reduction and Assignment. Flip Flop Excitation Tables.

Design Procedure - Design of Counters- Ripple Counters- Binary and BCD ripple counters. Synchronous counters - Binary and Binary updown counters- BCD Counters-Ring Counter-Johnson Counter. Registers - Shift Register. **(11)**

MEMORY

Memory Basics- Random Access Memory - RAM Family -Static RAMs-Memory Cell - Basic SRAM Cell Array -Cache Memory - DRAM Memory Cells - Types of DRAMs. Read-Only Memory-ROM Family-Mask ROM-Simple ROM -Internal ROM Organization-Programmable ROMs. Flash Memory- Flash Memory Cell-Flash Memory Operation-Basic Flash Memory Array-Comparison of Flash Memories with other Memories. **(6)**

TOTAL : 45

TEXT BOOKS

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 1st Edition, 2016.

2. Thomas L.Floyd, "Digital Fundamentals", Pearson Education; Eleventh Edition, 2017. (For "MEMORY" Only).

REFERENCES

1. Charles H. Roth Larry L. Kinney, Raghunandan G. H. "Fundamentals of Logic Design" , Cengage Learning, 1st Edition, 2019.

2. Tocci R.J., Neal S. Widemer, Gregory L. Moss "Digital Systems: Principles and Applications", Prentice Hall of India (New Delhi), 12th Edition, 2016.

3. V.Rajaraman, T.Radhakrishnan, "Digital Logic and Computer Organization", PHI Learning Pvt. Ltd, New Delhi, 2009.(For "Programmable Logic Arrays").

19IT31 - DISCRETE MATHEMATICS AND AUTOMATA THEORY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Apply logical reasoning in verifying the correctness and validity of simple instances of valid logical arguments.*

CO2 : *Design encoding and decoding procedures for error detection and correction.*

CO3 : *Knowledge in constructing system models which are the natural extension of Automata that are used to devise design procedures.*

CO4 : *Discuss and deploy specification of languages using grammars.*

MATHEMATICAL LOGIC

Connectives - Conditional and Biconditional 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. **(8)**

ALGEBRAIC STRUCTURES I

Rings, Integral domains and Fields - Properties - Polynomial Rings - Construction of Finite Fields - Irreducible Polynomials - Primitive element of a Finite Field - Primitive Irreducible Polynomials. **(7)**

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

Chomsky Classification of Grammars - Finite State Systems - Basic definitions - Transition diagrams - Deterministic & Nondeterministic Finite Automata - Finite Automata with ϵ-moves - Finite Automata with Output - Moore & Mealy Machine. **(9)**

GRAMMARS AND PUSH DOWN AUTOMATA

Context-Free Grammars - Simplification of Context -Free Grammars - Chomsky Normal Form. Pushdown Automata : Definitions - Pushdown Automata and Context-Free Languages - Solving problems like 0^n, 1^n etc. **(5)**

TURING MACHINES

Introduction - The Turing Machine Model - Simulating Computers using Turing Machines -Well-formedness of parentheses - Addition of unary numbers - Multiplication of unary numbers - Recognition of binary palindromes - Recognition of words of the form 0^n, 1^n. **(8)**

TOTAL : 45

TEXT BOOKS

1. *J.P.Tremblay, R.Manohar, "Discrete Mathematical structures with applications to computer science", Tata McGraw Hill, 38th Edition reprint 2010.*

2. *John E.Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages and Computation", Addison Wesley, Pearson Education, Third Edition, Second Impression, 2009.*

3. *Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley Publishing Company, Fifth Edition, Pearson Education, Second Impression, 2008.*

REFERENCES

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, 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.

19CI33 - OBJECT ORIENTED PROGRAMMING AND JAVA

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Identify classes and objects in software applications.*

CO2 : *Design objects for specific applications in java.*

CO3 : *The concepts of Exception Handling and its types.*

CO4 : *Demonstrate the concepts of multithreading and java networking.*

CO5 : *Demonstrate the concepts of applet and its use.*

OBJECT ORIENTED PROGRAMMING

Introduction to object oriented languages - Evolution of object oriented languages - Object oriented programming paradigm - Basic concepts of object oriented programming - Procedural vs Object oriented programming. **(6)**

INTRODUCTION TO JAVA

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 and String Buffer. **(12)**

EXCEPTION HANDLING

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - User defined Exceptions. **(5)**

THREADS AND NETWORKING

Multithreaded Programming : Thread Model - The Main Thread - Creating a Thread - Creating Multiple Threads - Thread priorities - Synchronization - Inter thread communication - Networking : Networking Basics - Inet address - TCP/IP Sockets -URL - Datagrams. **(11)**

APPLET AND DATABASE CONNECTIVITY

Introduction to Abstract Window Tool kit - Applet class : Applet Basics - Applet Architecture - HTML applet tags - Parameter passing - Audio clip interface - Event Handling: The Delegation Event Model - Event class: Keyboard and Mouse events handling. Data Base Connectivity: basic structure of JDBC API. **(11)**

TOTAL : 45

TEXT BOOK

1. *Herbert Schildt, " Java The Complete Reference ", Tata McGraw Hill, McGraw Hill Education, Eleventh Edition, 2018.*

REFERENCE

1. *Deitel H.M and Deitel P.J, " Java - How to Program", Prentice Hall of India, Eleventh Edition, 2018*

19HSS01 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS

L	T	P	C
1	0	0	1

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Describe the principles of karma yoga and functioning of mind and consciousness.

CO2 : Hypothesize the evolution of Universe and living beings in a global and societal context

CO3 : Infer the principles of Yoga to practice it and know the value of health.

CO4 : Interpret the philosophy of introspection procedures for better living

CO5 : Assess, take personal responsibility and follow professional ethics for sustained growth in career and life.

LIFE FORCE, MIND AND CONCIOUSNESS

Science of Creativity and Personality Development - Objectives - Principles of Karma Yoga - Duty Consciousness - Communism and Capitalism - Law of Nature - Life Force - Origin - Potentiality of the Life Force - Premordial State - Wave Theory - Consciousness - Pancha Thanmatras - Secret of Revelations - Mind - Biomagnetism - Physical Transformation of Biomagnetism.   **(7)**

EVOLUTION OF THE UNIVERSE AND LIVING BEINGS

Evolution of the Universe: Creation Theory - Evolution Theory - Theory of Permanence - Theory of Mithya - Evolution of Living Beings: Absolute Space and Force - Plants Experience Pain - Two Eyes and Two Ears - Seven Constituent Layers in the Body.   **(5)**

YOGA AND ITS BENEFITS

Simple and Safe Yoga - Upa Yoga Practices: Yoga for Peace - Yoga for Health - Yoga for Joy - Yoga for Love - Yoga for Well-being - Yoga for Success. Physical Exercise - Meditation - Seven Centers of Meditation - Benefits - Effect of Good Vibrations - Cause and Effect System -Food and Health.   **(6)**

INTROSPECTION

Attachment, Detachment and Moderation in Enjoyment - Imaginary Expectations - Harmony in Life: Self, Family, Society and Nature - Introspection: Analysis of Thought, Moralization of Desire, Neutralization of Anger, Eradication of Worries and Self Realization.   **(6)**

HUMAN VALUES

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Virtues - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment - Empathy - Self Confidence - Challenges in Work Place - Impact of cyberspace on individuals.   **(6)**

TOTAL : 30

TEXT BOOKS

1. Yogiraj Vethathri Maharishi, "Karma Yoga - The Holistic Unity", Vethathri Publications, IV Edition, 2009. (Chapters 1-7, 10-12)

2. R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2011.

REFERENCES

1. *Sadhguru, "Body the Greatest Gadget and Mind is your Business", Diamond Pocket Books Pvt. Ltd, Isha Foundations, 2013.*

2. *Swami Vivekananda and Swami Nikhilananda, "Karma Yoga and Bhakti Yoga", II Edition, Ramakrishna Vivekananda Publications, 2008.*

3. *Henry Dreyfuss, "The Measure of Man and Woman: Human Factors in Design", John Wiley and Sons Publications, 2012.*

4. *Mike W. Martin and Roland Schinzinger,"Ethics in Engineering", IV Edition, McGraw Hill, NewYork, 2005.*

5. *M. Govindarajan, S. Natarajan, V.S. Senthilkumar, "Engineering Ethics", I Edition, Prentice Hall of India, 2009.*

19CIL34 - DIGITAL DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Understand the operations of logic gates and verify Boolean algebra theorems.*

CO2 : *Ability to design combinational digital circuits like adder, subtractor, decoders, encoders, multiplexers, and de-multiplexers.*

CO3 : *Construct and analyze sequential digital circuits like flip-flops, registers and counters.*

LIST OF EXPERIMENTS

1. Realization of AND, OR and NOT gates using Universal gates.

2. Verification of Boolean algebra theorems and postulates.

3. Design of Half adder, Full adder, Half subtractor and Full subtractor.

4. Design of combinational circuits using NAND and NOR gates.

5. Design of code converter.

6. Design of Encoders, Decoders, Multiplexer and De-Multiplexer circuits.

7. Design and implementation of Priority Encoder.

8. Implementation of Boolean functions using 4x1 Multiplexer.

9. Realization of R-S, J-K, D and T Flip flops.

10. Design of Counters.

11. Design of Shift registers.

12. Simple VHDL programming.

19CIL35 - OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Create effective java applications using fundamental object oriented programming Concepts.*

CO2 : *Demonstrate advanced java concepts like Exception handling, Multithreading and Applets.*

CO3 : *Design and develop java applications for real world problems.*

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Control statements in Java.

2. Classes.

3. Inheritance.

4. Exception Handling.

5. Packages & Interface.

6. Multithreading.

7. Applet and AWT Tools.

8. Socket programming using TCP and UDP.

9. Case study - Database Connectivity

19CI41 - DATA STRUCTURES AND ALGORITHMS - II

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Explain the various file organization and access methods.*

CO2 : *Analyze sorting, searching algorithms with their complexities and their application to real world problems*

CO3 : *Describe various memory management algorithms as used in different operating Systems*

CO4 : *Choose the appropriate data structure and algorithm design method to implement real world problems.*

FILES

External Storage Devices - Definitions and Concepts - Record Organization - Sequential Files - Indexed Sequential Files: Structure and Processing - Other Method of File Organizations: VSAM - Multiple KeyAccess: Multilist, Inverted List.   **(7)**

SORTING

Introductory Considerations - Internal Sorts: Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Shell Sort, Heap Sort, Quick Sort, Radix Sort, Address Calculation Sort - External Sorts: Polyphase Sort, Oscillating Sort, Sorting on Discs-Extended Run List - Time Complexity for Sorting Algorithms.   **(9)**

SEARCH STRATEGIES

Sequential Search - Binary Search -Extended Binary Tree - Huffman Coding- Search Trees: Height Balanced Trees, 2-3 Trees, Weight Balanced Trees, B-Tree, B+ Trees, Tries, Red Black Trees, Tournament Trees.   **(9)**

HASH TABLE METHODS

Introduction- Hashing Functions - Hashing Methods - Collision Resolution Techniques - Time complexity for Searching Algorithms.   **(5)**

DYNAMIC STORAGE MANAGEMENT

First Fit - Best Fit - Storage Release - Boundary Tag Method - Buddy System - Garbage Collection -Compaction.   **(7)**

ALGORITHMS DESIGN

Basic Steps in Complete Development of an Algorithm - Algorithms and Design Methods: Sub Goals, Hill Climbing and Working Backward, Heuristics, Back Track Programming, Branch and Bound, Simulated Annealing - Knapsack Problem (Back Tracking)- Traveling Salesmen Problem (Branch and Bound).   **(8)**

* Note : Algorithms will be taught in Sparks like notation.

TOTAL : 45

TEXT BOOKS

1. *Jean Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill, Second Edition, 2008. (Files,Sorting,Hash Table Methods,Search Strategies, Dynamic Storage Management).*

2. *Horowitz E., Sahni S., and Rajasekaran Sanguthevar, "Fundamental of Computer Algorithms", Universities Press (Computer Science), Second Edition, 2008. (Algorithms Design).*

REFERENCES

1. *Alfred V. Aho, John. E. Hopcroft, Jeffrey D, Ullman, "Data Structures and Algorithms", Pearson Education, 2002.*

2. *Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson, Third Edition, 2011.*

19CI42 - DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge in basic concepts, the architecture of database management systems, data models, relational database theory and the features of ER Model.*

CO2 : *Ability to apply relational algebra operations and write appropriate SQL queries with suitable constraints for a given database application*

CO3 : *Master the sound design principles of relational database design using normalization concepts.*

CO4 : *Ability to use different Database Storage structures, access techniques and Indexing methods in Database applications.*

CO5 : *Knowledge in transaction processing concepts, Concurrency Control mechanism and Database Recovery methods and the ability to apply the concepts in the design of Database applications.*

INTRODUCTION

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. Entity-Relationship(E-R) Model: Basic concepts - Constraints - E-R Diagram - Weak Entity Sets - Reduction of Relational schemas. BigData - Introduction. **(9)**

RELATIONAL MODEL

Structure of Relational Databases - Relational Algebra Fundamentals - Codd's Rule- Additional and extended relational algebra operations - Null values - Modification of Database.SQL: Basic Structure - Set operations - Aggregate functions - Nested Sub queries - Complex queries - Views - Modification of the database - Integrity constraints - Referential Integrity - Triggers - Assertions - Embedded SQL. **(10)**

DATABASE DESIGN

Features of good relational design - Atomic domains and First Normal Form - Decomposition using Functional Dependencies - Functional Dependency theory - Normalization using Functional Dependencies - Decomposition using Multi-valued Dependencies. **(7)**

STORAGE

Data Capturing Technique: Bar code - QR code. RAID, Indexing and Hashing: Basic concepts, Ordered Indices: Dense and Sparse Indices - MultiLevel Indices - Index Update. B+-Tree Index Files: Structure of a B+-Tree - Queries in B+-Trees. Static Hashing, Dynamic Hashing **(8)**

TRANSACTION MANAGEMENT

Transaction Concepts and States - Concurrent Executions - Serializability. Concurrency control: Lock Based Protocols: Locks, Granting of Locks, 2-phase locking protocol - Timestamp Based Protocols - Validation based protocols - Deadlock Handling.Recovery Systems: Failure classification - Log based Recovery - Recovery with concurrent Transactions. **(11)**

TOTAL : 45

TEXT BOOK

1. *Abraham Silberschatz, Henry F.Korth,S.Sudharshan,"Database System Concepts", McGraw-Hill, Seventh Edition, 2019.*

REFERENCES

1. *Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson Education, Seventh Edition, 2015.*

2. *Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill Education, Third Edition, 2014.*

3. *Peter Rob, CorlosM.Coronel, "Database Systems: Design, Implementation and Management," Thompson Learning Course Technology, Tenth Edition, 2012.*

4. *Thomas M.Connolly and Carolyn E.Begg, " A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2014.*

19CI43 - COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Demonstrate the working of the algorithm for performing arithmetic operations, using the registers and ALU within the processor.*

CO2 : *Illustrate the control sequences and draw data flow path during the instruction execution.*

CO3 : *Discuss the concept of pipelining and examine hazards and techniques to enhance the performance of the system.*

CO4 : *Given a memory module specifications, choose the appropriate memory mapping procedure to enhance the performance of the system.*

CO5 : *Discuss the communication of I/O interface and ports with the processor*

MACHINE INSTRUCTIONS AND ARITHMETIC OPERATIONS

Memory Locations and Addresses : Byte Addressability - Big-Endian and Little-Endian-Word Alignment -Accessing Numbers and Characters. Instruction and Instruction sequencing: Register Transfer Notation - Assembly Language Notation - RISC and CISC Instruction Sets - Instruction Execution and Straight Line Sequencing - Branching. Addressing modes - Stacks - Subroutines - CISC Instruction sets - RISC and CISC styles. Arithmetic algorithms for Additions, Subtraction, Multiplication and Division on Signed magnitude, 2's complement numbers and Floating point Numbers. **(10)**

BASIC PROCESSING UNIT

Fundamental Concepts - Instruction Execution: Load - Store - Arithmetic and Logical Instructions. Hardware components: Register File - ALU - Data path - Instruction Fetch Section. Instruction Fetch and Execution Steps: Branching - Waiting for Memory. Control signals - Hardwired Control: Data path Control Signals - Dealing with Memory Delay. CISC Style Processor: Interconnect using Buses - Micro programmed Control. **(9)**

PIPELINING

Basic Concepts - Pipeline Organization - Pipelining Issues - Data Dependencies: Operand Forwarding - Handling Data Dependencies in Software. Memory Delays - Branch Delays: Unconditional Branches - Conditional Branches - Branch Delay Slot - Branch Prediction. Resource limitations - Performance Evaluation: Effects of stalls and penalties - Number of pipeline stages. Superscalar Operation: Branches and Data Dependencies - Out-of-Order Execution - Execution Completion - Dispatch Operation. **(9)**

MEMORY SYSTEM

Memory Hierarchy - Memory Address Map - Memory Connection to CPU - Associative Memory: Hardware Organization - Match Logic - Read and Write Operation. Cache Memory: Associative mapping - Direct Mapping - Set Associative Mapping - Writing into Cache - Cache Initialization. Virtual Memory: Address Mapping using Pages - Associate Memory - Page Table - Page Replacement. **(8)**

I/O ORGANIZATION

Accessing I/O Devices: I/O Device Interface - Program-Controlled I/O. Interrupts: Enabling and Disabling Interrupts - Handling Multiple Devices - Controlling I/O Device Behavior - Processor Control Register. Direct Memory Access - Bus Structures - Bus Operation: Synchronous Bus - Asynchronous Bus. Arbitration - Interface circuits: Parallel Interface - Serial Interface **(9)**

TOTAL : 45

TEXT BOOKS

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraj Manjikian, "Computer Organization and Embedded Systems", McGraw-Hill, Sixth Edition, 2017.

2. Morris Mano, "Computer System Architecture ", Prentice Hall of India, Third Edition, 2008. (for Arithmetic Algorithms and Memory System).

REFERENCES

1. William Stallings, "Computer Organization and Architecture - Designing for Performance", Pearson Education, Tenth Edition, 2016.

2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware / Software Interface", Morgan Kaufmann, Fifth Edition, 2013.

3. John P. Hayes, "Computer Architecture and Organization", McGraw Hill, Third Edition, 2017.

19CI44 - OPERATING SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Outline the basic functionalities of operating systems, operating system components, various types of operating system and system software.*

CO2 : *Apply process scheduling to demonstrate process execution.*

CO3 : *Understanding of various process synchronization techniques.*

CO4 : *Knowledge in various memory management schemes.*

CO5 : *Infer about secondary storage management techniques file organization and access methods.*

OPERATING SYSTEM OVERVIEW

Introduction to system software - Objectives and functions of OS - Evolution of OS - Distributed system - Real-Time systems - Operating system components - Interrupts -System call - Virtual machines - Symmetric Multiprocessing - Microkernel.   **(7)**

PROCESS DESCRIPTION AND CONTROL

Process - Process states - Process description - Process control -Processes and Threads Uniprocessor Scheduling: Types of Processor Scheduling - Scheduling Algorithms: FCFS, SJF, SRT, Round Robin, Priority, Multi-Level Queue, Multi-level Feedback, Fair Share - Overview of Multiprocessor Scheduling and Real time scheduling.   **(10)**

MUTUAL EXCLUSION AND SYNCHRONIZATION

Principles of concurrency - Mutual exclusion: Software and hardware approaches - Semaphores - Monitors - Message Passing - Readers/ Writers problem. Deadlock and Starvation: Principles of deadlock - Deadlock Prevention - Deadlock Detection - Deadlock Avoidance.   **(10)**

MEMORY MANAGEMENT

Memory management requirements - Memory partitioning - Loading and Linking - Paging - Segmentation. Virtual Memory: Hardware and control structures - Virtual Memory Management Policies: Fetch Policy, Placement policy, Replacement policy- Resident set management - Cleaning policy - Load control   **(10)**

I/O MANAGEMENT AND FILE MANAGEMENT

I/O devices - Organization of I/O function - OS design issues - I/O buffering - Disk scheduling. File management: Overview - File organization and access - File directories - File sharing - Record blocking-Secondary storage management.   **(8)**

TOTAL : 45

TEXT BOOK

1.   *William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Ninth Edition, 2018.*

REFERENCES

1.   *Silberchatz, Galvin, Gagne, "Operating System Concepts", John Wiley, Tenth Edition, 2018.*

2.   *Dhananjay M. Dhamdhere, "Operating System a Concept Based Approach " McGraw Hill Publication, Third Edition, 2017.*

19CI45 - SOFTWARE ENGINEERING

L	T	P	C
2	1	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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, ER diagrams and Software Requirement Specifications.*

CO3 : *Employ suitable architectural styles, software design methodologies, coding standards and practices in developing practical applications*

CO4 : *Discuss various testing techniques and their application in defect removal.*

INTRODUCTION

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 **(9)**

SOFTWARE REQUIREMENTS AND ANALYSIS

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. **(8)**

SOFTWARE DESIGN

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. **(10)**

CODING

Programming principles and guidelines - Structured programming - Information hiding - some programming practices - Coding standards - Code inspection - Planning- Self review - Group review meeting. **(7)**

TESTING

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 **(11)**

TOTAL: 45

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, Eighth Edition, 2019.*

2. *Ian Sommerville, "Software Engineering", Dorling Kindersley (India) Private Ltd., Eighth Edition, 2008.*

19CIL46 - DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Practice various DDL,DML,TCL commands so as to perform various database operations and solve queries for given application.*

CO2 : *Demonstrate open database connectivity by establishing connections between front end and databases*

CO3 : *Experiment various PL/SQL features such as procedures, functions, triggers and report generation.*

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. Database Creation, Insertion and Deletion.

2. Queries based on DML commands.

3. Aggregate Functions.

4. Sub-Queries and Joins.

5. Group by clause and DATE functions.

6. Views and Triggers.

7. PL/SQL Procedures.

8. Using Cursors and Functions in PL/SQL blocks.

9. ODBC Connectivity.

19CIL47 - DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	3	1.5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Selection and application of suitable data structures in implementing practical problems.*

CO2 : *Apply searching and sorting algorithms for real world problems.*

CO3 : *Identify suitable graph based algorithms and apply them for solving problems that arise in the real world scenarios.*

LIST OF EXPERIMENTS

1. Operations on Stacks, Queues and Linked List.

2. Applications using Stacks and Queues.

3. Polynomial operations using Linked List.

4. Trees - Binary Tree Traversals, Binary Search Tree operations.

5. Traversals on graphs.

6. Implementation of shortest path algorithms in Graph.

7. Implementation of search algorithms.

8. Implementation of sorting algorithms.

19CIL48 - OPERATING SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO 1 : *Knowledge in using different system and I/O calls, UNIX commands and shell programming.*

CO 2 : *Demonstrate algorithms for process scheduling, process synchronization, Inter- process communication and memory management.*

LIST OF EXPERIMENTS

1. System calls - fork, exec, getpid, exit, wait, close, stat, opendir, readdir.

2. I/O system calls -open, close, read, write, create, lseek, dup.

3. Simulate UNIX commands - ls, grep, chmod, passwd, who, date.

4. Shell programming.

    - Simple functions.

    - Basic tests.

    - Loops.

    - Patterns.

    - Expansions.

    - Substitutions.

5. Process Scheduling- FCFS, SJF, Priority and Round robin.

6. Synchronization using semaphores

7. Implementation of Inter-process Communication.

8. Implementation of memory management schemes -first fit, Best fit, worst fit and page replacement algorithms.

19CI51 - COMPUTER NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the layered architecture of computer networks, factors influencing the performance of networks.*

CO2 : *Discuss the services of application layer protocols and develop applications for client server model using socket functions.*

CO3 : *Demonstrate the working of TCP and UDP protocols.*

CO4 : *Discuss IP address range for subnets and routing protocols used in computer networks.*

CO5 : *Describe the link layer access protocols and their functions in networking.*

INTRODUCTION

Internet- The Network Core-Packet Switching, Circuit Switching- Delay, loss, throughput in packet switched networks- Protocols layers and their service models. **(6)**

APPLICATION LAYER

Principles of Network applications- The web and HTTP- overview of HTTP, Persistent and non-persistent connections, HTTP message format- FTP-Electronic Mail in the Internet-DNS-Peer-Peer applications- Socket Programming: creating Network Applications. **(9)**

TRANSPORT LAYER

Introduction and Transport Layer services-Multiplexing and Demultiplexing- connectionless Transport: UDP- Connection oriented Transport: TCP-TCP segment structure, Round-Trip Time Estimation and Timeout, TCP Connection Management-TCP congestion control **(10)**

NETWORK LAYER

Introduction-Virtual Circuit and Datagram Networks-The Internet Protocol (IP): Forwarding and Addressing in the Internet-Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm-Broadcast and Multicast Routing-Routing in the Internet: Inter-AS Routing: BGP. **(10)**

LINK LAYER

Introduction to the Link Layer-Multiple Access Links and Protocols: Random Access Protocols-Switched Local Area Networks: Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs)- Multiprotocol Label Switching (MPLS). **(10)**

TOTAL : 45

TEXT BOOK

1. *James F. Kurose & Keith W. Ross, Computer Networking A Top-down approach, Sixth Edition, Pearson Education, 2013.*

REFERENCES

1. *Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill, 2013.*

2. *William Stallings, Data and Computer Communications, 8th Edition, Pearson Prentice Hall, 2007.*

3. *Larry L .Peterson and Bruce S. Davie, Computer Networks A Systems Approach, Fifth Edition, Morgan Kaufman, 2012.*

4. *Andrew S Tanenbaum and David J. Wetherall, Computer Networks, Fifth Edition, Pearson, 2010.*

19CI52 - DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the basic concepts, modeling, architectures of data warehouse and sketch different data warehouse schema for the real world applications*

CO2 : *Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data pre-processing.*

CO3 : *Ability to apply frequent pattern and association rules mining techniques for data analysis.*

CO4 : *Analyse different types of data using classification and clustering techniques.*

CO5 : *Discuss mining of various complex data types and its application to real world problems.*

DATA WAREHOUSE

Data Warehouse: Basic concepts - Data Warehouse Modeling: Data Cube and OLAP - Design and Usage - Implementation **(6)**

DATA MINING AND DATA PREPROCESSING

Data Mining-Kind of Data-Data Patterns- Data Mining Technologies- Targeted Applications - Major Issues in Data Mining.Data Pre-processing: Major tasks in data pre-processing - Data Cleaning- Data Integration - Data Reduction: Attribute subset selection - Clustering - Data Transformation by normalization **(10)**

ASSOCIATION RULES

Definition-Apriori Algorithm-Partitioning Algorithm-Pincer Search -Dynamic Item Set Counting Algorithm-FP Tree Algorithm-Discussion on different Algorithms-Incremental Algorithm-Border Algorithm-Generation of Association Rules **(10)**

CLUSTERING AND CLASSIFICATION

Cluster analysis - Types of data -Requirements for cluster analysis - Categorization of major clustering methods - Partitioning K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Classification: Decision tree induction - Attribute selection measures - Tree Pruning **(10)**

MINING COMPLEX TYPES OF DATA

Mining Complex Data Types: Mining sequence data: Time - Series, Symbolic sequences & Biological sequences - Mining graphs and networks - Mining other kinds of data - Other methodologies of data mining-Data mining applications **(9)**

TOTAL : 45

TEXT BOOKS

1. *Jiawei Han &Micheline Kamber, "Data Mining-Concepts and Techniques" Morgan Kaufmann Publishers, Third Edition, 2012.*

2. *Arun K Pujari, "Data Mining Techniques" Universities Press India Ltd., Fourth Edition, 2017. (Association Rules and Partitioning - CLARA, CLARANS)*

REFERENCES

1. Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, First Edition, 2006.

2. Pieter Adriaans, DolfZantinge, "Data Mining", Pearson Education, Delhi,Third Edition, 2009.

3. Sam Anahory, Dennis Murray, "Data Warehousing in the Real World", Pearson Education,Seventhindian Reprint New Delhi, 2003.

4. George M. Marakas, " Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003

5. PaulrajPonnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.

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.*

19IT51 - ECONOMICS FOR ENGINEERS

L	T	P	C
2	0	0	2

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Students will learn how markets organize core economic activities, such as production, distribution, and consumption, and the growth of productive resources.*

CO2 : *Determine the Breakeven point and find out the strength and weakness of the Market Structure*

CO3 : *Sketch the curve for cost behavior for short run concepts*

CO4 : *Able to predict market outcomes through the extent of market competition*

CO5 : *Analyze the foundations of Finance, cost classification,*

CO6 : *Understand to assess the state of the economy and identify the key institutional factors that contribute to economic growth*

CO7 : *Help to develop strategies for the efficient distribution of products and services*

CO8 : *Apply the principles of business and corporate social responsibility*

BASICS OF MICRO ECONOMICS

Definition-Relationship between Economics and Engineering-Nature and Scope-Significance of Economics for Engineers - Demand Analysis and Supply Analysis - Elasticity of Demand and Supply - Cost concepts- Classifications - Short run and Long run cost curves - Break-even Analysis **(9)**

INDUSTRIAL FINANCE AND MARKET STRUCTRUE

Need for Finance-Types and Sources of Finance- Market structure-Perfect competition-Monopoly and Monopolistic market - Business Cycle and Business policies-Trading concepts in Stock Market **(8)**

NATIONAL INCOME AND EMPLOYMENT

Meaning - National Income - Concepts -Methods of Calculating and Problems in calculating National Income - Inflation - Causes - Measures -Deflation - Causes - Measures - Unemployment and its types New Economic reforms 1991- Liberalization -Privatization - Globalization **(7)**

MONEY AND BANKING and HUMAN RESOURCE MANAGEMENT

Money - RBI Measures of Money Supply - Banking - Functions of Commercial Banks and Central Banks-Principles of Management -Objectives-Job analysis-Recruitment -Selection and Placement Training Development- Marketing- Need for Marketing-Marketing Function-- Marketing Versus Selling **(6)**

TOTAL : 30

TEXT BOOKS

1. *Dewett .K.K., & Navalur M.H., "Modern Economic Theory", S. Chand and Company Ltd, New Delhi 19th Revised Edition*

2. *Lipsey & Chrystal, "Micro Economics Theory", Oxford University Press,*

3. *M.L.Jinghan, " Macro economics" Kindle Edition 2016*

4. *V.S. Bagad, "Principles of Management", Technical Publication, Pune 2017*

5. *Phillip Kotler "Marketing Management" 15th Edition Pearson*

REFERENCES

1. Paul A Samuelson & William, "Economics", Tata McGraw Hill, New Delhi,

2. Francis Cheriunullem, "International Economics", McGraw Hill Education, .

3. William A McEachern and Smrit Kaur, "Micro Economics", Cengage Learning,

4. William A McEachern and Indira A., "Macro Economics", Cengage Learning, 2014.

5. Lipsey & Chrystal, "Economics", Oxford University Press, 2010.

6. James. C., Vanhorn, "Fundamentals of Financial Management" PHI, 2012

7. Charles T.Homgren, "Cost Accounting", PHI, 2012

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

19CIL54 - COMPUTER NETWORKS LABORATORY

L	T	P	C
0	0	2	1

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 *:* *Implement different models of servers using Socket functions.*

CO2 *:* *Simulate the working of protocols used in different layers of networks.*

EXPERIMENTS USING THE FOLLOWING CONCEPTS

1. TCP Socket

2. UDP Socket

3. Concurrent Server

4. Sliding window protocol

5. Error detection and control

6. FTP, TELNET

7. Multicasting

8. Broadcasting

9. Case Study on Software Defined Network (SDN)

10. Real time working knowledge of Networking equipment like L2 Switch, Routers, Unifi WiFi and LAN

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*

19IT61 - MOBILE COMPUTING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Identify the strength, limitation of mobile networks and discuss the technologies for mobile communication.

CO2 : Describe the basic working principle of Mobile IP and express different scenarios for performing mobile communication.

CO3 : Analyze TCP variations for mobility support and discuss about WAP architecture.

CO4 : Explain different types of data dissemination and synchronization mechanisms for mobile computing.

CO5 : Develop simple android mobile application using development tools.

INTRODUCTION

Mobile Communication-Mobile Computing-Mobile Computing Architecture-Mobile Devices-Mobile System Networks-Data Dissemination - Mobility Management - Security - Introduction to Cellular Systems - Global System for Mobile Communication- General Packet Radio Services and their architectures. **(9)**

MOBILE IP NETWORK LAYER

Mobile IP overview - IP packet delivery - Agent Discovery registration - Tunneling and Encapsulation - Route optimization - Reverse Tunneling - IPv6 - IP Micro Mobility Support - Dynamic Host Configuration Protocol. **(9)**

MOBILE TRANSPORT AND APPLICATION LAYER

Mobile TCP - Fast Retransmit / Fast Recovery - Transmission Timeout Freezing - Selective Retransmission - Transaction oriented TCP - TCP over 2.5/3G Wireless Networks. WAP Architecture : Datagram Protocol, Transport Security - Transaction Protocol - Session Protocol - Application Environment-WML - WML Script - Wireless Telephony Application. **(9)**

DATA DISSEMINATION AND SYNCHRONIZATOIN

Data Delivery Mechanisms - Synchronization - Synchronization Software - Synchronization Protocol- SyncML - Synchronized Multimedia Markup Language (SMIL). **(9)**

MOBILE APPLICATION DEVELOPMENT

Features of Palm OS, Symbian OS, Android OS: Development framework - Developing application for android - Development tools - Application Lifecycle - Externalizing Resources - Application class -Android activities. **(9)**

TOTAL : 45

TEXT BOOKS

1. Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, Third Edition, 2019.

2. Jochen Schiller, "Mobile Communications", Pearson Education India, Second Edition, 2008. (Mobile Transport And Application Layer)

3. RetoMeier, "Professional Android4 Application Development", Wiley India Pvt Ltd, Third Edition, 2012. (Mobile Application Development)

REFERENCES

1. Stojmenovic and Cacute,"HandBook of Wireless Networks and Mobile Computing", Wiley, 2006.

2. Reza Behravanfon, " Mobile Computing Principles: Designing and Developing Mobile Applications with UML & XML", Cambridge University Press, 2004.

19IT62 - INTERNET TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO 1 : *Identify working model and learn basic web concepts to develop Static and Dynamic web pages.*

CO 2 : *Understand the basic programming with XML and the role of XML in libraries.*

CO 3 : *Demonstrate an ability to use static and dynamic design techniques to construct an interactive web page using Client/ Server side technologies.*

CO 4 : *Understand and discuss the concepts in e-business models and e-marketing.*

CO 5 : *Demonstrate use of Ruby on Rails framework in developing interactive web applications.*

INTRODUCTION

Basic Web Concepts - Web based Client/Server model -Web Protocols- Working of web browser - Browser & Server Communication - History of HTML / XHTML / HTML5 - HTML5 Structural Elements-Images - HTML5 Form Elements and Attributes-DHTML-CSS3-Selectors-Positioning elements-Colors-Shadows-Gradients-Transitions and Transformations.   **(9)**

XML

Introduction to XML - XML fundamentals - Well-formed XML documents - components of XML document - XML tools - XML Namespaces - XML Vocabularies - Document Object Model (DOM) - Simple API for XML(SAX) - Extensible Style Sheet Languages (XSL) - XML database program.   **(10)**

SCRIPTING LANGUAGES

Client Side scripting - Introduction to Java Script - Arrays - Control statements -Events - Cookies - Introduction to CGI Concepts - Server Side Technologies: PERL - Arrays - Strings - files - Database.   **(9)**

SERVER SIDE TECHNOLOGIES

Java Server Pages - System Architecture -Basic JSP life cycle-JSP elements: Variables and objects - Methods-Implicit objects-Parsing Request Strings-Session Management. - Java Servlets - Design-Servlet life cycle- Reading HTTP Request Headers-Writing HTTP Response Headers.   **(9)**

WEB BASED APPLICATIONS AND ITS TECHNOLOGIES

Rails: Overview of Rails - Document request - Processing forms - Rails application with databases - Layouts - Introduction to Ruby - MVC Framework- Ajax: Ajax based web application, alternatives of Ajax - E-Business Models - E-Marketing - Online payments and Security.   **(8)**

TOTAL : 45

TEXT BOOKS

1. *Deitel & Deitel, "Internet and World Wide Web-How to Program", Pearson Education Fifth Edition, 2011.*

2. *Rashim Mogha, V.V Preetham. V.V. "Java Web Services Programming", Wiley Dreamtech, New Delhi, Java 2 Enterprise Edition, 2011. (Server Side Technologies)*

3. *Robert W.Sebesta, "Programming with World Wide Web", Pearson   Education, Eighth Edition, 2015.(Web Based Applications and its Technologies)*

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, First Edition, 2002.

3. Jeffrey C. Jackson," Web Technologies: A Computer Science Perspective", Pearson Education, Second Edition, 2007

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

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.

19IT65 - MINI PROJECT

L	T	P	C
0	0	3	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Apply computing algorithms and techniques in designing simple solutions and examine the outcome of real- time projects.*

CO2 : *Integrate various interdisciplinary areas to enhance domain knowledge.*

CO3 : *Develop technical skills in providing feasible solutions for real-life problems and enhance technical writing ability.*

CO4 : *Demonstrate effective communication and collaborative working in peer groups.*

19CI71 - CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	1	0	4

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Apply the symmetric ciphering algorithms for security attacks and threats.

CO2 : Apply the asymmetric ciphering algorithms for security attacks and threats.

CO3 : Use of hashing and message authentication concepts to generate digital signatures.

CO4 : Describe the concepts of key management and user authentication techniques.

CO5 : Select suitable Intrusion detection system and Firewall to prevent intrusion.

INTRODUCTION

Computer and Network Security Concepts: Security Attacks - Security Services - Security Mechanisms. Introduction to number theory : Fermat's and Euler's theorems-Testing on Primality. Modular arithmetic-Euclidean Algorithm. Classical Encryption Techniques: Symmetric Cipher Model - Substitution Techniques - Transposition Techniques. Block Cipher and the Data Encryption Standard- Advanced Encryption Standard-Block Cipher Operation: Electronic codebook-Cipher block Chaining mode-Cipher Feedback mode-Output feedback mode-Counter mode. **(12)**

ASYMMETRIC CIPHERS

Public Key Cryptography and RSA:Principles of Public key Cryptosystems - RSA Algorithm-Diffie-Hellman Key Exchange - Elliptic Curve Arithmetic - Elliptic Curve Cryptography. **(7)**

CRPTOGRAPHIC DATA INTEGRITY ALGORITHMS

Cryptographic hash functions: Applications-Requirements and Security-Secure Hash Algorithm-SHA-3.Message Authentication Codes : Requirements - Functions. Digital Signatures: Digital Signatures-NIST Digital Signature Algorithm- Elliptic Curve Digital Signature Algorithm. **(8)**

MUTUAL TRUST AND NETWORK SECURITY

Key Management and Distribution: Distribution of public keys-X.509 Certificates- Public-Key Infrastructure. User Authentication: Kerberos. Transport Layer security: Transport Layer security -Secure Shell (SSH).Electronic Mail Security : Pretty Good Privacy-S/MIME. IP Security: Policy- Encapsulating Security Payload - Cryptographic primitives in block chain. **(12)**

INTRUSION DETECTION SYSTEM

Intruders - Intrusion detection - Malicious Software : Viruses and Related Threats - Virus Countermeasures - Distributed DoS attacks. Firewalls : Firewall Design Principles. **(6)**

TOTAL : 60

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Seventh Edition, 2017.

2. William Stallings, "Cryptography and Network Security - Principles and Practices", Prentice Hall of India, Fourth Edition, 2005. (Intrusion Detection System)

REFERENCES

1. Behrouz A.Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, Third Edition, 2015.

2. Atul Kahate, "Cryptography and Network Security", Tata McGraw-Hill, Third Edition, 2013.

3. Wade Trappe, Lawrence C.Washington, "Introduction to Cryptography with coding theory", Pearson Education, Second Edition, 2011.

4. Bruce Schneier, "Applied Cryptography", John Wiley and Sons, New York, Second Edition, 2006.

19IT71 - DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Discuss the challenges and issues in applying various distributed system models in real time applications.*

CO2 : *Demonstrate inter-process communication using Remote Method Invocation and Remote Procedure Call*

CO3 : *Describe the architecture and security provided by OS layer to support Distributed System.*

CO4 : *Identify the design issues related to naming services, synchronization and use synchronization algorithms in various distributed system scenarios.*

CO5 : *Classify various consistency models and describe the approaches to achieve fault tolerance in distributed environment.*

INTRODUCTION

Characterization of Distributed Systems - Examples - Resource Sharing - Challenges - web. System Models - Architectural and Fundamental Models. **(9)**

PROCESSES AND DISTRIBUTED OBJECTS

Inter-Process Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client-Server Communication - Group Communication - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call. **(9)**

OPERATING SYSTEM SUPPORT AND NAMING SERVICES

The OS Layer - Protection - Processes and Threads - Communication and Invocation - OS Architecture Distributed File Systems : File Service Architecture-Name Services: Name Services and the domain Name System-Directory Services. **(8)**

SYNCHRONISATION AND MUTUAL EXCLUSION

Time and Global States : Clocks, Events and Process States - Synchronizing Physical Clocks - Logical Time And Logical Clocks - Global States. Coordination and Agreement: Distributed Mutual Exclusion - Elections - Multicast Communication **(9)**

CONSISTENCY AND REPLICATION

Data-centric consistency models: Continuous consistency- Consistent ordering of operations. Client-centric consistency models: Eventual consistency - Monotonic Reads - Monotonic Writes - Read your writes - Writes Follow Reads. Replica Management: Replica-Server Placement - Content Replication and Placement -Content Distribution. Consistency protocols: Continuous Consistency - Primary-Based Protocols - Replicated-Write Protocols - Cache- Coherence Protocols. **(10)**

TOTAL : 45

TEXT BOOKS

1. *George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Pearson Education, Fifth Edition, 2017.*

2. *Andrew S Tanenbaum, Maartenvan Steen,"Distributed Systems -Principles and Paradigms", Pearson Education, Second Edition, 2015. (consistency&replication only)*

REFERENCES

1. *Ajay. D Kshem Kalyani, Mukesh Singhal, "Distributed computing principles, Algorithms and Systems", Cambridge University Press, First Edition, 2011.*

2. *Mukesh Singhal, Niranjan G. Shivaratri, "Advanced concepts in Operating Systems", First Edition, Tata McGraw Hill, 2017.*

3. *M.L. Liu, "Distributed computing Principles and Applications", First Edition ,Pearson Education, 2019.*

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

19IT75 - PROJECT PHASE - I

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Perform a survey in the selected area, formulate the problem, collect data*

CO2 : *Examine mathematical techniques in various fields for solving computer engineering problems.*

CO3 : *Working with various interdisciplinary projects to extend the teams domain knowledge*

CO4 : *Effectively communicate and collaboratively work with in peer groups and enhance technical writing ability*

19IT81 - PROJECT PHASE - II

L	T	P	C
0	0	10	5

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

CO1 : *Apply algorithm and design techniques in the project and experience their outcome in their own real time project scenario.*

CO2 : *Develop the management skills to achieve the project goal by working as a team and enhance technical writing skills*

CO3 : *Examine mathematical techniques in various fields for solving computer engineering problems.*

CO4 : *Working with various interdisciplinary projects to extend the teams domain knowledge.*

CO5 : *Demonstrate the technical skills acquire to provide feasible solution for real-life problems*

CO6 : *Effectively communicate and collaboratively work with in peer groups to develop optimized hardware/software solutions*

19ITE01 - ADVANCED ALGORITHMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Develop a sound theoretical understanding on a wide range of algorithms and their relations.*

CO2 : *Develop basic knowledge on advanced algorithm design techniques and analysis skills.*

CO3 : *Explore the functionalities of major graph Algorithms and their applications.*

CO4 : *Design of Linear Programming and String Matching model for solving various applications.*

CO5 : *Outline the basic concepts of Computational Geometry and develop algorithm analysis skills for analyzing the approximation ratio of approximation algorithms.*

ALGORITHMIC CONFLICTS

Insertion sort - Analyzing algorithms-Designing algorithms. Growth of Functions: Asymptotic notation-Standard notations and common functions. Divide-and-Conquer: The maximum-subarray problem-Strassen's algorithm for matrix multiplication-The substitution method for solving recurrences-The recursion-tree method for solving recurrences-The master method for solving recurrences. **(9)**

ADVANCED DESIGN AND ANALYSIS TECHNIQUES

Dynamic Programming: Rod cutting- Matrix-chain multiplication- Elements of dynamic programming-Longest common subsequence-Optimal binary search trees. Greedy Algorithms: An activity-selection problem-Elements of the greedy strategy-Huffman codes-Matroids and greedy methods-A task-scheduling problem as a matroid. **(9)**

GRAPH ALGORITHM

Single-Source Shortest Paths:The Bellman-Ford algorithm-Single-source shortest paths in directed acyclic graphs-Dijkstra's algorithm-Difference constraints and shortest paths -Proofs of shortest-paths properties. All-Pairs Shortest Paths: Shortest paths and matrix multiplication-The Floyd-Warshall algorithm -Johnson's algorithm for sparse graphs. Maximum Flow: Flow networks-The Ford-Fulkerson method-Maximum bipartite matching -Push-relabel algorithms- The relabel-to-front algorithm. **(9)**

LINEAR PROGRAMMING AND STRING MATCHING

Linear Programming:Standard and slack forms-Formulating problems as linear programs-The simplex algorithm-Duality-The initial basic feasible solution.String Matching:The naive string-matching algorithm-The Rabin-Karp algorithm-String matching with finite automata. **(9)**

CONFIDENTIAL GEOMETRY AND APPROXIMATION ALGORITHMS

Computational Geometry: Line-segment properties-Determining whether any pair of segments intersects-Finding the convex hull-Finding the closest pair of points. Approximation Algorithms: The vertex-cover problem-The traveling-salesman problem-The set-covering problem-Randomization and linear programming-The subset-sum problem. **(9)**

TOTAL: 45

TEXT BOOK

1.   *Thomas H. Cormen. Charles E. Leiserson. Ronald L. Rivest. Clifford Stein. Introduction to Algorithms. Third Edition, 2009*

REFERENCES

1.   *Michael T. Goodrich and Roberto Tamassia,"Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley and Sons, 2002.*

2.   *SanjayDasgupta,Christos Papadimitriou and Umesh Vazirani,"Algorithms",Tata McGraw-Hill, 2009*

3.   *Steven S.Skiena."The Algorithm Design Manual", Second Edition, 2010.*

4.   *Udi Manbert,"Introduction to Algorithms",A Creative Approach,Addison-Wesley Publishing Company, 1989.*

19CIE01 - AD-HOC NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Recognize the issues involved in designing MAC protocol and describe the different type of MAC protocols in wireless Ad-Hoc Network*

CO2 : *Choose appropriate routing protocols for a given networking scenario and demonstrate the routing process with its merits and demerits*

CO3 : *Point out the characteristics and compare the qualitative behavior of various multicast routing protocols.*

CO4 : *Discuss various transport layer solutions employed in wireless Adhoc networks.*

CO5 : *Outline the QoS support and energy management schemes in wireless Adhoc networks.*

MAC PROTOCOLS

Ad Hoc Wireless Networks & MAC Protocols: Introduction - Issues in Ad Hoc Wireless Networks - Issues in Designing a MAC Protocol for Ad hoc Wireless Networks - Classification of MAC Protocols - Contention-Based: MACAW, Busy Tone Multiple Access Protocols - Contention-Based with Reservation Mechanisms: Distributed Packet Reservation Multiple Access Protocol - Collision Avoidance Time Allocation Protocol - Contention-Based with Scheduling Mechanisms: Distributed Priority Scheduling - MAC Protocols that Use Directional Antennas. **(9)**

ROUTING PROTOCOLS

Issues in Designing a Routing Protocol for Ad hoc Wireless Networks - Classifications of Routing Protocols- Table-Driven: Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing Protocol On-Demand: Dynamic Source Routing-Ad Hoc On Demand Distance Vector Routing Protocol-Location- Aided Routing-Signal Stability based Adaptive Routing Protocol - Hybrid : Core Extraction Distributed Ad Hoc Routing Protocol- Zone Routing Protocol. **(9)**

MULTICAST ROUTING

Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - Classification of Multicast Routing Protocols - Tree-Based: Bandwidth efficient Multicast Routing Protocol-Multicast Core Extraction Distributed Ad Hoc Routing- MAODV - Mesh-based: On Demand Multicast Routing Protocol, Core Assisted Mesh Protocol-Multicasting with Quality of Service Guarantees - Application Dependent Multicast Routing. **(10)**

TRANSPORT LAYER PROTOCOLS & SECURITY ISSUES

Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks-Classification of Transport Layer Solutions-TCP over Ad Hoc Wireless Networks - Security in Ad-Hoc Wireless Networks-Requirements-Issues-Attacks-Key Management in Ad Hoc Wireless Networks-Secure Routing: Secure Efficient Ad Hoc Distance Vector Routing Protocol, Authenticated Routing for Ad Hoc Networks **(7)**

QUALITY OF SERVICE & ENERGY MANAGEMENT

Issues and challenges in providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions: MAC Layer Solutions: Cluster TDMA - Network Layer Solutions: Ticket Based Protocol-QoS Frameworks for Ad Hoc Wireless Networks: INSIGNIA-INORA-SWAN- Energy Management in Ad Hoc Wireless Networks: Classification - Battery Management Schemes - System Power Management Schemes. **(10)**

TOTAL : 45

TEXT BOOK

1. C.Siva Ram Murthy, B.S.Manoj, "Ad-Hoc Wireless Networks- Architectures and Protocols", Prentice Hall, First Edition, 2012.

REFERENCES

1. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, First Edition, 2009.
2. Carlos DE MoraisCordeiro. Dharma Prakash Agrawal, "Ad-Hoc and Sensor Networks -Theory and Applications", World Scientific Publishing Corporation Pvt Ltd, Second Edition, 2011

19ITE02 - ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge in different performance parameters of computer design.*

CO2 : *Analyze performance of different ILP techniques.*

CO3 : *Understand the thread level parallel programming concepts.*

CO4 : *Identify cache and memory related issues in multi-processors.*

CO5 : *Describe concepts of vector processing and SIMD computers.*

FUNDAMENTALS OF COMPUTER DESIGN

Introduction - Classes of Computers - Trends in Technology - Trends in Power in Integrated Circuits - Trends in Cost - Dependability - Measuring - Reporting and Summarizing Performance - Quantitative Principles of Computer Design. **(8)**

INSTRUCTION LEVEL PARALLELISM

Concepts and Challenges - Basic Compiler Techniques for Exposing ILP-Reducing Branch Costs with Prediction-Dynamic Scheduling-Hardware-Based Speculation-Advanced Techniques for Instruction Delivery and Speculation-Limitations of ILP. **(10)**

THREAD LEVEL PARALLELISM

Symmetric Shared-Memory Architectures-Performance of Symmetric Shared-Memory Multiprocessors-Distributed Shared Memory and Directory-Based Coherence-Synchronization-Models of Memory Consistency. **(9)**

MEMORY

Memory Hierarchy Technology-Cache Memory organizations: Cache addressing models-Direct mapping and associative caches-Set associative and sector caches-Cache Performance issues. Virtual Memory Technology. Shared memory organizations: Interleaved memory organization-Bandwidth and fault tolerance-Memory allocation schemes. **(10)**

MULTIVECTOR AND SIMD COMPUTERS

Vector Processing Principles-Multivector multiprocessors-SIMD computer organizations: Implementation models-CM2 network architecture-MasPar MP-1 architecture. **(8)**

TOTAL : 45

TEXT BOOKS

1. *John L Hennessey and David A Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann; Sixth Edition, 2017.*

2. *Kai Hwang, "Advanced Computer Architecture - Parallelism, Scalability, Programmability", Tata McGraw Hill, Third Edition, 2016.*

REFERENCE

1. *David E Culler, Jaswinder Pal Singh and Anoop Gupta, "Parallel Computer Architecture - A Hardware / Software approach", Morgan Kaufman, New Delhi, 2000.*

19ITE03 - ADVANCED OPERATING SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe process synchronization and Distributed Mutual Exclusion Algorithms.*

CO2 : *Knowledge in deadlock detection and agreement protocols of Distributed operating systems.*

CO3 : *Understanding of various distributed resource management techniques.*

CO4 : *Knowledge in process synchronization, processor scheduling and memory management of multiprocessor systems.*

CO5 : *Identify the different types of real time scheduling.*

DISTRIBUTED CLOCK AND PROCESS SYNCHRONIZATION

Introduction - Issues - Communication Primitives - Inherent Limitations - Lamport's Logical Clock - Vector Clocks - Causal Ordering - Global State. Distributed Mutual Exclusion: Classification of Mutual Exclusion Algorithms - Non-Token Based Algorithms - Lamport's Algorithm - Ricart-Agrawala Algorithm - Token-Based Algorithms - Suzuki-Kasami's Broadcast Algorithm - Singhal's Heuristic Algorithm - Raymond's Tree based Algorithm. **(9)**

DISTRIBUTED DEADLOCK DETECTION

Introduction - Handling Strategies - Issues - Centralized Deadlock Detection Algorithms Distributed Deadlock Detection Algorithms - Hierarchical Deadlock Detection Algorithms - Agreement Protocols - Classification - Solutions - Applications. **(9)**

DISTRIBUTED RESOURCE MANAGEMENT

Distributed File systems: Architecture - Mechanisms - Design Issues - Distributed Shared Memory: Architecture - Algorithms - Memory Coherence - Protocols - Design Issues - Distributed Scheduling: Issues in Load Distributing - Components - Algorithms. **(10)**

MULTIPROCESSOR OPERATING SYSTEMS

Introduction - Structures - Design Issues - Threads - Process Synchronization - Processor Scheduling - Memory Management: Mac Operating System. **(8)**

REAL TIME OPERATING SYSTEMS

Characteristics of Real Time Systems - Safety and Reliability - Types of Real Time Tasks - Timing Constraints - Modeling Timing Constraints Real Time Task Scheduling: Characteristics - Classification - Clock Driven Scheduling - Event Driven Scheduling - Hybrid Schedulers - Earliest Deadline First Scheduling - Rate Monotonic Algorithm. **(9)**

TOTAL: 45

TEXT BOOKS

1. *Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw- Hill Edition, 2001.*

2. *Rajib Mall, "Real Time Systems: Theory and Practice", Pearson Education, 2009.*

REFERENCES

1. *Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", 8th Edition, John Wiley & Sons Incorporated, 2009.*

2. *Pradeep K.Sinha,"Distributed Operating System-Concepts and Design", PHI, 2003.*

3. *Andrew S.Tanenbaum, "Distributed Operating System", Pearson Education, 2003.*

19CIE02 - BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the basics of big data analytics and exposure to state-of-the-art data analytic tools and techniques.*

CO2 : *Apply appropriate Map Reduce Logic for solving computational problems.*

CO3 : *Demonstrate Big data analytics using Hadoop and related tools such as Pig, HBase.*

CO4 : *Acquire knowledge on fundamental techniques and principles in data stream analytics.*

BIG DATA

Introduction to Big Data concepts: divide-and-conquer, parallel algorithms, distributed virtualized storage, distributed resource management, orchestration and scheduling, lambda architecture, data flow paradigm, real-time event processing. Big data characteristics - Data in the Warehouse and Hadoop - Big Data Use Cases- Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - Map Reduce and YARN   **(6)**

MAPREDUCE

MapReduce (MR) basics: Functional Programming Roots, Mappers and Reducers, The Execution Framework, Partitioners and Combiners , MR algorithm design: Local Aggregation, Pairs and Stripes, Computing Relative Frequencies, Secondary Sorting, Relational Joins ,Inverted Indexing for Text Retrieval: Web Crawling, Inverted Indexes - Baseline and Revised Implementation   **(12)**

HADOOP ECOSYSTEM

Hadoop distributed file system: HDFS Concepts, Hadoop File systems, Data Flow, Parallel Copying with distcp. PIG: Pig Latin, User defined functions, Data processing operators, HBASE: HBase data model, Installation, Clients, Examples, HBase Vs RDBMS.   **(10)**

MINING DATA STREAMS

The stream data model - Sampling data streams - Filtering Streams- counting distinct elements in a stream - Estimating moments- Counting ones in a window- Decaying Windows.   **(9)**

GRAPH ALGORITHMS

Graph Representations - Parallel Breadth - First Search- PageRank - Efficient Computation of PageRank- Topic-Sensitive PageRank - Link Spam- Hubs and Authorities- Issues with Graph Processing.   **(8)**

TOTAL : 45

TEXT BOOKS

1. *Jimmy Lin and Chris Dyer, "Data Intensive Text Processing using MapReduce", Morgan and Claypool Publishers, USA, First Edition, 2010. (MapReduce, Graph Algorithms)*

2. *Tom White, "Hadoop: The Definitive Guide", O`Reilly Publishers, USA, Third Edition, 2012. (Hadoop ecosystem)*

3. *Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2012. (Mining Data Streams, Graph Algorithms)*

REFERENCES

1. *Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.*

2. *Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, First Edition, 2012.*

3. *Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis",Elsevier, First Edition, 2007.*

4. *Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.*

5. *David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.*

19CIE03 - BIOINFORMATICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Description of fundamental concepts in molecular biology and genomics.*

CO2 : *Analyse gene sequences using appropriate sequence alignment methods.*

CO3 : *Illustrate the structure of protein, its classification, functions and the steps in drug discovery and development.*

CO4 : *Demonstrate the usage of sequence alignment tools and bioinformatics search engines to retrieve data.*

INTRODUCTION TO BIOINFORMATICS

Introduction- Historical overview- Definition-Applications- Major Databases- Data management & Analysis - Molecular Biology and Bioinformatics - Central Dogma of Molecular Biology.

Information search & data retrieval : Introduction, Tools for Web Search, Data Retrieval Tools and Data Mining of Biological Databases. **(8)**

GENOME ANALYSIS IDENTIFICATION AND PREDICTION

Introduction - Genome Analysis - Genome Mapping - The Sequence Assembly Program - Cloning the entire Genome - Genome Sequencing - The Human Genome Project.

Gene identification & prediction : Basis of Gene Prediction, Pattern Recognition, Gene Prediction Methods. **(10)**

ALIGNMENTS AND PHYLOGENETIC TREES

Introduction to Sequence Alignment - The dotplot - Dotplots and Sequence Alignments - Measures of Sequence similarity - Computing the Alignment of two sequences - The dynamic programming algorithm Signature of alignments - Multiple sequence alignment - Applications - Phylogeny - Phylogenetic trees. **(10)**

PROTEIN STRUCTURE AND DRUG DISCOVERY

Protein Stability and Folding - Applications of Hydrophobicity - Superposition of structures - DALI - Evolution of Protein Structures - Classification of Protein Structures - Protein Structure prediction and modeling - Assignment of protein structures to genomes - Prediction of protein function - Drug discovery **(10)**

TOOLS IN BIOINFORMATICS

Sequence Alignment Tools : FASTA - BLAST - CLUSTAL.Accessing Database Archives: ENTREZ -ExPASy-SRS-Ensembl.

(7)

TOTAL : 45

TEXT BOOKS

1. *Rastogi. S. C, Mendiratta. N and Rastogi. P. Bioinformatics Methods and Applications : Genomics, Proteomics and Drug Discovery, Prentice-Hall of India Pvt. Ltd., 4th Edition, 2013.*

2. *Arthur M Lesk, "Introduction to Bioinformatics", Oxford University Press, India, Fourth Edition, 2013. (Alignments And Phylogenetic Trees, Protein Structure And Drug Discovery, Tools In Bioinformatics)*

REFERENCES

1. *Jin Xiong, "Essential Bioinformatics", Cambridge University Press, 2006.*

2. *Affward T.K., Parry Smith D.J., "Introduction to Bioinformatics:, Pearson Education, Reprint, 2007.*

3. *Dr. Zhumur Ghosh, Dr. Bibekanand Mallick, "Bioinformatics. Principles and Application", Oxford University Press, India, Reprint, 2008.*

19CIE04 - BLOCK CHAIN TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand and apply the fundamentals of Cryptography in Cryptocurrency*

CO2 : *Gain knowledge about various operations associated with the life cycle of Blockchain and Cryptocurrency*

CO3 : *Deal with the methods for verification and validation of Bitcoin transactions*

CO4 : *Demonstrate the general ecosystem of several Cryptocurrency*

CO5 : *Educate the principles, practices and policies associated Bitcoin business*

INTRODUCTION TO CRYPTOGRAPHY & CRYPTOCURRENCIES

Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. **(7)**

BLOCK CHAIN

Decentralization-Centralization vs. Decentralization-Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets. **(10)**

MECHANICS OF BITCOIN

Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin

network, Limitations and improvements. The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies, Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash **(10)**

BITCOIN AS A PLATFORM

Bitcoin as an Append only Log, Bitcoins as "Smart Property", Secure Multi Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source-Prediction Markets and Real World Data Feeds. **(8)**

ALTCOINS AND THE CRYPTOCURRENCY ECOSYSTEM

Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and

Altcoins, Merge Mining-Atomic Cross chain Swaps-6 Bitcoin Backed Altcoins, "Side Chains", Ethereum and Smart Contracts., Recent Trends & applications **(10)**

TOTAL: 45

TEXT BOOK

1. *Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S, Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press., 2016.*

REFERENCES

1. *Antonopoulos, A. M, Mastering Bitcoin: unlocking digital cryptocurrencies. "O'Reilly Media, Inc.", 2014.*

2. *Franco, P. Understanding Bitcoin: Cryptography, engineering and economics. John Wiley & Sons, 2014.*

19CIE05 - CLOUD AND VIRTUALIZATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1   :   *Knowledge on the basics of cloud computing and various services deployed from a cloud architecture supported by different providers.*

CO2   :   *Understand the concepts of virtualization and virtual machines and to explore the types of virtualization.*

CO3   :   *Ability to configure and setup cloud and virtual environments and identify security challenges and manage risks.*

CO4   :   *Critically analyze case studies to derive the best practice model for cloud and virtualization based applications.*

INTRODUCTION

Evolution of Cloud Computing -System Models for Distributed and Cloud Computing - NIST Cloud Computing Reference Architecture -IaaS - On-demand Provisioning - Elasticity in Cloud - Examples of IaaS Providers - PaaS - Examples of PaaS Providers - SaaS - Examples of SaaS Providers - Public , Private and Hybrid Clouds - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus **(9)**

VIRTUALIZATION

Basics of Virtual Machines - Process Virtual Machines - System Virtual Machines - Emulation - Interpretation - Binary Translation - Taxonomy of Virtual Machines. Virtualization -Management Virtualization -- Hardware Maximization - Architectures - Virtualization Management - Storage Virtualization - Network Virtualization. **(9)**

VIRTUALIZATION INFRASTRUCTURE

Comprehensive Analysis - Resource Pool - Testing Environment -Server Virtualization - Virtual Workloads - Provision Virtual Machines -Desktop Virtualization - Application Virtualization - Work with AppV - Mobile OS for smart phones - Mobile Platform Virtualization - Collaborative Applications for Mobile platforms. **(8)**

COMPUTER CLUSTERS FOR SCALABLE PARELLEL COMPUTING

Clustering for Massive Parallelism: Development Trends - Objectives - Fundamentals Cluster Design Issues - Computer Clusters and MPP Architectures: Cluster Organization and Resource Sharing - Node Architectures and MPP Packaging - Cluster System Interconnects - Hardware, Software and Middleware Support - GPU Clusters for Massive parallelism - Cluster Job and Resource Management: Scheduling Methods - Management Systems - Load Sharing Facility for Cluster Computing. **(10)**

CLOUD INFRASTRUCTURE AND SECURITY

Architectural Design of Compute and Storage Clouds - Inter Cloud Resource Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources - Security Overview - Cloud Security Challenges - Software as a Service Security - Security Governance - Risk Management - Security Monitoring - Security Architecture Design - Data 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.   *Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.*

3. *Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.*

4. *John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.*

REFERENCES

1. *Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.*

2. *Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner's Guide", McGraw-Hill Osborne Media, 2009.*

3. *Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.*

19ITE04 - CUSTOMER RELATIONSHIP MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 type of collecting and connecting the customer data with proper guidelines for privacy.*

CO4 : *Demonstrate the scoring process and apply the various CRM optimization techniques to optimize CRM process in order to improve customer profitability.*

CO5 : *Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.*

INTRODUCTION

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. **(9)**

BUILDING THE BUSINESS CASE

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. **(10)**

COLLECTING CUSTOMER DATA

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. **(8)**

SCORING YOUR CUSTOMER

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. **(8)**

OVERVIEW OF DATA MINING AND CRM TOOL MARKETS

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. **(10)**

TOTAL : 45

TEXT BOOKS

1. *Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.*

2. *Ian H.Witten ,Eibe Frank, Mark A.Hall, "Data Mining Practical Machine Learning Tools and Techniques", Morgan Kaufmann, Fourth Edition, 2016.*

REFERENCES

1. *Francis Buttle, Stan Maklan "Customer Relationship Management: Concepts and Technologies", Routledge, Fourth Edition, 2019.*

2. *Roger J. Baran, Robert J. Galka, "CRM: The Foundation of Contemporary Marketing Strategy", S.Chand (G/L) & Company Ltd, Second Edition, 2017.*

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*

19ITE06 - DATA COMMUNICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Gain knowledge on different analog and digital transmission techniques.*

CO2 : *Demonstrate various multiplexing schemes such as TDM, FDM, WDM, Spread spectrum and compare the main categories of transmission media and Switching.*

CO3 : *Knowledge on various error detection and correction mechanisms and their application for maintaining data accuracy.*

CO4 : *Gain exposure to the basics of wired communication and technologies involved in it.*

CO5 : *Ability to understand wireless communication and its evolutions.*

ANALOG AND DIGITAL TRANSMISSION

Overview of analog and digital signals - Transmission impairments - Data Rate Limits - Performance - Digital coding Schemes: Line Coding, Block Coding.

Modulation Schemes: Pulse-code modulation, Delta modulation, Amplitude-shift keying modulation, Frequency-shift keying, Phase-shift keying modulation, Quadrature amplitude modulation , Amplitude modulation, frequency modulation, Phase modulation. **(12)**

BANDWIDTH UTILIZATION AND SWITCHING

Multiplexing: Frequency-Division, Wavelength-Division, Time-Division Multiplexing - Spread Spectrum: Frequency Hopping Spread spectrum, direct sequence Spread spectrum. Transmission Media: Guided, Unguided Media - Switching: Circuit Switching, Packet Switching - Space division switches, Time division switches. **(8)**

ERROR DETECTION AND CORRECTION

Types of Errors - Block Coding: Hamming distance, Parity Check code - Cyclic Codes: Cyclic Redundancy Check - Checksum: One's Complement addition - Forward Error Correction. **(9)**

WIRED COMMUNICATION

Telephone Networks: Components, LATAs, Signaling, SS7, Dial-up Service, Digital Subscriber Line - Cable TV Networks - SONET: Architecture, STS-1 Frame Format - ATM: Architecture, Cell format. **(9)**

WIRELESS COMMUNICATION

Cellular Telephony: Operations, First generation (1G): AMPS-Second generation (2G): GSM, IS-95-Third generation (3G): IMT-2000-Introduction to 4G - Satellite Communications: Operations, GEO, MEO, LEO Satellite Systems. **(7)**

TOTAL : 45

TEXT BOOK

1. *Behrouz A Forouzan, "Data Communication & Networks", McGraw Hill, 5th Edition, 2017*

REFERENCES

1. *William Stallings, "Data & Computer Communications", Pearson Education, 8th Edition, 2013.*

2. *Wayne Tomasi , "Introduction to Data Communications and Networking", Pearson, 1st Edition, 2009.*

19CIE06 - DIGITAL FORENSICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Acquire knowledge on the Computer Forensics fundamentals.*

CO2 : *Familiarize with evidence collection and analysis procedures and ability to deploy in practice.*

CO3 : *Gain knowledge on the investigative measures, surveillance tools and information act*

INTRODUCTION TO COMPUTER FORENSICS

Computer Forensics Fundamentals - Types of Computer Forensics Technology - Types of Computer Forensics Systems - Types of Vendor and Computer Forensics Services. **(9)**

CYBER CRIME INVESTIGATION AND EVIDENCE

Introduction to Cyber Crime Investigation - Evidence collection and data seizure: Collection options - Types of evidence - Rules of evidence - Duplication and preservation of digital evidence - Documentation and Reporting. **(9)**

COMPUTER FORENSICS ANALYSIS

Discovery of electronic evidence - E-Discovery - Identification of data - Data Recovery Tools and Procedures - Importance of Log Analysis in forensic analysis - Storage Formats for Digital Evidences - Performing RAID data acquisitions. **(9)**

INTRUSION DETECTION

Network forensics scenario, Network vs. Host based detection - Network based and host based intrusion detection systems: Architecture - Detection engine - Benefits and challenges, Detection mechanism, Signatures, Traffic analysis, Intrusion detection **(9)**

SURVEILLANCE AND IT-ACT

The Information Warfare Arsenal of the Future - Surveillance Tools for Information Warfare of the Future - IT Act: Concepts - Sections, Digital laws and legislation, Basics of Indian evidence act: IPC - CrPC. **(9)**

TOTAL : 45

TEXT BOOKS

1. *John R. Vacca, "Computer forensics: Computer Crime Scene Investigation", Second Edition, Charles River Media, Firewall, 2015.*

2. *Paul E Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall, USA, 2007.*

3. *Vivek Sood, "Cyber Law Simplified", Tata McGraw Hill, New Delhi, 2008.*

REFERENCES

1. *Warren G Kruse II and Jay G Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, USA, 2010.*

2. *Eogen Casey, "Digital Evidence and Computer Crime", Elsevier, USA, 2011.*

3. *Chad Steel, "Windows Forensics: The Field Guide for Conducting Corporate Computer Investigations" Wiley India, 2006.*

19ITE07 - DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Classify the fundamental process of image processing.*

CO2 : *Apply image transformation in spatial and frequency domain.*

CO3 : *Evaluate the methodologies for image segmentation, restoration and apply various compression techniques as per the requirement*

CO4 : *Demonstrate the working of image segmentation algorithms.*

IMAGE FUNDAMENTALS

Introduction to Digital image Processing - Fundamental steps in Image processing -components of Digital Image processing systems. Reading, Storing and Displaying Elements Using MATLAB-Elements of Visual perception - Sampling and Quantization - Basic relationships between pixels **(8)**

IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN

Basic intensity transformation functions - Histogram Equalization - Histogram Matching - Gray level transformations and Histogram plotting using MATLAB - Fundamentals of spatial filtering - Smoothing spatial filters - sharpening spatial filters - use of first and second derivatives for enhancement. **(9)**

IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN

Fourier transforms and frequency domain: one dimensional Fourier transforms and its inverse - Two Dimensional Discrete Fourier Transform (DFT) and its inverse -Computing and Visualizing 2D DFT using MATLAB- Basics of filtering in the frequency domain - correspondence between filtering in the spatial and frequency domain - Fast Fourier transform (FFT). Smoothing frequency domain filters: Gaussian low pass filters. Sharpening frequency domain filters: Gaussian high pass filters. **(10)**

IMAGE RESTORATION AND COMPRESSION TECHNIQUES

Image Restoration: Noise models: spatial frequency properties of noise - Important noise probability Density Functions. Periodic Noise Reduction: Band pass filters. Image Compression: Fundamentals: Coding Redundancy- spatial and temporal redundancy - Measuring Image information - Fidelity criteria - image compression models - image compression standards - Run length Coding - Block transform coding - Color image processing : Color fundamentals - Color models (RGB, HSI, CMY & CMYK) **(10)**

IMAGE ANALYSIS

Image segmentation: Edge linking and boundary detection - Thresholding -Region-based segmentation - use of motion in segmentation. Image representation and description: Representation schemes: Border Following - chain codes -Boundary descriptors, Regional descriptors: Simple descriptors - topological descriptors - Texture **(8)**

TOTAL: 45

TEXT BOOKS

1. *Rafael C.Gonzalez, Richard E.Woods, "Digital Image Processing", Pearson, Fourth Edition, 2018.*

2. *Rafael C.Gonzalez, Richard E.Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, Tata McGraw Hill, 2010 (Reading, Storing and Displaying Elements Using MATLAB, Computing and Visualizing 2D DFT using MATLAB).*

REFERENCES

1.   Jahne Bernd, "Digital Image Processing", Springer-Verlag Berlin Heidelberg, Sixth Revised and Extended Edition 2009.

2.   Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, New Delhi, First Edition, 2015.

3.   William. K.Pratt, "Digital Image Processing", John Wiley, New York, Fourth Edition, 2006.

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*

19CIE08 - GRAPH THEORY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Knowledge about Graph Theoretical Concepts.*

CO2 : *Familiarize with Special types of Graphs for Modelling and analysing real-world complex networks.*

CO3 : *Ability to Deploy Graph Colouring Techniques to solve topological problems.*

CO4 : *Knowledge in solving Combinatorial Optimization and Geometrical problems using Graph Theoretic approaches.*

CO5 : *Relate Graph Theory Algorithms in their respective field of Engineering.*

FOUNDATIONS

Foundations: Graphs - Paths - Cycles and Trails - Vertex Degrees and Counting - Directed Graphs. Trees and Distances: Properties - Spanning Trees and Enumerations - Optimization and Trees. **(8)**

MATCHING AND FACTORS

Matching and Factors: Matching and Covers - Bipartite Graphs Matching - Matching in General Graphs. **(5)**

PATHS CONNECTIVITY AND GRAPH COLORING

Paths and Connectivity: Cuts and Connectivity - k-Connected Components - Network Flow Problems. Graph Coloring: Vertex Colouring and its Upper Bound Analysis - k-chromatic graph structures and Enumerative aspects of Graph Colouring. **(10)**

PLANAR GRAPHS

Planar Graphs: Embedding - Properties of Planar Graphs and Planarity Parameters. **(6)**

EDGES AND CYCLES

Line Graphs and Edge - colouring - Hamiltonian cycles - Planarity graphs - Coloring and Cycles: Taits Theorem - Grinberg's Theorem. **(6)**

MATROIDS AND EIGEN VALUES OF GRAPHS

Matroids: Properties- The Span function-The Dual of a Matroid. Eigen Values of Graphs: Characteristic Polynomial-Linear Algebra of Real Symmetric Matrices- Eigen Values and Graph Parameters - Eigen Values of Regular Graph. **(10)**

TOTAL : 45

TEXT BOOK

1. *Douglas. B. West," Introduction to Graph Theory", Pearson Education, Second Edition, reprint 2017.*

REFERENCES

1. *Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications, First Edition, 2016.*

2. *Reinhard Diestel, "Graph Theory", Springer Publications, 4th Edition, 2010.*

3. *Bondy. J.A. and Murthy. U.S. R, "Graph Theory with Applications", Elsevier science ltd / North - Holland 1976.*

19CIE09 - GRAPHICS AND MULTIMEDIA SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Demonstrate the working of graphics output primitive algorithms, clipping algorithms and apply two dimensional geometric transformations.*

CO2 : *Illustrate three dimensional object representation, transformations and concepts involved in spline representation.*

CO3 : *Describe the Multimedia concepts, its architecture and its real world applications.*

CO4 : *Ability to understand the importance of various multimedia applications.*

CO5 : *Analyze various compression techniques for the efficient transmission of Multimedia data.*

GRAPHICS PRIMITIVES, 2D TRANSFORMATION AND VIEWING

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. **(9)**

3D CONCEPTS, TRANSFORMATION AND VIEWING

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. **(9)**

MULTIMEDIA SYSTEM DESIGN

Elements - Applications - Multimedia system architecture - Evolving technologies for Multimedia system - Defining objects - Multimedia Data Interface standards - Multimedia databases. **(9)**

COMPRESSION AND DECOMPRESSION

Need for Data Compression - Types - Binary Image Compression Schemes - Color, Gray Scale and Still Video Image Compression -Video Image Compression - Audio Compression. **(9)**

MULTIMEDIA APPLICATIONS

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. **(9)**

TOTAL : 45

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)*

REFERENCES

1. *Steve Harrington, "Computer Graphics - A Programming Approach", McGraw Hill Book Co., Second Edition, 2007.*

2. *John F.Koegal Buford, "Multimedia System", Pearson Education Limited, Reprint 2008.*

3. *Ranjan Parekh, "Principles of Multimedia", Tata McGraw Hill, Second Edition, 2013.*

19ITE08- HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the importance and need for effective user-friendly Graphical User Interfaces (GUI)*

CO2 : *Understand the importance of Human Characteristics and Business Functions*

CO3 : *Understand the principles of good screen design*

CO4 : *Understand the characteristics and guidelines of Device-Based, Screen-Based Controls, Icons and Images*

CO5 : *Understand the different types of user-interface specification methods and interface building tools*

INTRODUCTION

Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design. **(9)**

THE GRAPHICAL USER INTERFACE & DESIGN PROCESS

GUI: Popularity of graphics-The concept of direct manipulation-Graphical system -Characteristics-Web user-Interface Popularity-Characteristics and Principles of User Interface.

Design process: Human Interaction with computers- Importance of Human Characteristics- Human Consideration- Human Interaction Speeds and Understanding Business Junctions. **(9)**

SCREEN DESIGNING

Design Goals- Screen Planning and Purpose- Organizing Screen Elements- Ordering of Screen Data and Content- Screen Navigation and Flow- Visually Pleasing Composition- Amount of Information- Focus and Emphasis- presenting Information Simply and Meaningfully- Information retrieval on web- Statistical Analysis -Technological considerations in Interface Design. **(11)**

WINDOWS & COMPONENTS

Windows: New Navigation Schemes-Selection of Window-Selection of Devices Based on Screen Based Controls. Components: Text and Messages- Icons and Increases - Multimedia-Colors - Uses -Problems-Choosing colors. **(9)**

SOFTWARE TOOLS AND INTERACTION DEVICES

Specification Methods- Interface Building Tools- Keyboard and Function Keys- Pointing Devices Speech Recognition. **(7)**

TOTAL: 45

TEXT BOOKS

1. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.

2. Ben Schneiderman, "Designing the User Interface", Sixth Edition, Pearson Education Asia, 2019.

REFERENCE

1. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition,2004.

19ITE09 - INFORMATION RETRIEVAL

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the concepts, architecture, characteristics of Information retrieval and search engines*

CO2 : *Apply the traditional IR models for searching text to acquire useful information*

CO3 : *Apply various indexing techniques and querying operations to speed up the task of matching documents to queries.*

CO4 : *Choose suitable classification and clustering algorithms for retrieval of valuable information from web documents.*

CO5 : *Use searching and ranking techniques of various IR models to rank the documents retrieved from heterogeneous information repositories*

INTRODUCTION

Motivation - Basic Concepts - Practical Issues - Retrieval Process - Architecture - Boolean Retrieval -Retrieval Evaluation -Open Source IR Systems-History of Web Search - Web Characteristics-The impact of the web on IR-IR Versus Web Search-Components of a Search engine. **(9)**

MODELING

Taxonomy and Characterization of IR Models - Boolean Model - Vector Model - Term Weighting - Scoring and Ranking -Language Models - Set Theoretic Models - Probabilistic Models - Algebraic Models - Structured Text Retrieval Models - Models for Browsing. **(9)**

INDEXING

Static and Dynamic Inverted Indices - Index Construction and Index Compression Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages-Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis - Measuring Effectiveness and Efficiency. **(9)**

CLASSIFICATION AND CLUSTERING

Text Classification and Naïve Bayes - Vector Space Classification - Support vector machines and Machine learning on documents. Flat Clustering - Hierarchical Clustering -Matrix decompositions and latent semantic indexing - Fusion and Meta learning. **(9)**

SEARCHING AND RANKING

Searching the Web - Structure of the Web -IR and web search - Static and Dynamic Ranking - Web Crawling and Indexing - Link Analysis - XML Retrieval Multimedia IR: Models and Languages - Indexing and Searching Parallel and Distributed IR - Digital Libraries. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Ricardo Baeza - Yates, Berthier Ribeiro - Neto, "Modern Information Retrieval: The concepts and Technology behind Search", Addison Wesley, Second Edition, 2011.*

2. *Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2012. (Classification and Clustering)*

.

REFERENCES

1. *Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010.*

2. *Bruce Croft, Donald Metzler and Trevor Strohman, "Search Engines: Information Retrieval in Practice", Addison Wesley, First Edition, 2010.*

19CIE10 - INFORMATION SECURITY

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Identify and analyze the security threats and attacks and apply device suitable security policies and standards.*

CO2 : *Assess the risks and apply suitable risk control strategies.*

CO3 : *Understanding of Information Security Policies, Standards and Blue print.*

CO4 : *Employ appropriate intrusion detection and prevention systems to ensure information security.*

CO5 : *Discuss various national and international laws of information security and its framework.*

INTRODUCTION, NEED, ETHICAL AND PROFESSIONAL ISSUES

Introduction to Information Security - The History of Information Security- Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction - Business Needs First -Threats -Attacks. Ethics and Information Security - Codes of Ethics and Professional Organizations.**(7)**

RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Documenting Results - Recommended Practices in Controlling Risk. **(6)**

POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and its controls - NIST Security Models - Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies **(9)**

SECURITY TECHNOLOGY : INTRUSION DETECTION, ACCESS CONTROL AND SECURITY TOOLS

Introduction - Intrusion Detection and Prevention Systems: IDPS - Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools - Access Control Devices - Physical Security - Security and Personnel **(11)**

BIOMETRIC CONTROLS

Biometrics - Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods. **(4)**

SECURITY OF WIRELESS NETWORKS

Attacks on Wireless Networks: Other Security Risks in Wireless Networks - Management and Mitigations for Wireless Networks Attacks. **(3)**

LAWS AND LEGAL FRAMEWORK

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security: A Conceptual Framework - The Indian IT Act - Laws for Intellectual Property Rights (IPR) - Health Insurance Portability and Accountability Act (HIPAA) -Gramm-Leach-Bliley Act (GLBA) - Overview of Sarbanes-Oxley (SOX) - Building Security into Software/System Development Life Cycle. **(5)**

TOTAL : 45

TEXT BOOKS

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Sixth Edition, 2017.

2. Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, Second Edition, 2017. (Biometric Controls, Security of Wireless Networks, Laws and Legal Framework)

REFERENCES

1. Thomas R.Peltier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.

2. Micki Krause and Harold F.Tipton, "Information Security Management Handbook", Auerbach Publications, Sixth Edition,2008.

3. Mark Merkow and Jim Breithaupt," Information Security - Principles & Practices", Second Edition,Pearson Education, 2014.

19CIE11 - INFORMATION STORAGE MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe Data Centre Infrastructure, various storage technologies and disk performance*

CO2 : *Discuss Intelligent Storage Systems, Analyze and implement RAID solutions.*

CO3 : *Analyze Storage Attached Networks and Network Attached Storage technologies and identify suitable solutions for practical applications.*

CO4 : *Describe Content Addressed Storage and storage virtualization techniques.*

CO5 : *Compare different backup, restoration and replication methods and select suitable solutions to ensure business continuity.*

INTRODUCTION TO STORAGE TECHNOLOGY

Information Storage - Evolution of Storage Technology and Architecture - Data Centre Infrastructure - Key challenges in Managing Information - Information Lifecycle. Storage System Architecture: Component Storage System Environment - Disk Drive Components and Performance - Laws Governing Disk Performance - Logical Components of Host - Application Requirement and Disk performance. **(7)**

DATA PROTECTION AND INTELLIGENT STORAGE SYSTEMS

Implementation of RAID - RAID Array Components - RAID levels - RAID Comparison - RAID impact on Disk Performance - Hot Spares - Component of an Intelligent Storage System - High - end Storage Systems - Midrange Storage System. **(6)**

DIRECT ATTACHED STORAGE AND SCSI

Directly Attached Storage and Introduction to SCSI: Types of DAS - DAS benefits and limitations - Disc Drive Interfaces - Introduction to parallel SCSI - SCSI Command Model **(4)**

SAN AND NAS

Storage Area Networks : Fibre Channel overview - The SAN and its evolution - Components of SAN - FC Connectivity - Fibre Channel Ports - Fibre Channel Architecture- Zoning - Fibre Channel Login Types - FC Topologies

Network Attached Storage : General Purpose Servers vs NAS devices - Benefits of NAS - NAS file I/O- Components of NAS-NAS Implementation - NAS File Sharing Protocols - NAS I/O operations - factors affecting NAS performance and availability. **(9)**

IP SAN, CONTENT ADDRESSED STORAGE AND STORAGE VIRTUALIZATION

IPSAN : iSCSI - FCIP - Content Addressed Storage: fixed content and archives - types of archives - features and benefits of CAS - CAS Architecture

Storage Virtualization : overview- Forms of Virtualization- Storage Virtualization Challenges- Types of storage Virtualization.**(10)**

INFORMATION AVAILABILITY AND MONITORING

Introduction to Business Continuity - Information Availability - BCTerminology - Failure Analysis - Backup and Recovery -Backup Purpose - Backup Consideration - Backup - Granularity - Methods - Backup and Restore operations - Local Replication - source and target - uses of local replica - Data Consistency - Local Replication Technologies - Restore and Restart consideration - Creating Multiple replicas - Remote replication - Modes of remote Replication - Remote replication Technology - Network infrastructure. **(9)**

TOTAL : 45

TEXT BOOK

1. *EMC2 Corporation, "Information Storage and Management", Wiley, Second Edition, 2012.*

REFERENCE

1. *Robert Spalding, "Storage Network - The Complete Reference", Tata McGraw Hill, Osborne, First Edition, 2017.*

19CIE12 - INFORMATION THEORY AND CODING

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Gain insight on the fundamentals of probability, essential parameters of information theory and employ it in source coding and channel coding techniques to compute various operational parameters.*

CO2 : *Identify and devise error detecting and error correcting capabilities of the code and sketch the encoder configurations.*

CO3 : *Determine the final code word by choosing the suitable text compression technique for the given scenario and discuss various kinds of speech compression techniques.*

CO4 : *To analyze image and audio compression techniques and infer about the encoding and decoding of digital data streams.*

CO5 : *To understand the principles of video compression techniques and the various standards associated with them.*

FUNDAMENTALS OF INFORMATION THEORY

Uncertainty - Information and Entropy - Information rate - conditional and Joint entropies - Mutual information.

Source Coding : Prefix codes - Kraft McMillan Inequality.

Entropy Coding : Source Coding Theorem - Shannon - Fano Coding - Static Huffman Coding.

Channel Coding : Discrete Memory less Channel - Channel models - Cascaded channels - Channel capacity - Channel coding theorem - Information capacity theorem. **(10)**

ERROR CONTROL CODING

Linear Block codes: Introduction to Error Control Coding- Basic Definitions- Matrix description of linear block codes - Decoding of Linear Block codes - Syndrome decoding.

Cyclic codes: Generator polynomial - Parity check polynomial - Encoder of cyclic codes - Calculation of syndrome.

Convolution codes: Introduction - Code Tree, Trellis, State diagram - Encoding - Decoding: Feedback decoding, Sequential decoding and Viterbi algorithm. **(12)**

TEXT AND SPEECH COMPRESSION

Text Compression : Dynamic Huffman Coding - Arithmetic coding - Adaptive Dictionary: LZ77-LZ78 - LZW- Subband Coding : The Basic Subband Coding Algorithm - Speech Compression : Channel Vocoder - Linear Predictive Coder - Code excited Linear Prediction- Mixed Excitation Linear Prediction -Wideband Speech Compression : ITU-T G.722.2 **(9)**

IMAGE AND AUDIO COMPRESSION

Lossless Image Compression: CALIC- JPEG-LS.

Wavelet -based Image Compression: Embedded Zero Tree Coder - Set Partitioning in Hierarchical Trees- JPEG 2000 - Audio compression : MPEG Audio Coding -- Dolby AC-3 **(9)**

VIDEO COMPRESSION

Motion Compensation - H.261 - MPEG-1 Video Standard - MPEG-2 Video Standard- H.264 **(5)**

TOTAL : 45

TEXT BOOKS

1. *Ranjan Bose, "Information Theory, Coding and Cryptography", Tata McGraw Hill, Second Edition, Eighth Reprint, 2010.*

2. *Khalid Sayood, "Introduction to Data Compression", Elsevier, Fourth Edition, 2012.*

REFERENCES

1. *Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Limited, Fourth impression, 2009.*

2. *Todd K.Moon, "Error Correction Coding: Mathematical Methods and algorithms", John Wiley & Sons, First Edition, 2005.*

19CS62 - MACHINE LEARNING

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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

TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", PHI Learning Pvt. Ltd Third edition, 2015, ISBN: 978-8120350786. (Introduction, Baysian Decision Theory , Dimensionality Reduction, Multilayer Perceptron)

2. Zhi-Hua Zhou,"Ensemble Methods:Foundations and Algorithms", A Chapman & Hall Book, CRC Press, 2012. (AdaBoost Algorithm, Bagging Algorithm, Random Tree Ensembles)

3. Tom Mitchell, "Machine Learning", McGraw-Hill, First Edition, 2017, ISBN: 978-1259096952. (Concept Learning And Decision Tree Learning , Reinforcement Learning)

4. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press, Second Edition, 2018, ISBN 978-0262039406 (Convolution Networks)

REFERENCES

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman Hall/CRC Second Edition, 2014, ISBN: 978-1466583283

2. Stuart Russel and Peter Norwig, "Artificial Intelligence A modern approach ",Pearson Education India; Edition (2015), ISBN 978-9332543515

3. https://www.dropbox.com/s/j2pjnybkm91wgdf/visual_notes.pdf?dl=0 (Convolution Networks)

4. https://indoml.com/2018/03/07/student-notes-convolutional-neural-networks-cnn-introduction/(Convolution Networks)

19ITE10 - MULTI-AGENT INTELLIGENT SYSTEM

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Gain Introductory knowledge about building Multi-agents*

CO2 : *Knowledge about how Agents reach Agreements*

CO3 : *Familiarize the methodologies of Competitive and Cooperative Interactions*

CO4 : *Exposure in the Logics of Agent Communication Languages*

CO5 : *Know the applications of Agent Technology*

INTRODUCTION

Introduction to agent and multi agent systems-Environments - Intelligent Agents - Agents and Objects - Agents and Expert Systems - Agents as Intentional Systems - Abstract Architectures for Intelligent Agents. **(8)**

DEDUCTIVE REASONING AGENTS

Agents as Theorem Provers - Agent -Oriented Programming - Practical Reasoning Agents: Deliberation - Means-Ends Reasoning - Implementing a Practical Reasoning Agent - The Procedural Reasoning System. **(10)**

REACTIVE AND HYBRID AGENTS

Brooks and the Subsumption Architecture -Situated Automata - The Agent Network architecture-The Limitations of Reactive Agents - Hybrid Agents: Touring Machines. **(6)**

COMMUNCATION AND COOPERATION

Ontology Fundamentals, Ontology languages, XML, OWL .Agent Communication Languages, KQML, FIPA, JADE. Cooperative Distributed Problem Solving, Task Sharing and Result Sharing, Combining Task and Result Sharing. Coordination - Coordination through partial global planning, Coordination through joint intentions, coordination by mutual modelling, coordination by norms and social laws, multi agent planning and synchronization. **(12)**

DECISION MAKING

Multi agent interactions-Utilities and preferences, Dominant Strategies, Nash Equilibria , Pareto Efficiency , Competitive and Zero-Sum Interactions, Making group Decisions- Voting Procedures, Plurality, Arrow's Theorem- Applications. **(9)**

TOTAL: 45

TEXT BOOK

1. *Michael Wooldridge, "An Introduction to MultiAgent Systems", John Wiley & Sons Ltd.,2nd Edition, Revised 2009.*

REFERENCES

1. *YoavShoham and Kevin Leyton-Brown, "Multi Agent Systems - Algorithmic, Game-Theoretic and Logical Foundations",Cambridge University Press, 1st Edition, 2008.*

2. *Russell S and Norvig P, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice-Hall, 2014.*

19CIE13 - NEURAL NETWORKS AND DEEP LEARNING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the basics of neural network and deep learning*

CO2 : *Understand and implement basic neural network model with hidden layers*

CO3 : *Analyze optimization and generalization in deep learning*

CO4 : *Understand convolutional neural network (CNN, or ConvNet) and implement to analyse visual imagery applications.*

CO5 : *Understand Recurrent Neural Network (RNN) and implement real-time applications.*

INTRODUCTION

Basics: Biological Neuron, Biological Neuron, Idea of computational units, McCulloch-Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. **(9)**

FEEDFORWARD NETWORKS

Representation Power of Feedforward Neural Networks, Backpropagation, Empirical Risk Minimization, Regularization, Autoencoders. Applications: speech recognition, image recognition, and machine translation **(9)**

DEEP NEURAL NETWORKS

Difficulty of training deep neural networks, Greedy layerwise training. Gradient Descent (GD), Stochastic Gradient Descent (GD), Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), Regularization methods (dropout, drop connect, batch normalization). Applications: Vision, NLP, Speech **(9)**

CONVOLUTIONAL NEURAL NETWORKS

Architecture, LeNet, AlexNet, Visualizing Convolution Neural Networks: Applications: Image recognition, Video analysis, Drug discovery **(9)**

RECURRENT NEURAL NETWORKS

Long Short Term Memory, Bidirectional LSTMs, Bidirectional RNNs. Applications: Machine Translation, Robot control, Handwriting recognition

(9)

TOTAL : 45

TEXT BOOKS

1. *Ian Goodfellow and Yoshua Bengio and Aaron Courville., "Deep Learning", MIT Press, 2016.*

2. *Christopher Bishop., "Pattern Recognition and Machine Learning ", Springer, 2007.*

REFERENCES

1. *Raúl Rojas, "Neural Networks: A Systematic Introduction", Springer-Verlag, Berlin,1996.*

2. *Yegnanarayana, B., "Artificial Neural Networks", PHI Learning Pvt. Ltd, 2009.*

3. *Golub, G.,H., and Van Loan,C.,F., "Matrix Computations", JHU Press, 2013.*

19CIE14 - OBJECT ORIENTED ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the fundamental aspects of Object Models.*

CO2 : *Identify classes and Objects and establish relationship among objects and classes and objects.*

CO3 : *Selection and Application of appropriate object oriented design Methodologies in real world applications.*

CO4 : *Construct Class, Use Case and Interaction Diagrams for software specifications.*

CO5 : *Illustrate the object-oriented software development process and work flow.*

OBJECTS AND OOS

Objects-Attributes: object state and properties-Object behaviour and methods-Object Respond to messages-Encapsulation and information Hiding-Class Hierarchy -Polymorphism-Aggregation and Object Containment-The software development Process-Building High Quality Software-Reusability **(7)**

OBJECT ORIENTED METHODOLOGIES

Rumbaugh - Booch - Jacobson - Patterns - Frameworks - Unified approach. **(9)**

UNIFIED MODELING LANGUAGE

Static and dynamic models -UML Diagrams :Class diagram : Notation- Object diagram - Class interface notation - Binary Association notation, Association Rule - Qualifier -Multiplicity - OR Association - Association Class - N-ary association - Aggregation and Composition - Generalization. Use case diagram : Actors-Use Cases-Use case Diagram-Include and Extend Relationships-Generalization. Interaction Diagrams : Sequence Diagrams - Collaboration Diagrams. State chart diagram: Activity diagram Implementation diagrams: Component diagram - Deployment diagram. **(11)**

OBJECT ANALYSIS AND DESIGN

Classification Theory-Noun Phrase Approach-Classes, Responsibilities and Collaborators. **(9)**

PROCESS

Macro Process: Content Dimension - Time Dimension - Milestones and Phases - Iterations

Micro Process: The analysis and Design Process - Micro process and levels of abstraction - Associations-Super-Sub Class Relationships-A-Part-of Relationships-Aggregation-Object-Oriented Design Axioms-Corollaries **(9)**

TOTAL:45

TEXT BOOKS

2. *Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, Singapore, Second Reprint, 2008.*

2. *Grady Booch, Robert A.Maksimchuk, Michael. W. Engle, Bobbi J. Young, JIM Conallen, Kelli A. Houston "Object Oriented Analysis and Design with Applications", Third Edition, Pearson Education Inc., USA, 2007.*

REFERENCES

1. *Rumbaugh J, Blaha M, Premerlani W, Eddy F and Lorensen W, "Object Oriented Modeling and Design", Prentice Hall of India / Pearson Education, New Delhi, 2004.*

2. *Kendall Scott, Martin Fowler, "UML Distiled : A brief guide to the standard Object modeling Language", Addison Wesley, USA, 2009.*

3. *Atul Kahate, "Object Oriented Analysis and Design", Tata McGraw-Hill, New Delhi 2007.*

19CIE15 - OPEN SOURCE SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *State the various open source Licenses and understand the Linux build systems.*

CO2 : *Illustrate the concept of NoSQL Database and to Choose the Appropriate No-SQL DataBase Types*

CO3 : *Implement NoSQL Database for real world application*

CO4 : *Ability to learn and use PHP and Python programming languages/scripts to develop and demonstrate real time applications.*

INTRODUCTION TO OPEN SOURCE TECHNOLOGIES: Overview of Free/Open Source Software - Definition of FOSS & GNU - History of GNU/Linux and the Free Software Movement - Linux Distributions - Advantages of Free Software and GNU/Linux - Free Software Licenses- GNU Build systems: Autoconf , Automake, Libtool, Autogen, GNU make - Linux Installation and Hardware Configuration- Apache Web Server : Introduction - Starting, Stopping and restarting Apache- Configuration.   **(8)**

OPEN SOURCE NON RELATIONAL DATABASES: Why NoSQL - Aggregate Data Models - More Details on Data Models - Distribution Models -Consistency.   **(9)**

IMPLEMENTATION OF NON RELATIONAL DATABASES: Key Value Databases - Document Databases - Column-Family Stores - Graph Databases Beyond NoSQL. Case study: Querying on Non relational Databases.   **(10)**

OPEN SOURCE PROGRAMMING LANGUAGES: PHP: Essential PHP- Operators and flow control- Strings and Arrays - Functions - PHP Browser Handling power - Working with PHP and MYSQL Database.   **(9)**

OPEN SOURCE PROGRAMMING LANGUAGES:PYTHON: Regular expressions: Match function-Search function-Matching Vs Searching-Modifiers-Patterns, Database:Executing queries-Transactions- Python numpy, Python Pandas, Python Matplotlib   **(9)**

TOTAL : 45

TEXT BOOKS

1. *James Lee and Brent Ware, "Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP", Addison Wesley Publiser, First Edition, 2002. (Introduction to Open Source Technologies, Open Source Programming Languages, Open source web server)*

2. *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, Types of Non Relational Databases, Implementation of Non Relational Databases)*

3. *Mark Lutz, "Learning Python", O'Reilly Media Fifth Edition, 2013.(Python)*

4. *Steven Holzner, "PHP: The Complete Reference", TMH Edition Second Reprint 2007*

REFERENCES

1. *N. B. Venkateshwarlu, "Introduction to Linux: Installation and Programming (Ed)", BS Publishers (An NRCFOSS Publication) Reprint 2014.*

2. *Wesley J.Chun, "Core Python Programming" Prentice Hall, Second Edition, 2007.*

3. *Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/.*

19CS71 - PRINCIPLES OF COMPILER DESIGN

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the different phases of compilers.*

CO2 : *Construct Automata for accepting regular languages*

CO3 : *Learn different parsing techniques.*

CO4 : *Understand the functions of compiler in Code optimization and Code generation*

INTRODUCTION

Compilers and Interpreters - The structure of a Compiler - Phases of a compiler : Lexical analysis, Syntax analysis, Intermediate code generation, Code optimization, Code generation, Error handling - Passes of a compiler - Interleaving phases - Preprocessors- Compiler construction tools. **(3)**

HIGH-LEVEL PROGRAMMING LANGUAGES

Definition of Programming languages -The Lexical and Syntax structure of a language - Data environment - Parameter transmission - Storage management. **(2)**

LEXICAL ANALYSIS

Finite Automata and Lexical Analysis: The role of Lexical Analyzers, Input Buffering - A simple approach to the design of Lexical analyzer - Regular expressions - Finite automata - Regular expression to Finite Automata - Minimizing the states of a DFA - A language for specifying lexical analyzers - Implementation of a lexical analyzer. **(7)**

SYNTACTIC SPECIFICATION OF PROGRAMMING LANGUAGES

Grammar: Definition, Context sensitive, Context free, Regular grammar - Regular expression and Regular Grammars - Context Free Grammars: Notations - Derivations and Parse trees. **(4)**

BASIC PARSING TECHNIQUES

Bottom up parsing: Handle, Handle pruning - Operator precedence parsing - Simple precedence parsing- Top down parsing: Recursive descent parsing, Predictive parsers-LR parsers: SLR parser, LALR Parser. **(9)**

SYNTAX DIRECTED TRANSLATION

Syntax directed translation schemes- Synthesized and Inherited attributes - Implementation of syntax directed translators - Intermediate code - Postfix notation - Parse trees and Syntax trees - Three address code, Quadruples and Triples - Translation of assignment statement - Boolean expressions - Statements that alter the flow of control - Array references - Symbol tables: Contents, Structure. **(8)**

INTRODUCTION TO CODE OPTIMIZATION

The Principle Sources of Optimization -Loop Optimization - The DAG representation of Basic Blocks - Global data flow analysis- Dominators- Reducible flow graphs - Loop invariant computations - Induction variable elimination - Other loop optimizations. **(7)**

CODE GENERATION

Object programs - Issues in Code generation - A simple code generator - Register allocation and assignment - Code generation from DAG - Peephole optimization. **(5)**

TEXT BOOKS

1.   *Alfred V.Aho, Monica S.Lam, Ravi Sethi and Jeffrey D.Ullman "Compilers: Principles, Techniques and Tools", Pearson Education,Inc., Second Edition, 2013.*

2.   *Alfred V. Aho and Jeffrey D. Ullman, "Principles of Compiler Design", Narosa Publishing House pvt. ltd.,Twenty fifth Reprint 2002.*

REFERENCE

1.   *Jean Paul Tremblay and Paul G.Sorenson., "Theory and Practice of Compiler Writing", BS Publication, Reprint 2008.*

19CIE16 - PARALLEL ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe Thread-Level Parallelism, Interconnection Networks and basics of parallel architecture.*

CO2 : *Apply parallelism primitives like patterns and data distribution for program parallelization.*

CO3 : *Appraise various performance metrics and CPU performance for Parallel programs*

CO4 : *Apply message passing programming for parallelisation using MPI*

CO5 : *Employ threads scheduling to achieve parallelism by pthreads and OpenMP.*

PARALLEL COMPUTER ARCHITECTURE

Parallel Architecture and Technology Trends - Flynn's Taxonomy of Parallel Architectures - Memory Organization of Parallel Computers - Thread-Level Parallelism: Simultaneous Multithreading, Multicore Processors - Interconnection Networks: Cube, Mesh, Bus, Crossbar, Omega, Butterfly.   **(9)**

PARALLELIZATION OF PROGRAMS

Levels-of-Parallelism : Instruction Level, Data Parallelism, Loop Parallelism, Functional Parallelism. Parallel Programming Patterns: Creation of Processes threads, fork-join, Parbegin-Parend, SPMD and SIMD, Master-Slave, Client-Server, Pipelining, Task Pools, Producer-Consumer. Data distributions for Arrays: Cyclic and Checkerboard distribution. Information Exchange: Shared Variables, Communication Operations, Parallel Matrix-Vector product.   **(9)**

PERFORMANCE ANALYSIS OF PARALLEL PROGRAMS

Evaluation of CPU performance - MIPS and MFLOPS - Performance of Processes with Memory Hierarchy - Performance Metric for Parallel Programs: Speedup, Efficiency-Scalability of Parallel Programs.   **(8)**

MESSAGE-PASSING PROGRAMMING

MPI Point-to-Point communication - NonBlocking operation in communication modes-Collective communication in MPI-Process groups and Communicators. Introduction to MPI-2: Dynamic Process Generation in Management.   **(8)**

THREAD PROGRAMMING

Programming with pthreads - Threads Coordination - Implementation of a Task Pool - Parallelism by Pipelining - Thread Scheduling with pthreads. Introduction to openMP: Designing Parallel Algorithms for Matrix-Vector Multiplication, Floyd's Algorithm, Quicksort   **(11)**

TOTAL : 45

TEXT BOOK

1. *Thomas Rauber,Gudula Runger,"Parallel Programming: for Multicore and Cluster Systems", Springer, Second Edition,2013.*

REFERENCES

1. *Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman, First Edition 2011.*

2. *Michael J Quinn, "Parallel programming in C with MPI and OpenMP ",McGraw-Hill Higher Education, First Edition, 2004.*

3. *David.E.Culler, Jaswinder Pal Singh, Anoop Gupta, "Parallel Computer Architecture - A Hardware/Software Approach", Morgan Kauffman Publishers, First Edition, 2002.*

19ITE11 - REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the basics of real-time systems*

CO2 : *Analyze multi-task scheduling algorithms for periodic, aperiodic, and sporadic tasks*

CO3 : *Identify the Resource Allocation Strategies for Scheduling Real Time Tasks*

CO4 : *Examine the characteristics of various real- time communication protocols and real-time databases.*

CO5 : *Understand the capabilities of Real Time Operating Systems*

INTRODUCTION

Real-time systems - Applications - Basic Model - Characteristics - Safety and Reliability - Real-Time tasks - Timing Constraints - Modelling Timing Constraints **(8)**

SCHEDULING REAL-TIME TASKS

Concepts - Types of RT Tasks and their Characteristics - Task Scheduling - Clock-Driven Scheduling - Hybrid Schedulers - Event-Driven Scheduling - EDF Scheduling - RMA - Issues with RMA - Issues in Using RMA in Practical Situations **(10)**

RESOURCE SHARING AMONG RT TASKS

Resource Sharing Among RT Tasks - Priority Inversion - PIP - HLP - PCP - Types of Priority Inversions Under PCP - Features of PCP - Issues in using Resource Sharing Protocol - Handling Task Dependencies - Multiprocessor Task Allocation - Dynamic Allocation of Tasks - Fault-Tolerant Scheduling of Tasks - Clocks in Distributed RT Systems - Centralized and Distributed Clock Synchronization. **(9)**

RT COMMUNICATION & DATABASES

Basic Concepts - RT Communication in a LAN - Soft & Hard RT Communication in a LAN - Bounded Access Protocols for LANs - Performance Comparison - RT Communication Over Packet Switched Networks - QoS Framework - Routing - Resource Reservation - Rate Control - QoS Models - RT Databases - Characteristics of Temporal Data - Concurrency Control in RT Databases. **(10)**

REAL TIME OPERATING SYSTEMS

MicroC/OS-II : System Level Functions - Task Service and Time Functions - Time Delay Functions - Memory Allocation Related Functions - Semaphore Related Functions -VxWorks : Basic Features- System Functions and System Tasks - IPC Functions. RTLinux - Basic Features and Functions. **(8)**

TOTAL: 45

TEXT BOOKS

1. *Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson Education, 2008.*

2. *RajKamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw Hill Education Private Ltd, Second Edition, 2009.*

19CIE17 - RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Solve linear programming problem transportation & Assigment problem which exist in the real life applications.*

CO2 : *Apply the knowledge gained on inventory models, simulation & quering theory to provide decisions for Common business problems.*

CO3 : *Analyze the network model through CPM & PERT techniques to the problems that occur in project management.*

CO4 : *Design the resource allocation problem as dynamic programming & Solve them.*

CO5 : *Determine the replacement policies using available resources & time for industrial problems.*

LINEAR PROGRAMMING

Linear inequalities - Feasible solutions - Equality principles - Simplex algorithm and its variants: Artificial Variables Techniques, Duality in LPP-Primal - Dual relationship - transportation and assignment problems-Integer Programming: Gomory's cutting plane methods. **(10)**

INVENTORY

Functions of inventories - Costs associated with inventory - Elementary inventory models - Price break model - Economic order quantities - Safety stocks. **(6)**

QUEUING THEORY AND SIMULATION

Poisson arrivals - Exponential service times - Basic equations - Single channel model : (M/M/1) : (?/FCFS), (M/M/1) : (N/FCFS), Simulation: Monte - Carlo technique, use of random numbers. **(7)**

PERT/CPM

Critical Path Methods (CPM) - Program evaluation and review techniques (PERT) -Time - Cost analysis - Crashing **(6)**

DYNAMIC PROGRAMMING

Characteristic features, functions, equations - Analysis - Computational procedures for solution - Stage Coach problem, Cargo loading problem, Resource allocation problem. **(8)**

REPLACEMENT MODELS

Individual replacement Policy: Basic concept Money Value, Present Worth Factor (PWF) and Discount Rate, Group replacement policy. **(8)**

TOTAL : 45

TEXT BOOK

1. *Hamdy A.Taha, "Operations Research - Principles and Problems", Keerthi Publication, First Edition, 2005.*

2. *Dharani Venkatakrishnan, "Operations Research - Principles and Problems", Keerthi Publication, First Edition, 2005.*

REFERENCES

1. *Operations Research - Kandiswarup, P. K. Gupta, Man Mohan, S. Chand & Sons Education Publications, New Delhi, Fifteenth Edition, 2010.*

2. *Sasieni, Yaspan and Friedman, "Operation Research-Methods and Problems", Literary Licensing, LLC, First Edition, 2013.*

3. *F.S. Hillier and G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, Ninth Edition, Tata Mc Graw Hill, 2010.*

19ITE12 - SEMANTIC WEB

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the fundamental concepts, advantages of semantic web and understand how this technology revolutionizes the World Wide Web and its uses.*

CO2 : *Understand the semantic relationships among the data elements using Resource Description Framework (RDF)*

CO3 : *Model domain knowledge as ontologies using standards such as XML, RDF and OWL and develop inference systems.*

CO4 : *Infer the knowledge to implement logic and Inference rules*

CO5 : *Analyse the use of semantic web technologies in web service applications using semantic web tools and services.*

INTRODUCTION

Today's Web - Transformation from Today's Web to the Semantic Web - Semantic Web Technologies - A Layered Approach - XML: Structuring -Namespaces - Addressing & Querying - Processing. **(7)**

RDF

Overview-Basic Elements of RDF-RDF Triples-Basic Syntax-Literal values-Fundamental Rules of RDF-Relationship between XML and RDF- Need for RDFS-Elements of RDFS **(9)**

OWL

Introduction- Using OWL to define classes: Localize Global Properties, Set Operators and Enumerations- Using OWL to define Properties: Property Characteristics-ontology Matching and Distributed Information-Three Faces of OWL **(10)**

LOGIC AND INFERENCE RULES

Monotonic Rules - Relationships - Syntax - Semantics - Description Logic Programs (DLP) - SWRL - Non Monotonic Rules - Motivation and Syntax - Examples - Rule Markup Language (RuleML). **(10)**

APPLICATIONS OF SEMANTIC WEB

Swoogle- architecture, usage and examples of using Swoogle; FOAF - Explanation, Vocabulary -Creating FOAF documents, API to understand OWL ontology- JENA, Protege **(9)**

TOTAL : 45

TEXT BOOKS

1. *Grigoris Antoniou, Paul Groth, Frank Van Harmelen and Rinke Hoekstra, "A Semantic Web Primer", MIT Press, Third Edition, 2012. [Unit 1,4]*

2. *Liyang Yu , "Introduction to the Semantic Web and Semantic web services" , Chapman & Hall/CRC, Taylor & Francis group, 2019. [Unit 2,3 and 5]*

REFERENCES

1. *Rajendra Akerkar, "Foundation of the Semantic Web: XML, RDF and Ontology", Alpha Science International Ltd., 2009.*

2. *Karin K.Breitman, Marco Antonio Casanova and Walter Truszkowski, "Semantic Web: Concepts, Technologies and Applications", Springer-Verlag London Ltd., 2007.*

19CIE18 - SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe web browser, Web service frame works and recognize its internal functionalities.*

CO2 : *Discuss various SOA delivery strategies, service oriented analysis and modeling guidelines.*

CO3 : *Select suitable business process design for structured, unstructured data and security mechanism using xml..*

CO4 : *Design and implement business logic for real time systems using advanced web service technologies and standards.*

CO5 : *Describe the types of security issues and security attacks related to web services.*

SOA AND WEB SERVICES FUNDAMENTALS

Introduction to SOA: Fundamental SOA - Common characteristics of contemporary SOA - Common misperceptions about SOA - Common tangible benefits of SOA - Common pitfalls of adopting SOA. Evolution of SOA: SOA timeline - Continuing evolution of SOA - The roots of SOA. Web Services and Primitive SOA: The Web services framework - Services (as Web services) - Service descriptions (with WSDL) - Messaging (with SOAP). **(9)**

BUILDING SOA (PLANNING & ANALYSIS)

SOA Delivery Strategies: SOA delivery lifecycle phases - The top-down strategy - The bottom-up strategy - The agile strategy. Service Oriented Analysis: Introduction to Service oriented analysis - Benefits of business centric SOA - Deriving business services - Service modeling - Service modeling guidelines - classifying service model logic - contrasting service modeling approaches. **(9)**

BUILDING SOA (TECHNOLOGY & DESIGN)

Service Oriented Design: Introduction to service oriented design - WSDL related XML schema language basics - WSDL language basics - SOAP language basics - service interface design tools - SOA Composition Guidelines: Steps to composing SOA - considerations for choosing service layers - considerations for positioning core SOA standards - considerations for choosing SOA extensions - Service Design - Business Process Design. **(9)**

ADVANCED WEB SERVICES TECHNOLOGIES AND STANDARDS

Conversations overview- Web Services Conversation Language (WSCL)-WSCL interface components-Relationship between WSCL and WSDL - Workflow-Business Process Management-Workflows and work flow management system - BPEL-ACID Transactions-Scaling Transactions to web services-Other Web services Transaction Protocols. **(9)**

SECURITY IN WEB SERVICES

Web service security issues-Types of security attacks and threads-web services security roadmap-WS-security-Quality of service (QOS)Overview -QoS metrics for web services - Holes- Design patterns and best practices- Building QoS into web services and applications-QoS enabled web services -QoS enabled applications. **(9)**

TOTAL: 45

TEXT BOOKS

1. *Thomas Erl, "Service-Oriented Architecture: Concepts, Technology and Design", Prentice Hall of India, Ninth Edition, 2019.*

2. *Sandeep Chatterjee,"Developing Enterprise Web services, An architect's Guide", Pearson Education, First Edition, 2005. (Advanced Web Services Technologies and Standards, Security in Web Services)*

REFERENCES

1. *Dirk Krafzig, Karl Banke, Dirk Salma, "Enterprise SOA: Service- Oriented Architecture Best Practices", Pearson Education, First Edition, 2004.*

2. *Thomas Erl, "SOA Principles of Service Design", Prentice Hall of India, First Edition, 2007.*

3. *Frank P.Coyle , "XML ,Web services and the Data Revolution". Pearson Education, First Edition, 2002.*

19ITE13 - SOFT COMPUTING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Outline the basic concepts of Soft Computing.*

CO2 : *Design of Artificial Neural Networks for Various applications.*

CO3 : *Develop suitable fuzzy models for solving real world problems.*

CO4 : *Describe Genetic Algorithms and their applications.*

CO5 : *Integrate various soft computing techniques for complex problems.*

INTRODUCTION TO SOFT COMPUTING

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network. **(9)**

ARTIFICIAL NEURAL NETWORKS

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models. **(9)**

FUZZY SYSTEMS

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions - Defuzzification - Fuzzy Arithmetic and Fuzzy Measures -Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making. **(9)**

GENETIC ALGORITHMS

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction -Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm. **(9)**

HYBRID SYSTEMS

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools -GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller. **(9)**

TOTAL : 45

TEXT BOOKS

1. *N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.*

2. *S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.*

3. *S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications", PHI Learning Pvt. Ltd., 2017.*

REFERENCES

1. *Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.*

2. *Kwang H.Lee, "First course on Fuzzy Theory and Applications, Springer, 2005.*

3. *George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.*

4. *James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.*

19ITE14 - SOFTWARE AGENTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe agent based system principles, Programming Paradigms, knowledge representation and development process.*

CO2 : *Illustrate user interaction with agents and explore the role of agents which tends to develop secure agent communication.*

CO3 : *Describe search algorithms applied in agent design and implementation.*

CO4 : *Discuss various security issues and protection mechanisms for mobile agents.*

CO5 : *Design and implement agent based applications with simple construction tools.*

AGENTS - OVERVIEW

Agent Definition - Agent Programming Languages- Agent Vs Object - Abstract and Concrete Architectures for Intelligent Agents -Mobile Agents. **(9)**

MULTIAGENT SYSTEMS AND SOCIETIES OF AGENTS

Introduction - Agent Interaction Protocols -Societies of Agents - Learning: Introduction - Learning and Activity Coordination - Learning about and from other Agents - Learning and Communication. **(9)**

SEARCH ALGORITHMS FOR AGENTS

Constrain Satisfaction: Filtering Algorithm- Hyper Resolution Consistency Algorithm-Path Finding Problem-Two PlayerGames. **(9)**

MOBILE AGENTS AND SECURITY

Mobile Agent Security Issues - Mobile Agents Security - Protecting Mobile Agents against malicious hosts - Untrusted Mobile Agent - Black Box Security - Authentication for Mobile agents - Security in Multiple Language Mobile Agent System **(9)**

AGENT CONSTRUCTION

Mobile agent with java: Agent characteristics of java - Aglet model - Aglet package - Anatomy of an Aglet - Agent Design Pattern: classification - Master Slave Pattern - Itinerary pattern- Implementing Agent systems-JACK.. **(9)**

TOTAL: 45

TEXT BOOKS

1. *Gerhard Weiss, "Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence", The MIT Press, USA, 1999.*

2. *Danny.B.Lange Mitsuru Oshima, "Programming and Deploying Java Mobile Agents with Aglets", Addison Wesley, USA, 1998 (Agent Construction)*

3. *Giovanni Vigna (Ed.),"Mobile Agents and Security",Springer,1998.(Mobile Agents And Security)*

REFERENCES

1. *Richard Murch and Tony Johnson, "Intelligent Software Agents", Prentice Hall, USA, 2000.*

2. *Russel and Norvig, "Artificial Intelligence: a Modern Approach", Pearson Education, England, Third Edition, 2016.*

3. *Danny.B.Lange Mitsuru Oshima,"Mobile Agents with Java", The Aglet API,Springer,1998*

4. *Unland, Rainer, Matthias Klusch, and Monique Calisti, eds. Software agent-based applications, platforms and development kits. Springer Science & Business Media, 2005.*

19CIE19 - SOFTWARE METRICS AND MEASUREMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understand the representational theory of measurement, scales and various software metrics.*

CO2 : *Classify software measures, describe data collection procedures and apply suitable data analysis techniques*

CO3 : *Understand the measures for various internal and external product attributes*

CO4 : *Knowledge in various metrics on Product quality, Process quality and Software Maintenance*

CO5 : *Describe software reliability problem and reliability models to measure software reliability.*

FUNDAMENTALS OF SOFTWARE MEASUREMENT

Measurement: Measurement in software engineering - scope of software metrics. Basics of Measurement: representational theory of measurement-measurement and models- measurement scales and scale types - nominal scale - ordinal scale- interval scale- ratio scale- absolute scale - meaningfulness in measurement. **(7)**

GOAL BASED FRAMEWORK AND DATA COLLECTION

Classifying software measures - determining what to measure - software measurement validation. Empirical Investigation - Principles of empirical studies. Software metrics data collection: Defining good data, data collection for incident reports, how to collect data, reliability of data collection procedures. Analyzing software measurement data: Statistical Distributions and hypothesis testing, classical data analysis techniques, examples of simple analysis techniques, overview of statistical tests. **(10)**

PRODUCT ATTRIBUTES MEASUREMENT

Measuring internal product attributes: size - properties of software size - code size - design size - requirements analysis and specification size - functional size measures and estimators. Measuring internal product attributes: structure - Aspects of structural measures - control flow structure of program units - design level attributes. Measuring external product attributes: modeling software quality - measuring aspects of quality - usability measures - security measures. **(13)**

QUALITY METRICS

Product quality metrics, In - process quality metrics - software maintenance metrics. In-process metrics for software testing: Test Progress S curve, Testing defect arrivals over time, Testing defect backlog over time. **(7)**

SOFTWARE RELIABILITY MEASUREMENT

Basics of reliability theory- software reliability problem - parametric reliability growth models: Jelinski- Moranda Model, other models based on Jelinski Moranda, little wood model, littlewood-verrall model - the recalibration of software reliability growth predictions. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Norman Fenton and James Bieman, "Software Metrics - A Rigorous & Practical Approach", CRC press, Third Edition, 2015.*

2. *Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, Second Indian Reprint, New Delhi, 2016.(In-process metrics for software testing)*

REFERENCES

1. *Capers Jones, "Applied Software Measurement: Global Analysis of Productivity and Quality", McGraw Hill Publishing, Third Edition 2008.*

2. *International Function Point Users Group "IT Measurement - A Practical Advice from the Experts", Pearson Education, Asia, 2002.*

19CIE20 - SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe testing fundamentals, Testing principles, TMM levels and classify the defects*

CO2 : *Apply suitable Black box and White Box testing techniques and design Test cases in practice.*

CO3 : *Understand the levels of Testing, develop Test Plans, Testing goals & policies and perform reviews for practical applications.*

CO4 : *Ability to test different types of Web Applications, understand security and performance aspects of testing.*

CO5 : *Outline Software Quality attributes and Software Quality Assurance functions and Prepare Software Quality Assurance plans.*

INTRODUCTION TO TESTING AND TEST DESIGN STRATEGIES-I

Introduction to Testing as an Engineering Activity: The role of Process in Software Quality, Testing as a Process, Overview of Testing Maturity Model(TMM) - Testing Fundamentals: Basic Definitions, Software Testing Principles, Tester's Role in a Software Development Organization - Defects, Hypothesis and Test: Origins of Defect, Defect Classes, the defect Repository and Test Design.

Strategies and Methods for Test Case Design I: Test Case Design strategies -Black Box Approach to Test Case Design- Random Testing- Equivalence Class Partitioning- Boundary Value Analysis- Other Black Box Test Design Approaches- COTS-Black box Methods and TMM level 2 goals. **(9)**

TEST DESIGN STRATEGIES-II

Strategies and methods for test case design II: White Box Approach to Test Case Design- Test Adequacy Criteria -Coverage and Control flow graphs - Covering Code Logic- Paths- Additional White Box Test Design Approaches: Data Flow, Loop Testing, Mutation Testing- White Box Testing Methods and the TMM. **(6)**

LEVELS OF TESTING

Need for levels of testing - Unit Test : Functions, Procedures, Classes, and Methods as Units- Unit Test planning - Designing the Unit Tests - The Class as a Testable Unit and Special Considerations - Test Harness.

Integration test: Goals - Integration strategies for Procedures, Functions and Classes- Designing Integration Tests- Integration test Planning.

System test: Functional testing, Performance testing, Stress Testing, Configuration Testing, Security Testing, Recovery Testing- Regression Testing- Alpha, Beta, Acceptance Testing.

Testing Goals, Policies & Plans: Introductory concepts -Testing/Debugging goals & Policies - Test planning -Test Plan Components- Reporting test results -Role of three critical groups.

Reviews: Types of Reviews-Inspection - walkthroughs - Components of Review plan-Review Check List-Review Metrics. **(13)**

TESTING WEB APPLICATIONS

Testing Concepts for Web Apps- the Testing Process- Content Testing- User Interface

Testing- Component Level Testing- Navigation Testing- Configuration Testing- Security Testing - Performance Testing. **(5)**

SOFTWARE QUALITY ASSURANCE, STANDARDS AND PROCESS MODELS

Quality Concepts - Quality - Software Quality - Garvin's Quality Dimensions - McCall's Quality Factors - ISO 9126 Quality factors - Cost of Quality - Achieving software Quality - SQA Infrastructure - CASE Tools for Software Quality

Software Quality Assurance: Elements of SQA - SQA tasks, Goals, Attributes & Metrics - Statistical SQA - Software Reliability - ISO 9000 Quality standard - SQA Plan

Software process Improvements: The CMMI - The People CMM **(12)**

TOTAL: 45

TEXT BOOKS

1.   Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2010, Reprint.

2.   Roger. S. Pressman "Software Engineering A Practitioner's Approach, 7e", McGraw Hill International Edition, 2014. (Testing Web Applications, Software Quality and Quality Assurance, Quality Standards and Process Models)

3.   Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009 (CASE Tools form Software Quality, SQA Infrastructure)

REFERENCES

1.   Yogesh Singh, " Software Testing", Cambridge University Press, 2012

2.   Kshirasagar Naik, Priyadhrshini Tripathy, "Software Testing and Quality Assurance", John wiley & sons Inc Publication, 2008

3.   Nina S Godbole, " Software Quality Assurance-Principles and Practice", Narosa Publishing, Second Edition, 2016

19CIE21 - WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the sensor network architecture and its applications.*

CO2 : *Describe the different MAC protocols used in wireless sensor networks and their applications.*

CO3 : *Demonstrate knowledge of routing protocols developed for WSN.*

CO4 : *Describe and explain the function of Transport control protocols for WSN.*

CO5 : *Outline the features of OS and performance models of wireless sensor networks*

INTRODUCTION

BASIC sensor network Architecture-Generation of sensor network - challenges - hardware and software components of wireless nodes-operating environment - Applications: Home control. Building Automation- Medical applications.   **(9)**

MAC PROTOCOLS

Schedule based protocols: Self-organizing MAC for Sensor nets (SMACS), Low Energy Adaptive Clustering Hierarchy (LEACH)-Random Access based protocols - Sensor MAC protocol, IEEE 802.15.4 and Zigbee Reference Model - Super frame structure-Frame types - Modes of operation: Contention based channel Access - Beacon less mode.   **(10)**

ROUTING PROTOCOLS

Data Dissemination and Gathering - Challenges and Design Issues - Flooding - Sensor Protocols for Information via Negotiation (SPIN) - LEACH - Power Efficient Gathering in Sensor Information System (PEGASIS) - Directed Diffusion - Geographical routing.   **(11)**

TRANSPORT CONTROL PROTOCOLS

Design issues - Congestion Detection and Avoidance (CODA) - Event to Sink Reliable Transport (ESRT) - Reliable Multi Segment Transport (RMST) - Pump Slowly Fetch Quickly (PSFQ) - GARUDA - Ad-hoc Transport Protocol (ATP).   **(8)**

OPERATING SYSTEM AND PERFORMANCE MODELS

OS Design Issues - Features of Tiny OS, MANTIS - Performance Modeling of WSN : Performance Metrics - Basic Models: Traffic Models - Energy Models - Node model - Network models: MAC model - Routing Model - System Model.   **(7)**

TOTAL : 45

TEXT BOOK

1. *Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", Second Edition, John Wiley, 2011.*

REFERENCES

1. *Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, First Edition, 2005.*

2. *Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks",Wiley, First Edition, 2007.*

3. *Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2010.*

4. *Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks - A Networking Perspective", Wiley India,First Edition, 2014.*

19CS51 - UNIX INTERNALS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : Outline the architecture of Unix Operating System and the internal operations of file system and process management

CO2 : Discuss Allocation of Disk Blocks and Manipulation of inode for process and File Management.

CO3 : Examine Process Scheduling and memory management strategies on Unix Operating System

CO4 : Summarize the working Methodology of various IPC Mechanisms and device driver Interfaces

INTRODUCTION TO KERNEL

Basic Commands & Directory Hierarchy: Basic commands, Navigating directories, Intermediate commands.

Kernel Concepts: Architecture of UNIX operating system - Introduction to system concepts - Kernel data structures. - The Buffer Cache: Buffer headers - Structure of Buffer pool - Scenarios for retrieval of a buffer - Reading and writing disk blocks - Advantages and disadvantages of Buffer Cache. **(9)**

INTERNAL REPRESENTATION OF FILES

Inodes - Structure of regular file - Directories - Conversion of pathname to an inode - Super block - Inode assignment to a new file - Allocation of disk blocks - Overview of System Calls for the file system: Open, Close, Read, Write, File Creation, Creation of Special files, Link, Unlink **(9)**

STRUCTURE OF PROCESSES

Process States and Transitions - Layout of System Memory - The Context of a Process - Saving the Context of a Process - Manipulation of the Process Address Space - Sleep.

Process Control: Process Creation, Signals, Process Termination, Awaiting process termination, invoking other programs **(9)**

PROCESS SCHEDULING AND MEMORY MANAGEMENT POLICIES

Process Scheduling: Algorithm - Scheduling parameters - examples of Process Scheduling - Controlling Process priorities - Fair Share Scheduler. Memory Management Policies: Swapping - Demand Paging - A Hybrid system with Swapping and Demand Paging. **(9)**

I/O SUB SYSTEM AND INTERPROCESS COMMUNICATION

Driver Interfaces - Disk Drivers - Terminal Drivers - Streams. Inter Process Communication: Pipes, Shared Memory, Messages, Semaphores - Network communication **(9)**

TOTAL : 45

TEXT BOOKS

1. Maurice J Bach, "The Design of Unix Operating System ", Pearson Education, First Edition, 2015.
2. Brian Ward, "How Linux works", No Starch Press, Second Edition, 2015.

REFERENCES

1. Uresh Vahalia, "Unix Internals: The New frontiers", Pearson Education, Second Edition, 2010.
2. Robert Love, "Linux Kernel Development - Developer's Library", 3rd Edition, Pearson Education, 2010.
3. John Strang, Jerry Peek, Grace Todino, "Learning the UNIX OS", O'Reily, Fifth Edition, 2014.
4. Remy Card, Eric Dumas, Franck Mevel, "The Linux Kernel Book", Wiley India, 2013.

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.

19CIOC01 - C++ PROGRAMMING

L	T	P	C
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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.*

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.*

19CEOE01- TOWN PLANNING AND ARCHITECTURE

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *interpret the geometric forms and aesthetic qualities of Architecture*

CO2 : *integrate the various elements of architecture and orientation of buildings*

CO3 : *describe the development plans and planning regulations*

CO4 : *incorporate the development control rules in town and country planning*

PRINCIPLES OF TOWN PLANNING

Evaluation of planning - Objects of town planning - principles of town planning- origin of towns - growth of towns - origin - direction - various forms of planning **(9)**

ELEMENTS OF ARCHITECTURE

Introduction of architecture - definition - Evaluation of geometric forms - function and history - Sphere, Cube, Pyramid, Cylinder and Cone - aesthetic qualities of Architecture - Proportion, Scale, Balance, Symmetry, Rhythm and axis - Contrast in Form - Harmony. **(9)**

PRINCIPLES OF ORIENTATION AND PLANNING OF BUILDINGS

Factors affecting orientation - Sun-Wind-Rain - Orientation criteria for Indian conditions - Principles governing the theory of planning - Planning of residential buildings. **(7)**

DEVELOPMENT PLAN

Principles of city planning - levels of planning- scope and contents of regional plan, master plan, detailed development plan and structure plan - preparation and implementation - planning of new towns - slum clearance and urban renewal. **(9)**

PLANNING LEGISLATION AND DEVELOPMENT CONTROL RULES

Planning legislation and administration - Tamil Nadu Town and Country Planning Act, Tamil Nadu Housing Board Act, Tamil Nadu slum clearance and Improvement Act. Zoning regulations - sub division regulations - building regulations - Floor Space Index - minimum plot sizes - open spaces - minimum standard dimensions **(11)**

TOTAL : 45

TEXT BOOKS

1. *RangwalaS.C., "Town Planning", Charotar Publishing House, Anand, 2013.*

2. *Francis D.K., Ching, "Architecture Form, Space and Order", Oxford University Press, 2014.*

ONLINE RESOURCES

1. *https://nptel.ac.in/courses/124/107/124107001/*

2. *https://nptel.ac.in/content/storage2/courses/109104047/pdf/lecture40.pdf*

19CEOE02 - CLIMATE CHANGE AND ADAPTATION

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 earth's system which influences the climatic factors of the earth.*

CO2 : *Infer the evidences and observed changes in the climate and environment on a global scale and in India.*

CO3 : *Analyse the impacts of climate change on various sectors and the uncertainties over the projected impacts of climate change.*

CO4 : *Investigate the various adaptation and mitigation options in various sectors and examine the mitigation efforts made in India.*

CO5 : *Correlate future clean technology and alternate energy options inferred in clean development mechanism.*

EARTH'S CLIMATE SYSTEM

Introduction-Climate in the spotlight-The Earth's Climate Machine - Climate Classification - Global wind systems - Trade Wind Systems - Trade Winds and the Hadley Cell - The Weserlies - Cloud formation and Monsoon Rains - Storms and Hurricanes - The Hydrological Cycle - Global Ocean Circulation - EI Nino and its Effect - Green House Gases and Global Warming - Carbon Cycle. **(9)**

OBSERVED CLIMATE CHANGE AND ITS CAUSES

Observation of Climate Change - Changes in pattern of temperature, precipitation and sea level rise - Observed effects of Climate Changes - Patterns of Large Scale Variability - Drivers of Climate Change - Feedbacks - The Montreal Protocol - UNFCCC - IPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India. **(9)**

IMPACTS OF CLIMATE CHANGE

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. **(9)**

CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

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) - Mitigation Efforts in India and Adaptation funding. **(9)**

CLEAN TECHNOLOGY AND ENERGY

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. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.*

2. *UNIPCC Fifth Assessment Report, 2014.*

3. *Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.*

REFERENCES

1. *Anil Markandya, Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002.*

2. *Heal, G. M., Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty, Kluwer Academic Publ., 1998.*

3. *Jepma, C.J., and Munasinghe, M., Climate Change Policy - Facts, Issues and Analysis, Cambridge University Press, 1998.*

4. *Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.*

ONLINE RESOURCES

1. *"An Inconvenient truth (2006)"- video*

2. *https://climate.nasa.gov*

3. *https://unfccc.int*

4. *https://environment .gov.au*

19CEOEO3 - METRO SYSTEMS AND ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Integrate the basic elements of MRTS, BRTS, LRTS and other transportation systems*

CO2 : *Illustrate the components of metro rail systems*

CO3 : *Apply the concepts of ITS in the field of Transportation Engineering*

PRINCIPLES OF TRANSPORTATION SYSTEMS

Transportation systems in India - various modes of transport - public transport - Intermediate public transport - types - characteristics - other urban transportation modes - drawbacks- various transit systems **(9)**

MRTS

Definition - Mass Rapid Transit System - History of MRTS - Need for MRTS - connectivity in Indian conditions - cities having MRTS - infrastructure - operations - fares and ticketing - case study. **(8)**

BRTS and LRTS

Bus Rapid Transit System - terminology - history -features - performance - cost - drawbacks - Light Rail Transit System - necessity - types - gauge- capacity integration with cycles - comparison to other rail modes **(9)**

METRO RAIL SYSTEMS

History of Metro trains - Need for Metro rail - connectivity in Indian conditions - cities having Metro - construction techniques adopted in Metro Rail stations - Case study - Delhi Metro (DMRC) - Chennai Metro (CMRL) **(10)**

ITS

Definition - Intelligent Transport System - Principles - Application of ITS technologies in various countries - smart transportation - case studies **(9)**

TOTAL : 45

TEXT BOOKS

1. *Pradip Kumar Sarkar, Vinay Maitri, G. J. Joshi ·"Transportation Planning Principles, Practices and Policies", Prentice Hall India Pvt., Limited 2017*

2. *D. Johnson Victor, S. Ponnuswamy, "Urban Transportation Planning, Operation and Management" Tata McGraw-Hill Education, 2012*

3. *Mashrur A. Chowdhury, Adel Wadid Sadek "Fundamentals of Intelligent Transportation Systems Planning" Artech House · 2003*

4. *Sumit Ghosh, Tony S. Lee, "Intelligent Transportation Systems Smart and Green Infrastructure Design, Second Edition" CRC Press · 2010*

ONLINE RESOURCES

1. *https://nptel.ac.in/content/storage2/courses/105101008/downloads/cete_48.pdf*

19CEOE04 - RENEWABLE ENERGY RESOURCES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Infer the current energy scenario and future energy usage in India.*

CO2 : *Interpret the concepts of solar energy, wind energy, tidal energy and biomass energy.*

CO3 : *Compare the energy utilization from wind energy, solar energy, biomass energy and tidal energy.*

CO4 : *Correlate the challenges and problems associated with the use of energy sources.*

ENERGY PERSPECTIVES

Conventional and non conventional energies - Energy and sustainable development - Global energy scenario - Energy scenario in India - Energy consumption pattern in rural and urban regions in India - Energy efficiency and economy - Energy losses and its control - Renewable energy potential mapping - Plant load factor **(9)**

SOLAR ENERGY PERSPECTIVES

Concept of solar energy - Solar energy to light and to thermal conversions - Total energy and necessary infrastructure - Units and measurement of solar radiation - Temperature dependent collecting devices and their efficacies - Design aspects - Typical applications: heating, cooling, lighting, power generation and cooking. **(9)**

WIND ENERGY PERSPECTIVES

Wind potential in India - Wind turbines and their types - Merits and demerits - Wind power and appropriate coefficient - Efficiency and performance of wind machines -Energy conversion and storage - Synchronous invertors - Various storage aspects: battery, fly wheel, hydrogen and compressed air. **(9)**

BIOMASS ENERGY PERSPECTIVES

Biomass potential in India - Gobar gas and producer gas - Characteristics of biomass - Operation and design of biogas plants - Objectives, principles and operational aspect of biogassifiers - Pyrolysis and incineration - Power generation from municipal solid waste and industrial Sludges - Application of biodiesel plants - Fuel cells. **(9)**

TIDAL ENERGY PERSPECTIVES

Tidal aspects in coastal India - Tidal energy conversion system: mechanical to electrical and thermal to electrical - Tidal force calculation and power generation - conceptualization and potential of geothermal energy - Geothermal vents. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Sukathme, S.P, Nayak J.K., "Solar Energy", Tata McGraw-Hill Book Co., New Delhi, 2017.*

2. *Rai, G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2010.*

3. *P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.*

4. *Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.*

REFERENCES

1. *Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.*

2. *Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.*

3. *Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education, 2015.*

ONLINE RESOURCES

1. *https://swayam.gov.in/nd1_noc20_ge06/preview*

2. *https://swayam.gov.in/nd2_nou20_cs09/preview*

19CEOE05 - PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Identify the components, factors and environmental issues affecting Sustainable development.*

CO2 : *Assess the role of International summits, conventions and Environmental aspects on Sustainable development.*

CO3 : *Interpret the necessity and importance of Indian and International Socio -economical and legal aspects in Sustainability.*

CO4 : *Illustrate the different strategies to achieve Sustainable development.*

CO5 : *Assess the role of Life cycle Assessment, Cleaner Production and Sustainable Chemistry to achieve sustainable development.*

CONCEPTS OF SUSTAINABLE DEVELOPMENT

Sustainable development- Evolution of Environmental awareness and Sustainable development, global Sustainable development goals -components and factors affecting Sustainable development-Demographic dynamics and sustainability- Environmental issues and crisis- ozone layer depletion, global warming and climate change **(9)**

ENVIRONMENTAL ASPECTS

International Environmental summits, conventions and agreements-Tiwari committee recommendation - Role of Pollution Control Board - Transboundary issues - Ecological indicators- Ecological foot print- Carbon foot print - Basic concept of Environmental impact assessment **(9)**

SOCIO ECONOMIC AND JUDICIAL ASPECTS

UN Sustainable development policies through trade- World Trade Organization-International monetary fund and World bank - Circular Economy and Sustainable Development - Socio economic policies for sustainable Development- Role of Judiciary in Sustainable Development - Major Environmental Cases in India - Development of Environmental Policies in India - Environment Protection Act, 1986 - EIA notification 2006 - National Conservation Strategy and Policy Statement on Environment and Development, 1992 - Policy Statement for the Abatement of Pollution, 1992 - National Environment Policy, 2006. SDG India Index - Baseline Report 2018 **(9)**

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Economic growth and Sustainable Development - Resource depletion and resource protection- - Internet of things and Sustainable Development - Sustainable Management of Forest, Land, water- Natural Disaster management- case studies. **(9)**

CLEANER PRODUCTION, LIFE CYCLE ASSESSMENT - GREEN/SUSTAINABLE CHEMISTRY

Cleaner Production, definition, aim, application-Generic process of Cleaner Production Assessment- Life cycle Assessment - definition, necessity and elements- ISO Environmental standards- Environmental Audit -Green Chemistry - twelve Principles of Green Chemistry - case studies. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Ramakrishnan, P. S., "Ecology and Sustainable Development", National Book Trust, New Delhi, 2001*

2. *Paul Robbins, John Hintz, and Sarah A. Moore, "Environment and Society: A Critical Introduction", Wiley-Blackwell, 2014*

3. *Bimal N. Patel and Ranita Nagar, "Sustainable Development and India", Oxford University Press, 2018.*

REFERENCES

1. Nick Hanley, Jason F. Shogren and Ben White, "Environmental Economics in Theory and Practice", Macmillan Publishers, UK, 1997

2. Tietenberg T. and Lynne Lewis, "Environmental and Natural Resource Economics", Harper Collins, Routledge, 2016

3. Kirkby, J.O., Keefe, P., and Timberlake, "Sustainable Development", Earthsean Pub., London, 2001

ONLINE RESOURCES

1. https://nptel.ac.in/courses/107/103/107103081/

19CEOE06 - DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Identify natural and manmade disasters*

CO2 : *Explain in detail about causes and effects of natural and manmade disasters.*

CO3 : *Apply geospatial techniques (including GIS) that can enhance vulnerability assessments*

CO4 : *Identify and analyse the factors that give rise to differential vulnerabilities and levels of community resilience and suggest necessary mitigation plans*

CO5 : *Assess and manage these vulnerabilities through disaster planning and policy-making.*

NATURAL DISASTERS

Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. **(9)**

MAN MADE DISASTERS

Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster- Forest Fire-Oil fire -accident in Mines. **(9)**

GEOSPATIAL TECHNOLOGY

Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping. **(9)**

RISK ASSESSMENT AND MITIGATION

Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. **(9)**

DISASTER MANAGEMENT

Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism - Role of Engineers in Disaster Management. **(9)**

TOTAL : 45

TEXT BOOKS

1. *R. Subramanian, "Disaster Management" Vikas Publishing House Pvt. Ltd, New Delhi, 2018.*

2. *Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2017.*

REFERENCES

1. *Disaster Management in India-A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.*

2. *Murthy D. B. N., "Disaster Management : Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.*

3. *Sundar I. and Sezhiyan T., "Disaster Management", Sarup and Sons, New Delhi, 2007.*

4. *Singhal J.P. "Disaster Management", Laxmi Publications, 2010.*

5.   Khanna BK, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.

6.   Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.

7.   Rajdeep Dasgupta, "Disaster Management and Rehabilitation", Mittal Publishers, New Delhi, 2007.

19MEOE01 - DESIGN OF EXPERIMENTS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Demonstrate the fundamental concepts applied with mathematical knowledge, methodologies to bring knowledge of characterize, analyse and solve a wide range of problems between the purpose of a model and the appropriate level of complexity and accuracy.*

CO2 : *Plan, design and conduct experimental investigations efficiently and effectively; choose an appropriate experiment to evaluate a new product design or process improvement through experimentation strategy, data analysis, and interpretation of experimental results.*

CO3 : *Analyse the nature of variables, statistical inference, influence parameter selection, factorial concepts, Conduct Design of experiments; interpret the direct and interaction effects using RSM.*

INTRODUCTION

Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments. **(7)**

BASIC STATISTICAL CONCEPTS

Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples. **(9)**

EXPERIMENTAL DESIGN

Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples. **(11)**

ANALYSIS AND INTERPRETATION METHODS

Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples. **(9)**

EXPERIMENT DESIGN USING TAGUCHI'S ORTHOGONAL ARRAYS

Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples. **(9)**

TOTAL :45

TEXT BOOKS

1. *C.F. Jeff Wu & Michael Hamada, "Experiments-Panning, Analysis, and Optimization", 3ʳᵈ Edition, John Wiley & Sons. Inc., 2021.*

2. *D.C. Montgomery, "Design and Analysis of Experiments", 10ᵗʰ Edition, John Wiley & Sons. Inc. 2019.*

REFERENCES

1. T.B. Barker, Andrew Milivojevich, "Quality by Experimental Design", 4th Edition, CRC Press, 2021

2. https://nptel.ac.in/courses/110/105/110105087/

3. https://nptel.ac.in/courses/111/104/111104075/

19MEOE02 - ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Formulate single or multi-variable engineering optimization problems and comply with the appropriate objective functions.*

CO2 : *Select the appropriate optimization technique for the specified engineering problems based on number of variables and constraints.*

CO3 : *Derive, develop and utilize the possible randomness or any other associated factors that would possibly occur during constrained and unconstrained optimization situations.*

INTRODUCTION

Problem formulation - design variables, constraints, constraint surfaces, objective functions, objective function surfaces. Classification of optimization - based on existence of constraints, nature of design variables, structure of the problem, nature of equation involved, permissible value of the design variables, deterministic nature of the variables, separability of the functions and the number of objective functions. Example of engineering optimization problems.   **(11)**

SINGLE VARIABLE OPTIMIZATION

Optimal criteria - bracketing method - exhaustive search method, region elimination method - interval halving, Fibonacci, golden search method, point estimation method - successive quadratic approximation, gradient search method - Newton Raphson's method.   **(10)**

MULTIVARIABLE OPTIMIZATION WITH CONSTRAINTS

Multivariable optimization - semi definite case - saddle point. Multivariable optimization with equality constraints - solution by direct substitution - solution by the method of constrained variation - solution by the method of Lagrange multipliers. Multivariable optimization with inequality constraints - Kuhn-Tucker conditions, constraint qualification.   **(12)**

UNCONSTRAINED OPTIMIZATION

Introduction - classification of unconstrained minimization methods - general approach - rate of convergence - scaling of design variables. Direct Search Methods - random search methods - random walk method with direction exploitation - advantages of random search methods. Indirect Search Methods - gradient of a function - evaluation of the gradient - rate of change of function along a direction - steepest descent (Cauchy) method.   **(12)**

TOTAL : 45

TEXT BOOKS

1. S. S. Rao, "Engineering Optimization: Theory and Practice", 5th Edition, John Wiley & Sons, 2019.

2. K. Deb, "Optimization for Engineering Design - Algorithms and Examples", 2nd Edition, Prentice Hall India, 2013.

REFERENCES

1. J. S. Arora, "Introduction to Optimum Design", 4th Edition, Academic Press, 2016.

2. Ashok D. Belegundu &Tirupathi R. Chandrupatla, "Optimization Concepts and Applications in Engineering", 3rd Edition, Kindle Edition, Cambridge University Press, 2019.

3. *A. Ravindran, K. M. Ragsdell, Reklaitis G.V., "Engineering Optimization: Methods and Applications", John Wiley & Sons, Inc., 2006.*

4. *https://nptel.ac.in/courses/112/105/112105235/*

5. *https://nptel.ac.in/courses/105/108/105108127/*

6. *https://nptel.ac.in/courses/112/101/112101298/*

19MEOE03 - ENGINEERING POLYMERS, COMPOSITES AND ALLIED MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Choose manufacturing processes for polymers and PMC materials to obtain required shapes by applying product design considerations*

CO2 : *Find the processes to develop new ceramic and cermet materials for manufacturing of high temperature cutting tools by applying design considerations*

CO3 : *Develop and characterize the Nano-composites, MMCs, CMCs and PMCs for the engineering applications using secondary processing methods*

CO4 : *Synthesize, characterize, compaction and sintering of metal powders for application of P/M parts using powder metallurgy techniques*

CO5 : *Synthesize and characterize the nanostructured materials for fabricating electronic devices, MEMS, magnetic, electronic and optical sensors and fabricating carbon nano structured materials for fuel cell and energy storage applications*

SHAPING PROCESSES FOR PLASTICS

Properties of polymer melts - extrusion - production of sheet and film - fibre and filament production (spinning) - coating processes - injection moulding - compression and transfer moulding - blow moulding and rotational moulding - thermoforming. Casting - polymer foam processing and forming - product design considerations. **(8)**

RUBBER-PROCESSING TECHNOLOGY

Rubber processing and shaping - manufacture of tyres and other rubber products - product design considerations. **(5)**

SHAPING PROCESSES FOR POLYMER MATRIX COMPOSITES

Materials for PMC - open mold processes - closed mold processes - filament winding -pultrusion process - other PMC shaping processes. **(4)**

PROCESSING OF CERAMICS AND CERMETS

Processing of traditional ceramics - processing of new ceramics - processing of cermets - product design considerations. **(4)**

APPLICATION OF COMPOSITES

Composites including Nano-composites for electrical, superconducting and device applications, fabrication of Nano-composites, secondary processing and joining of various composite materials for structural applications and their fracture behavior and safety. **(9)**

POWDERS

Production and characterization of powders, compaction of metal powders - die compaction, isostatic pressing, powder forging, powder rolling and extrusion, pressure less compaction techniques, hot pressing and hot isostatic pressing, sintering of powder compacts, liquid phase sintering, sintering furnaces, post sintering operations, applications of P/M parts. **(7)**

INTRODUCTION TO NANOMATERIALS

Nano structured materials, low-dimensional structures: quantum wells, quantum wires, and quantum dots, Nano clusters & Nanocrystals, electronic and optical properties of Nano crystallites, metallic and semiconducting superlattices, synthesis of nanostructured materials, fabrication and characterization of Nano electronic devices and MEMS, basics of synthesis and

characterization of Nano-multi-component systems for sensors (magnetic, electronic and optical) and electrodes, synthesis and fabrication of carbon Nano structures for fuel cell and energy storage applications. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Mikell P. Groover, "Fundamentals of Modern Manufacturing Materials, Processes and Systems", 4th Edition, John Wiley & sons, Inc. 2015.*

2. *Ajayan P. M., Schadler L. S., & Braun P. V, "Nano composite Science and Technology", John Wiley & Sons, Inc., 2014.*

REFERENCES

1. *Charles A. Harper, "Modern Plastics Handbook", McGraw-Hill, 2010.*

2. *Sperling L.H., "Introduction to Physical Polymer Science", 3rd Edition, John Wiley & Sons, 2011.*

3. *Chawla K.K., "Ceramic matrix composites", 1st Edition, Chapman & Hall, 2013.*

4. *Randall M German, "A-Z of Powder Metallurgy (Metal Powders Technology)", Elsevier Science, 2007.*

5. *Upadhyaya G. S., "Powder Metallurgy Technology", Cambridge International Science Publishing, 2002.*

19MEOE04 - INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Examine the configuration of a robot and suggest a robot for a particular operation (pick and place, welding, vision, climbing etc.).*

CO2 : *Calculate the position, velocity and acceleration for a robot manipulator and solve the forward and inverse kinematics.*

CO3 : *Calculate mass and inertia for the links of a robot manipulator and also find its forward and inverse dynamics.*

CO4 : *Choose an appropriate vision system for the robot and then extract these images to get the desired output.*

CO5 : *Write a program to determine path for obstacle avoidance for a specific task and can solve using matrix laboratory software.*

INTRODUCTION

Brief history of robots, robot definitions, today's practical importance of robot applications, challenges faced by robots in industrial situations, future scope of robotics. **(3)**

GENERAL CONSIDERATION OF ROBOTIC MANIPULATORS

Introduction - Brief history of robotics- Robot geometrical configurations - wrist and gripper subassemblies - robot drive systems - robot software. **(5)**

KINEMATICS OF ROBOT MANIPULATORS

Homogeneous representation of objects, robot manipulator joint coordinate system, Euler angles and Euler transformations, Denavit- Hartenburg (D-H) representations, direct kinematics in robotics, inverse kinematic solutions, geometrical approach in inverse Kinematics, Jacobian of transformation in robotic manipulation. **(12)**

ROBOT WORKSPACE AND MOTION TRAJECTORY DESIGN

General Structure of robotic workspaces, robotic workspace performance index, extreme reach of robotic hands, robotic task description, robotic motion, trajectory design, general design considerations on trajectories, 4-3-4 trajectory, 3-5-3 trajectory, simulation of robotic workspaces. **(8)**

MOTION CONTROL OF ROBOTIC MANIPULATORS

General arm control system - open and closed loop control systems error controlled robotic dynamics - control structure of amplifier- control of a single axis robotic arm, common control systems for industrial robots, force control of robotic manipulators. **(9)**

ROBOT SENSING AND ROBOT VISION SYSTEM

Desirable features of sensor- range sensors - proximity sensors - tactile sensors-force sensors, torque sensing detectors - TV cameras - illumination techniques - fundamentals of image processing visual data acquisition - image enhancement - image segmentation - image extraction and recognition- object and model matching - image extraction. Typical vision systems, robot programming languages - characteristics of robot- level languages - characteristics of task level languages, simulation languages. **(8)**

TOTAL : 45

TEXT BOOK

1. *Fu.K S, Gonzales .R.C., & Lee.C.S.G., "Robotic Control, Sensing, Vision and Intelligence", McGraw Hill International, 2006.*

2. *Ashitava Ghushal "Robotics : Fundamental Concepts and Analysis", Oxford, 2006.*

REFERENCES

1. *Mikell.P.Groover, Mitchell Weiss, Tooger. N. Nager, & Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", McGraw Hill International, 2004.*

2. *Richard. D. Klafter, Thomas. A. Chmielewski, & Michaelnegin, "Robotic Engineering - An Integral Approach", Prentice Hall of India, 2002.*

3. *https://nptel.ac.in/courses/112/105/112105249/*

19MEOE05 - BUSINESS PROCESS REENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Gain knowledge about BPR, Factors affecting BPR operations and design BPR techniques.*

CO2 : *Use BPR tools, utilize concepts of BPR, analyse cost / Benefit and appreciate the need of IT in BPR.*

CO3 : *Incorporate changes in the business operation based on market demand and implement the same in the manufacturing system.*

CO4 : *Select an appropriate practice of the business re-engineering project by taking the practical situations into consideration.*

CO5 : *Provide the most feasible practical solution to the problem keeping in mind the considerations of business automation, value, processes and risks in launching the business reengineering project.*

INTRODUCTION TO BPR

Definition; the paradigm shifts in production; the need for BPR, advantages and benefits of BPR, constraining factors, challenges, the positioning concept; the re-engineering visions; The BPR Life Cycle Methodology, Guidelines for BPR steps, Role of Information Technology in BPR; process Improvement and Process Redesign; BPR Experience in Indian Industry. **(9)**

METHODOLOGIES AND TOOLS FOR BPR

Process management; dynamic business re-engineering change framework; steps to reengineer the process. Tools used in Modelling the Business: flow-charting, business activity maps, relational diagrams, benefit/cost analysis. The enabling role of information technology in business re-engineering. Conceptual Foundation of Business Process Re-engineering; Process Identification and Mapping; Role/Activity Diagrams. **(9)**

CHANGE MANAGEMENT

Planned changes in business re-engineering projects; challenges of business change; business change development. Success factors in re-engineering. The assessment of business re-engineering. Process Visioning and Benchmarking. Business process Improvement, Business Process Redesign; Man Management for BPR implementation; Re-organizing People and Managing Change. **(9)**

GOVERNANCE & BPR

Total Quality Management, Risk Management, Organizational Structures, BPR Project Management, The Power of Habit in organizations. The role of eLearning environments. Applications, gaming, BPR facilitation, BPR in Software Development, Basic principles, Relation to BPR. **(9)**

BEST PRACTICES IN BPR

Research & Practice, Perspectives in BPR, Discussion on research challenges, and practice challenges for industry and governments Case studies: Nissan, Chrysler, Hewlett Packard etc. Workflow systems, Imaging technology, Floware, Business design facility tools, Risk and impact measurement. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Davenport, "Process Innovation: Reengineering work through information technology". Harvard Business School Press, 1993.*

2. *Hammer & Champy, "Reengineering the Corporation: A Manifesto for Business Revolution" Harper Business Books, 1993.*

3. Hammer & Stanton, "The Reengineering Revolution" Harper Collins. London, 1995.

4. Henry J Johansson, Patrick McHugh, John Pendlebury & William A. Wheeler, "Business Process Reengineering: Break Point Strategies for Market Dominance", Wiley, New Delhi, 1993.

REFERENCES

1. Harmon, P, "Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals", Elsevier/Morgan Kaufmann Publishers, 2007.

2. R. Anupindi et al., "Managing Business Process Flows: Principles of Operations Management", Pearson Education Inc, 2006.

3. Kock, N.F., "Process Improvement and Organizational Learning: The Role of Collaboration Technologies", Idea Group, 1999.

5. Walford, R.B., "Business Process Implementation for IT Professionals and Managers" Artech Business Process Reengineering" Prentice Hall, New Delhi, 1993.

19MEOE06 - ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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

CO1 : *Analyze the demand and supply and sketch a demand and supply curve.*

CO2 : *Determine the Breakeven point and find out the strength and weakness of the Market Structure.*

CO3 : *Sketch the curve for cost behavior for the short run concept.*

CO4 : *Analyze and specify the causes and provide the solution to each cause.*

CO5 : *Formulate the steps involved in a recruitment process as a chart and interpret it.*

INTRODUCTION

Definition -Nature and Scope-Significance of Economics for Engineers.   **(5)**

BASICS OF MICRO ECONOMICS

Demand Analysis and Supply Analysis - Elasticity of Demand and Supply - Case Study in Demand Forecasting - Cost concepts - Classifications - Short run and Long run cost curves - Break-even Analysis.   **(8)**

MARKET STRUCTURE

Classification of Market - Perfect Competition-Characteristics -Monopoly - Monopolistic Competition - Oligopoly and Duopoly - Price Discrimination under different markets - Price and output determination in short run and long run.   **(8)**

MONEY AND BANKING

Money - Quantity theory of Money -Supply of Money - RBI Measures of Money Supply - Banking - Functions of Commercial Banks and Central Banks- Balance of Payments - Meaning and methods of Exchange control Methods of Foreign Payments - IMF, IBRD, WTO- Agreements of WTO and its Impact on Indian Economy.   **(9)**

NATIONAL INCOME

Meaning - National Income - Concepts -Methods of Calculating and Problems in calculating National Income - Inflation - Causes - Measures -Deflation - Stagflation - Phillips Curve - Unemployment New Environment Policy- Liberalisation -Privatisation - Globalisation.   **(8)**

HUMAN RESOURCE MANAGEMENT

Principles of Management, Evolution of Management, Development of Managerial Skills- Human Resource Management- Importance- Objectives- Job Analysis- Recruitment- Selection and Placement and Training Development.   **(7)**

TOTAL : 45

TEXT BOOKS

1. *Dewett. K. K., & Navalur M.H., "Modern Economic Theory", S. Chand and Company Ltd, New Delhi, 2014*

2. *Lipsey & Chrystal, "Economics", Oxford University Press, 2010*

3. *V. S. Bagad, "Principles of Management", Technical Publication, Pune*

REFERENCES

1. *Paul A Samuelson & William, "Economics", Tata McGraw Hill, New Delhi, 2012.*

2. *Francis Cheriunullem, "International Economics", McGraw Hill Education, 2011.*

3. *William A McEachern & Smrit Kaur, "Micro Economics", Cengage Learning, 2013.*

4. *William A McEachern & Indira A., "Macro Economics", Cengage Learning, 2014.*

5. *Lipsey & Chrystal, "Economics", Oxford University Press, 2010.*

6. *https://nptel.ac.in/courses/112/107/112107209/*

19EEOE01 - ENERGY AUDITING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Exhibit Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing*

CO2 : *Compute the thermal efficiency of various thermal utilities and use the energy audit methods learnt to identify the areas deserving tighter control to save energy expenditure.*

CO3 : *Analyse the cost- benefit of various investment alternatives for meeting the energy needs of productive processes through energy conservation study.*

CO4 : *Illustrate the energy saving techniques to reduce power consumption of the non- productive loads*

CO5 : *Advocacy of strategic and policy recommendations on energy conservation and energy auditing.*

ENERGY AUDIT

Global energy scenario - Heat and Electrical energy - Role of energy managers in industries - Energy auditing -Types of energy audit- Data to be collected in auditing - Needs, methodology and types of energy audits - Simple payback period - Net present value of saving- Energy audit report   **(9)**

ELECTRICAL ENERGY CONSERVATION

Basic Industrial electrical distribution- energy saving and energy efficiency with Transformers, reactive power correction and cable loss reduction- Energy saving in lighting systems -Specific Energy Consumption (SEC) - Load management - Demand Side Management (DSM).   **(9)**

HEAT ENERGY CONSERVATION

Energy Audit - Losses in Boiler - Waste heat recovery - Sources of waste heat - High temperature heat recovery - Medium temperature heat recovery - Waste heat recovery applications- Cogeneration- Heating, ventilation and air conditioning systems (HVAC) :Types - energy conservation in cooling towers and Spray ponds.   **(9)**

BUILDING, TRANSPORT AND UTILITY ENERGY CONSERVATION

Real buildings systems: Consumption - Cost versus lifecycle cost - Building design - Water supply systems Real Transportation Systems: Energy conservation in transportation - New technologies - Progress in clean diesel technology. Energy conservation inpumps, and fan and blowers - Energy efficient motors.   **(9)**

ENERGY AUDIT PLANNING AND MONITORING

Energy Action Planning: Energy management system - Management commitment and Energy conservation policy - Energy performance assessment - Data collection and management - Analysis of data, baseline and benchmarking - Estimation of energy savings potential - Action planning and Training planning.

Monitoring and Targeting: Defining monitoring & targeting, Elements of monitoring & targeting - Data and information, various techniques - Energy consumption, Production and Cumulative sum of differences (CUSUM).   **(9)**

TOTAL : 45

TEXT BOOKS

1. *D. P. Sen Gupta, K. R. Padiyar, IndranilSen, M.A, "Recent Advances in Control and Management of Energy Systems", Interline Publishers, Bangalore, 1993.*

2.   AmlanChakrabarti, "Energy Engineering and Management", PHI Learning, New Delhi 2012.

3.   YP.Abbi and Shashank Jain, "Handbook on Energy Audit and Environment Management", TERI, 2006.

4.   Frank Krieth and D Yogi Goswami, "Energy Management and Conservation Handbook", CRC Press, 2007.

5.   C.B. Smith, "Energy Management Principles", Pergamon Press, New York, 1981.

REFERENCES

1.   "General Aspects of Energy Management and Energy Audit-Unit- 1,2,3,4", BEE Guide book, 2010.

2.   Hamies, "Energy Auditing and Conservation: Methods, Measurements, Management & case study", Hemisphere, Washington, 1980.

3.   Diamant R.M, "Total Energy", Pergamon Press, Oxford Press, 1970.

4.   Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall, May 1984

5.   Larry C Whit et.al, "Industrial Energy Management & Utilization", 1st Edition, Springer, 1988.

19EEOE02 - SOLAR AND WIND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Summarize the solar radiation, measurements and characteristics of solar PV cell.*

CO2 : *Develop the model of a PV system and its applications.*

CO3 : *Illustrate the basic types, mechanical characteristics and model of wind turbine.*

CO4 : *Analyse the electrical characteristics and operation of various wind-driven electrical generators.*

CO5 : *Utilize various power electronic converters used for hybrid system.*

SOLAR RADIATION AND SOLAR CELL FUNDAMENTALS

Basic characteristics of sunlight - solar spectrum - insolation specifics- irradiance and irradiation pyranometer - solar energy statistics- Solar PV cell - I-V characteristics -P-V characteristics- fill factor. Modeling of solar cell- maximum power point tracking. **(9)**

SPV SYSTEM PERFORMANCE AND APPLICATIONS

PV module - blocking diode and by -pass diodes- composite characteristics of PV module - PV array - solar cell array design concepts - Peak power operation-System components. PV- powered fan-PV fan with battery backup - PV-powered pumping system - PV powered lighting systems - grid - connected PV systems. **(9)**

WIND ENERGY FUNDAMENTALS AND COMPONENTS

Wind source-wind statistics-energy in the wind- Basic principle of wind energy conversion - nature of wind - power in the wind -turbine power characteristics- parts of wind turbines- braking systems-tower-Maximum power operation. **(9)**

WIND TURBINE TYPES AND CONTROL

Classification of WECS - Generating Systems - DC generator, Synchronous generator, Induction -generator, Doubly fed Induction generator, Direct -driven generator- generator control - load control. **(9)**

SYSETM INTEGRATION

Energy storage-Power electronic converters for interfacing wind electric generators - power quality issues- Hybrid system: wind - diesel systems, wind-solar systems. **(9)**

TOTAL : 45

TEXT BOOKS

1. S N Bhadra, S Banerjee and D Kastha, "Wind Electrical Systems", Oxford University Press, 1st Edition, 2005.

2. Chetan Singh Solanki, "Solar Photovoltaic's: Fundamentals,Technologies and Applications" PHI Learning Publications, 3rd Edition, 2015.

REFERENCES

1. Roger A. Messenger and Jerry Ventre, "Photovoltaic systems engineering", Taylor and Francis Group Publications, 2020.

2. M.Godoy Simoes and Felix A. Farret, "Alternative Energy Systems: Design and Analysis with Induction Generators", CRC press, 2nd Edition, 2008.

3. Ion Boldea, "The electric generators hand book - Variable speed generators", CRC press, 2015.

19EEOE03 - ELECTRICAL SAFETY PROCEDURES AND MANAGEMENT

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 and analyze the precautions and protection of electrical hazards*

CO2 : *Select and use the suitable personal protective equipment according to the working environment*

CO3 : *Interpret the safety procedures for the specific work place*

CO4 : *Analyze and apply the various grounding techniques*

CO5 : *Infer the electrical safety against low voltage and high voltage and to manage the medical equipments*

INTRODUCTION AND HAZARDS OF ELECTRICITY

Electrical Safety introduction : Hazard Analysis: Primary and secondary hazards - Arc, blast, shocks - Causes and effects - Summary of causes- Protection and precaution - Injury and death protective strategies - IE Rules 1956 - Basic rules for new installations: power system, Domestic and Industry (Qualitative treatment only)   **(9)**

ELECTRICAL SAFETY EQUIPMENT

General inspection and testing procedure for electrical safety equipment - Electrical safety equipment for external protection: Flash and thermal protection - Head and eye protection - Insulation protection. Electrical safety equipment for internal protection: Over voltage, Short circuit, Earth Fault, Leakage current, High/ Low frequency - Single Line diagram of industrial power system with safety control - Electrician's Safety kit and materials.   **(9)**

SAFETY PROCEDURES

Introduction - Six step safety method - Job briefings - Energized or De - energized - Safe switching of power systems - General energy control programs - Lockout - Tagout - Voltage measurement techniques - Placement of safety grounds - Flash hazard calculations and approach distances - Calculating the required level of arc protection (flash hazard calculations) - Barriers and warning signs - Tools and test equipment - Field marking of potential hazards - Shock avoidance techniques - One minute safety audit.   **(9)**

GROUNDING AND ELECTRICAL MAINTENANCE

Need for electrical equipment grounding - System grounding - Equipment grounding - Types of Earthing - Earth testing for electrical equipment in Power house and Industry - Eight step maintenance program - Maintenance requirements for specific equipment and location - IEC and UL standard.   **(9)**

VOLTAGE SAFETY SYNOPSIS AND MEDICAL SAFETY MANAGEMENT

Safety equipment and safety procedures for low voltage and high voltage system - Electrical safety around electronic circuits- Electrical safety for medical equipment like over current safety, Isolation, EMI and harmonics - Battery maintenance procedure- Stationary battery safety - Accident prevention - Accident investigation - First aid - Rescue techniques - Electrical safety program structure and development - Safety meetings - Safety audits.   **(9)**

TOTAL : 45

TEXT BOOK

1. *John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel and Al Winfield, "Electrical Safety Handbook", 4th Edition, Mc Grew Hill, 2012*

REFERENCE S

1.   Mohamed A El - Sharkawi, "Electric safety: Practice and Standards", CRC press, New York, 2013

2.   Martha J. Boss and Gayle Nicoll, "Electrical Safety: systems, sustainability and stewardship", CRC press, New York, 2014

3.   Ray A. Jones and Jane g. Jones, "The Electrical Safety Program Guide", National fire protection association, Quincy, 2011

4.   Electrical Safety booklets issued by Government bodies

19EEOE04 - ENERGY EFFICIENT ILLUMINATION SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Understand the properties of light, importance of lighting in various fields, types of light sources and methods of lighting.*

CO2 : *Perform the calculation of luminance parameters in various applications.*

CO3 : *Identify the criteria for selection of lighting equipment's and control systems in various applications.*

CO4 : *Impart design and technology for Interior lighting and Exterior lighting applications*

CO5 : *Review the various technologies used in Smart lighting systems.*

INTRODUCTION : BASICS OF LIGHTING

Lighting Physics - Optical Radiation - Concept of Color - Biological Factors : Human eye and brain response - Different entities of illuminating systems. Properties of Lighting - Natural and Artificial lighting - Good and Bad Lighting - Challenges in Lighting - Good Practices in Lighting - Types of Lighting. **(7)**

LIGHTING CALCULATIONS AND LIGHT SOURCES

Basic Terms in Lighting System - Luminance measurement - Laws of Illumination - Polar Curves - Rousseau's construction - Concept of Photometry - Introduction of lighting software.

Lamps: Incandescent Lamps: Halogen lamps - Discharge Lamps: MV and SV Lamps, Fluorescent Lamps: FTL, CFL - Arc lamps - Special Lamps: LED: Surface Mounted Devices (SMD-LEDs), Chip on Board (COB-LEDs) - Neon lamps - Lasers - Comparison of Lamps - Life Cycle Cost (LCC) Analysis - Efficacy. **(12)**

LIGHTING EQUIPMENTS AND STANDARDS

Luminaries, Wiring, Control gears, Switching boards, Reflectors and Control circuits - Heating, Harmonics and EMI Suppression techniques from lighting equipment - Switching and Dimming control algorithm - Recommendation of Illumination Levels for Various Tasks / Activities / Locations - Role of 3D printing technology for designing luminaries - International Standards and codes of lighting system. **(9)**

LIGHTING APPLICATIONS

Interior lighting: Industrial, Residential, Indoor stadium and Hospitals. Exterior lighting: Flood, Street, Aviation and Transport lighting - Sign and display Board Lighting - Lighting in Agriculture - Lighting in Automobiles. **(8)**

SMART LIGHTING SYSTEMS

Intelligent lighting system - Smart LED lighting systems - LED Smart Projector system - Solar Street Lighting Systems - Role of IoT in lighting system - Concept of Light Fidelity (Li-Fi) - Significance of UV-C lighting in medical - Concept of Artificial Moon for street lighting. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to the Laser", Visions Communications, Washington DC, USA, 2nd Edition, 1994.*

2. *Jack L. Lindsey, "Applied Illumination Engineering", Prentice Hall of India, New Delhi, 3rd Edition, 2008*

3. *Leon Gaster, John Stewart Dow, "Modern Illuminants and Illuminating Engineering", Nabu Press, Washington DC, 1ˢᵗ Edition, 2010.*

4. *Philip Gordon., "Principles and Practices of Lighting Design: The Art of Lighting Composition", Blue Matrix Productions, 2011.*

REFERENCES

1. *Lighting Engineering: Practical Hand Book, INDALUX 2002*

2. *IES Lighting Handbook, 10ᵗʰ Edition, 2011.*

3. *NPTEL Course: Illumination Engineering*

4. *Lighting - Research paper reference from Philips - Lighting Academy and Signify Lighting University.*

19EEOE05 - ELECTRIC VEHICLE TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Apprehend the fundamentals and importance of electric vehicles and its components*

CO2 : *Select the suitable drive scheme based on the motor and topology for the given specification and applications*

CO3 : *Design and categorize the battery system for electric vehicles and hybrid electric vehicles*

CO4 : *Recognize the suitable battery charging scheme for different environments and applications.*

CO5 : *Describe the significance of E-mobility and its various business opportunities*

ELECTRIC VEHICLES

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 - Gradability **(9)**

ELECTRIC PROPULSION

Electric Motors in EVs - Configuration and control of DC motor drives - Induction motor drives- Permanent Magnet motor drives - Switched reluctance motor drives - Transmission configuration, Components - gears, differential, clutch, brakes - regenerative braking - types - Motor sizing.- Matching the electric machine and the internal - combustion engine (ICE), Sizing the propulsion motor, sizing the power - electronics, selecting the energy storage technology, Communications- supporting subsystems **(9)**

BATTERIES

Introduction to Batteries - Energy Storage Requirements in Electric Vehicles: Batteries Types: Lead-Acid Battery - Nickel-Metal Hydride - Lithium-Ion - Battery Operation - Battery Parameters and Comparisons - Battery Packs - Battery Sizing - Battery based energy storage and its analysis - Fuel Cells - Fuel Cell based energy storage and its analysis - Super capacitors- Hybridization of different energy storage devices **(9)**

BATTERY CHARGING

Charging methods for battery- Fast charging - Battery Charging, Protection, and Management System - Termination methods - Charging from grid - Isolated and Non-isolated DC - DC Converters - Bidirectional DC-DC converter - High-frequency transformer based isolatedcharger topology - Transformer less topologies. **(9)**

E-MOBILITY

Energy Management Strategies - Automotive networking and communication, EV and EV charging standards, V2G, G2V, V2B, V2H - E-mobility business - Electrification challenges - Connected Mobility and Autonomous Mobility- Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV). **(9)**

TOTAL : 45

TEXT BOOKS

1. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, 2nd Edition CRC Press, 2018.

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

REFERENCES

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, 2nd Edition, Wiley, 2012

2. Soylu "Electric Vehicles - The Benefits and Barriers", InTech Publishers, Croatia, 2011.

3. J.M. Miller, "Propulsion Systems for Hybrid Vehicles", Institution of Electrical Engineers (IEE), 2nd Edition, London, UK, 2010.

4. R. Stone and J.K. Bell, "Automotive Engineering Fundamentals", SAE International, Warrendale, PA, 2004.

5. Viswanathan B. and Scibioh Aulice M, "Fuel cells: Principles and Applications", University Press, 2008.

19EEOE06 - ENERGY EFFICIENCY 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 Kanolu, 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*

REFERENCES

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*

19ECEOE01 - SIGNAL PROCESSING AND ITS APPLICATIONS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Compute the Discrete Fourier Transform (DFT) of a given discrete time sequence using Radix-2 Fast Fourier Transform algorithms and design FIR/IIR Filters*

CO2 : *Apply source coding procedure to calculate coding efficiency based on entropy & mutual information and outline different pulse analog modulation techniques*

CO3 : *Analyze various equalization techniques and compare its performance*

CO4 : *Calculate channel capacity using Shannon's channel capacity theorem and develop channel error control codes*

CO5 : *Analyze speech processing methods in time and frequency domain and design codec methods for speech compression techniques*

ORTHOGONAL TRANSFORMS AND DIGITAL FILTER STRUCTURES

DFT-DCT-Properties of DFT- Computation of DFT, FFT and structures-Decimation in time-Decimation in frequency - Linear convolution using DFT

Basic FIR/IIR filter structures-FIR/IIR Cascaded lattice structures-Parallel allpass realization of IIR transfer functions- Sine cosine generator - Computational complexity of filter structures **(10)**

DATA COMPRESSION

Information entropy-Source coding-Huffman algorithm-Delta Modulation-Adaptive Delta Modulation- Continuously Variable Slope Delta Modulation-Differential Pulse Code Modulation - Adaptive Differential Pulse Code Modulation. **(8)**

SIGNAL PROCESSING IN COMMUNICATION RECEIVER

Temporal Equalization-Space Time Equalization-Frequency Domain Equalization-Symbol Timing Recovery- Channel Quality Estimation- Automatic Frequency Control-Overall Receiver Block. **(9)**

ERROR CORRECTING CODES & CHANNEL CODING

Error Correcting codes-Error Correction-Linear Blocks Codes-Cyclic Codes- Bose, Chaudhari and Hocquenghem Codes-Convolution Codes-Viterbi Decoding-Interleaving Codes-Concatenated Codes- Turbo Codes. **(9)**

SPEECH CODING

Speech Coding-Adaptive Predictive Coding-Sub Band Coding,-Vocoders-Liner Predictive Coding- Image Coding-Joint Photo Graphic Expert Group (JPEG)-Moving Pictures Expert Group (MPEG), the layer-3 of MPEG-1 Algorithms(MP3),Lempel- ZIV Algorithms - Recognition techniques:Speech Recognition and Image recognition. **(9)**

TOTAL : 45

TEXT BOOKS

1. *V. Oppenheim, R. W. Shafer and J.R.Buck, "Discrete-Time Signal Processing", Pearson Education, 3rd Edition, 2011.*

2. *Simon Haykin, "Digital Communications Systems", 1st Edition, Wiley, 2013.*

REFERENCES

1. Sanjit. K. Mitra and Sanjit Kumar Mitra, "Digital Signal Processing - A computer based approach", Tata McGraw Hill, 4th Edition, 2011.

2. Todd K Moon, "Error Correction Coding - Mathematical methods and Algorithms", John Wiley & Sons, 2005.

3. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003

4. L.R.Rabiner and R.W.Schaffer "Digital Processing of Speech signals" Prentice Hall 1978

5. Nirmal K. Bose, Calyampudi Radhakrishna Rao, "Signal Processing and Its Applications" North-Holland, 1993

19ECEOE02 - SMART SENSORS AND IoT

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 : *Explain the classification ,types,packaging and testing of smart sensors*

CO2 : *Interpret the construction and working principles of Electronic sensors*

CO3 : *Exemplify the working of different types of light radiation sensors .*

CO4 : *Illustrate the key concepts of temperature ,gas and airquality sensors used to measure the parameters.*

CO5 : *Interpret the characteristics, functional blocks and architecture of IoT to develop an IoT based applications.*

SMART SENSORS BASICS

Sensor Classification, Performance and Types, Error Analysis characteristics- Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors- Reliability Implications-Testing Smart Sensors- HVAC Sensor Chip- Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control-MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration. **(9)**

ELECTRONIC SENSORS

Resistance strain gauge - piezoelectric pressure gauge - characteristics- load cells-torque sensor- Piezo-resistive and capacitive pressure sensor- optoelectronic pressure sensors- vacuum sensors- Capacitor plate sensor, Inductive sensors, LVDT- Hall effect- Doppler detectors- liquid level detectors, flow sensors - ultrasonic sensor- flow sensors. **(9)**

GHT RADIATION SENSORS

Electronic and Optical properties of semiconductor as sensors - LED - Semiconductor lasers- Fiber optic sensors- Thermal detectors - Photo multipliers- photoconductive detectors- Photo diodes- Avalanche photodiodes - CCDs - Intensity sensor - Interferometers-Phase sensor: Phase detection, Polarization maintaining fibers. **(9)**

TEMPERATURE, GAS AND AIR QUALITY SENSORS

Bimetallic strip- Bourdon temperature gauge- thermocouples- Resistance thermometers- thermistors- bolometer- Pyroelectric detector-Engine combustion process- Catalytic exhaust after treatment, Emission limits- Exhaust sensors and Engine control - Exhaust sensors for OBD- Hydro-Carbon Sensors- NOx-Sensors-Oxygen Sensors- Measurement of oxides of sulphur,oxides of nitrogen unburnt hydrocarbons, carbonmonoxide, dust mist and fog- smoke sensors. **(9)**

IoT AND ITS APPLICATIONS

IoT Definition - Characteristics - IoT Functional Blocks -IoT Architecture -Physical design of IoT - Logical design of IoT- Sensing & Actuation -Basics of Networking - Communication Protocols- Machine-to-Machine - Communication models & APIs.

Domain specific applications of IoT: Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture, Smart Traffic Control and Smart water management. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Jacob Fraden," Handbook of modern sensors: physics, designs, and applications", 5th Edition, Springer, 2016.*

2. *Randy Frank, "Understanding Smart Sensors", Artech House, 2nd Edition, Boston, 2011.*

REFERENCES

1. *Arshdeep Bahga, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities Press, 2015.*

2. *Jon. S. Wilson, "Sensor Technology Hand Book", Elsevier, 1st Edition, Netherland, 2011.*

3. *John G Webster, "Measurement, Instrumentation and sensor Handbook", CRC Press, 2nd Edition, Florida, 2017.*

4. *John P. Bentley," Principles of Measurement systems", 3rd Edition, Pearson Education Asia Pvt. Ltd, 2009.*

5. *D. Patranabis," Sensors and Transducers", 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2006.*

6. *Ernest O Doebelin, Dhanesh N Manik, "Measurement Systems, Application and Design", McGraw Hill, 6th Edition, 2007.*

19ECEOE03 - CONSUMER ELECTRONICS

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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Understand the various types of microphones and loudspeaker.*

CO2 : *Explain the principle and working of Monochrome TV.*

CO3 : *Describe the Colour TV scanning process and camera tube.*

CO4 : *Illustrate LCD, LED TV, working of cable TV and DTH.*

CO5 : *Interpret the significant technical considerations using a broad systems perspective.*

AUDIO SYSTEMS

Microphones Carbon, moving coil, wireless microphone; Loudspeakers - Direct radiating Electrostatic and horn loudspeaker; Multi-speaker system; Sound Recording - Magnetic Recording, Digital Recording, Optical Recording (CD system and DVD). **(9)**

MONOCHROME TV

Elements of TV communication system, Scanning process, Scanning methods and Aspect Ratio, Need of synchronizing and blanking pulses, Composite Video Signal, Camera Tube: Vidicon. **(9)**

COLOUR TELEVISION

Primary, secondary colours, Concept of Mixing, Colour Triangle, Camera tube, PAL TV Receiver, Concept of Compatibility with Monochrome Receiver, NTSC, PAL, SECAM. **(9)**

LCD AND LED TELEVISION

Basic principle and working of LCD & LED TV, Cable Television: Working of Cable TV, DTH **(9)**

DOMESTIC & CONSUMER APPLIANCES

Operation of Microwave Oven, Automatic Washing Machine, Photostat Machine, Digital Camera, Vacuum cleaner, Food Processors, Scanner. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Bali S.P., "Consumer Electronics" Pearson Education, 2017.*

2. *Bali R and Bali S.P. "Audio video systems: principle practices & troubleshooting", Khanna Book Publishing Co. (P) Ltd., 2010.*

REFERENCES

1. *Gulati R.R., "Modern Television practices" New Age International Publication (P) Ltd.2011.*

2. *Gupta R.G, "Audio video systems" Tata Mc graw Hill, 2nd Edition, 2010.*

3. *Whitaker Jerry & Benson Blair, "Standard Handbook of Audio engineering" McGraw-Hill Professional, 3rd Edition, 2010.*

4. *Amit Dhir, "The Digital Consumer Technology Handbook", Elsevier Science, 2004.*

19ECEOE04 - ROBOTICS

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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

Upon completion of this course, students will be able to demonstrate an ability to

CO1 : *Describe the concepts of robotics, safety measures and homogeneous transformation.*

CO2 : *Formulate the concepts of mechanical drives and sensors in robotics.*

CO3 : *Describe the types of sensors and Robotic Vision*

CO4 : *Develop robotics programming, classifications and its applications.*

CO5 : *Exemplify the concepts of artificial intelligence.*

ROBOT KINEMATICS

Introduction - Robotics and programmable automation - Historical background - Laws of Robotics - Robot definitions - Robotics system and Robot anatomy - Specifications of Robots - Safety measures in Robotics.   **(10)**

ROBOTIC DRIVERS AND CONTROLS

Robot drives, actuators and control - Functions of drive systems - General types of fluids - Pump classification - Pneumatic systems - Electrical drives - DC motors - Stepper motors - Drive mechanism.   **(9)**

SENSORS AND MACHINE VISION

Need for sensing systems- Principles and Applications of the following types of sensors- Position and displacement sensors - Potentiometers, Encoders, Linear Variable Differential Transformer, Force and Torque sensors- Wrist sensor, Joint sensor, Tactile array sensor, Slip sensors- Proximity sensors- Range finders- Imaging sensors- Inductive Proximity switch- Acoustic sensors- Opto-electronic sensors- Lighting Techniques, Robot Vision- Sensing and Digitizing, Image Processing and analysis- Preprocessing, Segmentation, Description, Recognition, Interpretation and Applications of robot vision system   **(9)**

ROBOTIC LANGUAGE AND PROGRAMMING

Robot language and programming. Robot language - Classification of Robot languages - Computer control and robot software - VAL system and language. Applications of Robots: Capabilities of Robots - Robotics applications - Obstacle avoidance.   **(8)**

ARTIFICIAL INTELLIGENCE IN ROBOTICS

The history of Artificial Intelligence- Artificial and Natural Intelligence- Artificial Intelligence and Automated manufacturing- The application domains of Artificial Algorithms- Risks and Benefits of AI- Agents and Environments- Knowledge representation.

(9)

TOTAL : 45

TEXT BOOKS

1. *Satya Ranjan Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill, 2nd Edition, 2012.*

2. *Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2014.*

REFERENCES

1. *Robin.R.Murphy, "Introduction to AI Robotics", The MIT Press, Canbridge, Massachusetts, London, England, Second Edition, 2019.*

2. *Jadran Lenarcic, Jean-Pierre Merlet, "Advances in Robot Kinematics 2016", Springer International Publishing AG, 2018.*

3. Peter McKinnon, "Robotics", CreateSpace Independent Publishing Platform, 2016.

4. Ritu Tiwari, Anupam Shukla, Rahul Kala, "Intelligent Planning for Mobile Robotics: Algorithmic Approaches", Information science reference, United states of America, 2013.

5. David. L. Pool and Alan. K. Mackworth, "Artificial Intelligence: Foundations of Computational agents", Cambridge University, 2011.

19ECEOE05 - INFORMATION THEORY AND CODING TECHNIQUES

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Explain the information content in a discrete memoryless source through parameters such as entropy and mutual information.*

CO2 : *Estimate a channel's capacity based on Shannon's channel capacity theorem*

CO3 : *Analyze various channel encoding and decoding methods*

CO4 : *Design and develop an error control coding methods for random error and burst error detection and correction techniques*

CO5 : *Understand different applications in coding techniques*

INFORMATION THEORY AND SCHEMES FOR SOURCE CODING

Uncertainty Information and Entropy - Basic Properties of entropy - Information rate - Conditional entropy - Joint Entropy - Mutual Information - Channel capacity of a Gaussian channel

SOURCE CODING : Prefix codes - Necessary conditions for source coding - Kraft Mcmillan Inequality- Huffman Coding- Shannon Fano Coding Efficiency calculations. **(9)**

MEMORYLESS FINITE SCHEMES FOR CHANNEL CODING

Discrete Memoryless Channel - Channel models - BSC and BEC channels - Cascaded channels - Channel capacity of discrete and analog channels - Channel capacity of a Gaussian channel-Bandwidth-S/N trade-off-Channel coding theorem - Information capacity theorem - Code rate and redundancy-Parity check codes - Rate Distortion Theory. **(9)**

LINEAR BLOCK CODES AND CYCLIC CODES

Rationale for coding - Types of codes - Matrix description of linear block codes - Syndrome decoding - Minimum distance considerations -Repetition codes - Dual codes- Cyclic codes :Generator polynomial - Parity check polynomial - Encoder of cyclic codes - Calculation of syndrome - Cyclic codes for error correction. **(10)**

CONVOLUTIONAL CODES

Convolutional codes : Tree codes- Trellis codes- Viterbi decoding of convolutional codes - Catastrophic Error Propagation in Convolutional Codes -Performance Bounds for Convolutional Codes - Coding Gain - Convolutional Code Trade off - Soft Decision Viterbi Decoding -Feedback Decoding - Sequential Decoding **(9)**

CODING TECHNIQUES IN DATA COMPRESSION

Static and Dynamic Huffman coding - Arithmetic coding - Run length encoding- Lempel-Ziv coding -Image compression techniques -JPEG standard for Lossy and Lossless compression- Video compression standards. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003.*

2. *Ranjan Bose, "Information Theory Coding and Cryptography", Tata McGraw Hill, 3rd Edition 2016.*

REFERENCES

1. *Richard B.Wells, "Applied Coding and Information Theory for Engineers", Pearson Education, 1st Edition Indian reprint, 2009.*

2. *Khalid Sayood, "Introduction to Data Compression", 4th Edition, Elsevier, 2012.*

3. *Bernard Sklar, "Digital Communications: Fundamentals and Applications", Pearson Education, 2nd Edition, 2009.*

4. *Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2nd Edition, 2006.*

5. *Reza F M, "An Introduction to Information theory", McGraw Hill, 2000.*

6. *Todd K Moon, "Error Correction Coding - Mathematical methods and Algorithms", John Wiley & Sons, 1st Edition, 2021.*

19ECEOE06 - WIRELESS SENSOR NETWORKS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Outline the challenges & issues in the wireless sensor network and its subsystems and interpret network architecture and its components*

CO2 : *Describe the essential principles of the MAC protocols for Wireless Sensor Networks*

CO3 : *Elucidate the Routing & localization tracking inWireless Sensor Networks*

CO4 : *Discuss the features of WSN Operating systems*

CO5 : *Illustrate the methodologies to provide WSN based solution for various critical issues.*

SENSOR NETWORKS - INTRODUCTION & ARCHITECTURES

Challenges for Wireless Sensor Networks-Enabling Technologies for Wireless Sensor Networks- Characteristic requirements for WSN - WSN architecture - Commercially available sensor nodes -Imote, IRIS, Sunspot -Physical layer and transceiver design considerations in WSNs-Single Node Architecture -Energy Consumption of Sensor Nodes- Sensor Network Scenarios- Optimization Goals and Figures of Merit. **(9)**

DATA LINK LAYER

Fundamentals of MAC protocols- Issues in designing a MAC Protocol for WSN - Low duty cycle protocols and wakeup concepts - Contention based protocols:PAMAS - Schedule-based protocols:LEACH - Sensor MAC - Berkeley MAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4- Link Layer protocols - fundamentals task and requirements, error control, framing, link management, Address and Name Management, Assignment of MAC Addresses, Unique,Content-based and geographical addressing. **(10)**

ROUTING AND TRACKING

Routing Challenges and Design Issues in Wireless Sensor Networks- Taxonomy :Data-centric routing SPIN - Energy aware routing, Gradient-based routing -Hierarchical Routing LEACH -Location Based Routing GAF, Data aggregation - Various aggregation techniques

A Tracking Scenario - Problem formulation - Distributed representation and inference of states- Tracking multiple objects - Sensor models - Topology control - Clustering - Time synchronization - Localization and Localization Services **(10)**

EMBEDDED OPERATING SYSTEMS FOR WSNs

Embedded Operating Systems: Operating Systems for WSNs - Introduction - Operating System Design Issues- Introduction to Tiny OS - NesC - Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM. **(7)**

APPLICATIONS OF WSN

WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications - Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling **(9)**

TOTAL : 45

TEXT BOOKS

1. *Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, First Edition, 2007.*

2. *Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.*

REFERENCES

1. *Anna Hac, "Wireless Sensor Network Design", John Wiley & Sons, First Edition, 2003.*

2. *C.S.Raghavendra Krishna, M.Sivalingam and Taribznati, "Wireless Sensor Networks", Springer Publication, 2004.*

3. *Paolo Santi, "Topology Control in Wireless Adhoc and Sensor Networks", John Wiley & Sons, 2005.*

4. *Philip Levis, David Gay,"TinyOS Programming", Cambridge University Press, 2009 Contiki - Open Source Operating System for IoT - http://www.contiki-os.org/*

19ECEOE07 - AUTOMOTIVE EMBEDDED SYSTEMS

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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : *Design modules for hybrid vehicle using automotive system components.*

CO2 : *Design control system in automotives by appropriate choice of Microcontrollers, Sensors and actuators.*

CO3 : *Examine the communication protocols for real time applications*

CO4 : *Understand the safety and comfort in Automobiles as per the government test procedures.*

CO5 : *Understand the communication and diagnostic protocols*

AUTOMOTIVE SYSTEMS

Overview of Automotive industry - Tools and Processes - Introduction to modern automotive systems -Spark and Compression Ignition Engines - Automotive Transmissions - Vehicle braking fundamentals -Steering Control - Overview of Hybrid Vehicles - Analog and Digital Systems - Basic measurements systems. **(9)**

SENSORS AND ACTUATORS

Sensors: Characteristics, response and modeling - Actuators - Microcontroller and Digital Signal Processors used for automotive applications. **(9)**

EMBEDDED COMMUNICATION

Embedded Automotive Protocols: CAN, LIN, FLEXRAY, MOST **(9)**

SAFETY SYSTEMS

Active Safety Systems: ABS, TCS, ESP, brake assist - Passive Safety Systems: Airbag systems, Advance Driver Assistance system (ADAS) -Computer vision techniques - Connected cars technology - Trends towards Autonomous vehicles. **(9)**

FUNDAMENTALS OF DIAGNOSTICS

Basic wiring system and Multiplex wiring system, Self-Diagnostic system - various On board and off board diagnostics in Automobiles - Diagnostics tools - Diagnostics Protocols: KWP20000 and UDS. **(9)**

TOTAL : 45

TEXT BOOK

Ronald K Jurgen, "Automotive Electronics Hand Book", McGraw- Hill, 2nd Edition 1999.

REFERENCES

1. *William B. Ribbens, Ph.D, "Understanding Automotive Electronics", Elsevier Publications, 7th Edition, 2012.*

2. *Tom Denton, "Advance Automotive Diagnosis", 2nd Edition, Elsevier 2006.*

3. *BOSCH Automotive Handbook, 8th Edition.*

4. *Denton. T, "Automobile Electrical and Electronics Systems", SAE (Society for Automobile Engineers) International, 3rd Edition, 2004.*

5. *Jack Erjavec, "Automotive Technology: A Systems Approach", Delmar Cengage Learning, 5th Edition, 2009.*

19ECEOE08 - 5G TECHNOLOGIES AND APPLICATIONS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : describe the evolution of cellular systems from 2G to 4G

CO2 : explain the motivation, targets of 5G technology and its standardization

CO3 : elaborate the 3GPP releases and 5G radio access network architecture

CO4 : discuss the services offered by 5G deployment and its design approaches

CO5 : understand the role between 5G and emerging next generation wireless technologies

EVOLUTION OF CELLULAR SYSTEMS

Evolution from 2G to 3G and 3G to 4G - Circuit Switch to Packet Switch - ITU Standardization Process- - Evolution of LTE and releases. **(9)**

INTRODUCTION TO 5G

Motivation for 5G - 5G targets - Technology components - Spectrum - capabilities - The role of 3GPP in standardization - use cases - 5GPPP (Public-Private Partnership) **(9)**

5G RADIO ACCESS NETWORK

Radio access - 3GPP Releases - 5G New Radio (NR) - Requirements - 3GPP phases for IMT-2020 - NR air interface - 5G RAN architecture **(9)**

5G SERVICES

Enhanced Mobile Broadband (eMBB) systems - Massive Machine Type Communication (MMTC) system - Ultra Reliable and Low Latency Communication (URLLC) systems - Design approaches **(9)**

EMERGING TECHNOLOGIES IN 5G

Massive MIMO - Network Function Virtualization - Software Defined Networking - Cognitive radio -Millimetre Wave - Heterogeneous network - Internet of Things **(9)**

TOTAL : 45

TEXT BOOKS

1. *Saad Asif, "5G mobile Communications Concepts and Technologies", CRC Press,2018*

2. *Biljana Badic, Christian Drewes, Ingolf karls, Markus Mueck, "Rolling out 5G Use cases, Applications and Technology Solutions", Apress, 2016*

REFERENCES

1. *Antti Toskala, Harri Holma, Takehiro Nakamura, "5G Technology 3GPP New Radio", Wiley & Sons Ltd. 2020.*

2. *Devaki Chandramouli, Juho Pirskanen, Rainer Liebhart, "5G for the Connected World", Wiley,2019*

3. *Haesik Kim, "Design and Optimization for 5G Wireless Communications", Wiley, 2020*

4. *Ramjee Prasad, "5G Outlook Innovations and Applications", River Publications, 2016*

5. *Anwer Al-Dulaimi, "5G Networks Fundamental Requirements, Enabling Technologies, and Operations Management", Wiley, 2018*

6. *Mauro Boldi, Olav Queseth, Patrick Marsch, Ömer Bulakci, "5G System Design Architectural and Functional Considerations and Long Term Research", Wiley,2018*

19ECEOE09 - VEHICULAR COMMUNICATION

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 : *Understand basic principles, technologies, and system architecture of vehicular ad-hoc networks (VANET)*

CO2 : *Analyze Physical Layer and MAC Layer for signal propagation for vehicular communication*

CO3 : *Describe the various routing mechanisms and protocols to fulfill vehicular networking requirements.*

CO4 : *Explain the challenges and issues in establishing cellular V2X connection and mobility management.*

CO5 : *outline vehicular communication platforms for various emerging applications*

INTRODUCTION TO VEHICULAR RADIO NETWORKS

Basic principles and challenges-Mobile Wireless Communications and Networks-Need for Vehicular Communications-VANET activities- Network Architecture for Vehicular Communications. **(9)**

PHYSICAL LAYER AND MAC LAYER

Signal Propagation-Doppler spread and its impact on OFDM Systems-Proposed MAC approaches and standards, Intelligent Transportation Systems: IEEE 802.11p-ITS-IVC **(10)**

VANET ROUTING PROTOCOLS

Opportunistic packet forwarding-topology based routing- geographic routing **(8)**

VEHICULAR MOBILITY MANAGEMENT

Connected Vehicles& Connected Autonomous Vehicles- Dedicated Short Range Communication-flow and traffic models-Standards and Regulations- DSRC Protocol Stack, Cellular V2X **(9)**

EMERGING VANET APPLICATIONS

Vehicle to Infrastructure Safety Applications-communication paradigms-message coding and composition-data aggregation-Security and Privacy **(9)**

TOTAL : 45

TEXT BOOKS

1. *H. Hartenstein and K. P. Laberteaux, VANET: Vehicular Applications and Inter-Networking Technologies, John Wiley & Sons Ltd., 1ˢᵗ Edition 2010.*

2. *Luca Delgrossi, Tao Zhang, "Vehicle Safety Communications: Protocols, Security, and Privacy", John Wiley & Sons Ltd 1ˢᵗ Edition 2012.*

REFERENCES

1. *P. H.-J. Chong, I. W.-H. Ho, Vehicular Networks: Applications, Performance Analysis and Challenges, Nova Science Publishers, 2019.*

2. *C. Sommer, F. Dressler, Vehicular Networking, Cambridge University Press, 2015.*

3. *Popescu-Zeletin R, Radusch I and Rigani M.A, "Vehicular-2-X Communication",Springer,2010.*

4. *M. Watfa, Advances in Vehicular Ad-Hoc Networks: Development and Challenges, Information Science Reference, 2010.*

5. *H. Moustafa, Y. Zhang, Vehicular Networks: Techniques, Standards, and Applications, CRC Press, 2009.*

6. *Xiang W, "Wireless Access in Vehicular Environments Technology", Springer, 2015*

19ECEOE10 - SENSING FOR AUTOMOTIVE SYSTEMS

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ASSESSMENT : THEORY

COURSE OUTCOMES

Upon completion of this course the students will be able to demonstrate an ability to

CO1 : Acquaint with the basic automotive system components and need for automotive sensors.

CO2 : Discuss the fundamentals of various Power train sensors in automotive systems.

CO3 : Comprehend various sensors for chassis management.

CO4 : Understand the sensors for vehicle management & security systems in Automobiles.

CO5 : Examine the vehicle communication protocols standards in automotive applications.

AUTOMOTIVE SYSTEMS

Introduction to Modern Automotive Systems- Electronics in Automobiles - Combustion Engines- Power-train- braking systems - Transmission- Applications and Challenges in the automotive. **(9)**

POWERTRAIN AUTOMOTIVE SENSORS

Exhaust temperature sensor - λ sensors - PM sensor - NOx sensor - fuel quality sensor- level sensor- torque sensor-speed sensor- manifold pressure sensor - mass flow sensor. **(9)**

CHASSSIS SENSORS

Wheel speed sensors/direction sensors- steering position sensor (multi turn)- acceleration sensor (inertia measurement)- brake pneumatic pressure sensor- ABS sensor- electronic stability sensor. **(9)**

SENSORS FOR VEHICLE MANAGEMENT & SECURITY SYSTEMS

Gas sensors (CO2)- Temperature/humidity sensor- air bag sensor- key less entering sensor- radar sensors. Tire pressure monitoring systems- Two wheeler and Four wheeler security systems. **(9)**

VEHICLE COMMUNICATION STANDARDS

Automotive Protocols : CAN, LIN, FLEXRAY, MOST **(9)**

TOTAL : 45

TEXT BOOK

John Turner, Automotive Sensors, 2010, Momentum Press, 1ˢᵗ Edition, New York.

REFERENCES

1. Automotive Electrics, Automotive Electronics: Systems & Components, 2014, 5ᵗʰ Edition, BOSCH.

2. Ronald K Jurgen, "Automotive Electronics Hand Book", McGraw- Hill, 2ⁿᵈ Edition 1999.

3. Automotive Sensors Handbook, 8ᵗʰ Edition, 2011, BOSCH

4. Jiri Marek, Hans-Peter Trah, Yasutoshi Suzuki, Iwao Yokomori, "Sensors for Automotive Technology", 4ᵗʰ Edition, Wiley, New York, 2010.

5. Jack Erjavec, "Automotive Technology: A Systems Approach", Delmar Cengage Learning, 5ᵗʰ Edition, 2009.

19CSOE01 - CUSTOMER RELATIONSHIP MANAGEMENT

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

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 type of collecting and connecting the customer data with proper guidelines for privacy.*

CO4 : *Demonstrate the scoring process and apply the various CRM optimization techniques to optimize the CRM process in order to improve customer profitability.*

CO5 : *Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.*

INTRODUCTION

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. **(9)**

BUILDING THE BUSINESS CASE

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. **(10)**

COLLECTING CUSTOMER DATA

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. **(8)**

SCORING YOUR CUSTOMER

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. **(8)**

OVERVIEW OF DATA MINING AND CRM TOOL MARKETS

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. **(10)**

TOTAL : 45

TEXT BOOKS

1. *Alex Berson, Stephen Smith, Kurt Thearling, "Building Data mining Applications for CRM", Tata McGraw Hill, Fifteenth Reprint, 2008.*

2. *Ian H.Witten ,Eibe Frank, Mark A.Hall, "Data Mining Practical Machine Learning Tools and Techniques", Morgan Kaufmann, Fourth Edition, 2016*

REFERENCES

1. *Francis Buttle, Stan Maklan "Customer Relationship Management: Concepts and Technologies", Routledge, Fourth Edition, 2019.*

2. *Roger J. Baran, Robert J. Galka, "CRM: The Foundation of Contemporary Marketing Strategy", S.Chand (G/L) & Company Ltd, Second Edition, 2017.*

19CSOE02 - FUNDAMENTALS OF SOFTWARE ENGINEERING

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

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, ER diagrams and Software Requirement Specifications.*

CO3 : *Employ suitable architectural styles, software design methodologies, coding standards and practices in developing practical applications*

CO4 : *Discuss various testing techniques and their application in defect removal.*

INTRODUCTION

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   **(9)**

SOFTWARE REQUIREMENTS AND ANALYSIS

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.   **(8)**

SOFTWARE DESIGN

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.   **(10)**

CODING

Programming principles and guidelines - Structured programming - Information hiding - Some programming practices - Coding standards - Code inspection - Planning- Self review - Group review meeting.   **(7)**

TESTING

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.   **(11)**

TOTAL : 45

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*

19CSOE03 - INTERNET PROGRAMMING

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Gain knowledge in overview of www and web based applications.*

CO2 : *Design and develop dynamic and Interactive web page using DHTML.*

CO3 : *Design and develop web applications using servlets.*

CO4 : *Gain knowledge on E-business models and E-marketing.*

BASIC WEB CONCEPTS

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.   **(9)**

CLIENT SIDE PROGRAMMING

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.   **(9)**

DYNAMIC HTML

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.   **(9)**

SERVER SIDE PROGRAMMING

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.   **(9)**

WEB BASED APPLICATIONS AND ITS TECHNOLOGIES

Rails: Overview of Rails-Ajax: Overview of Ajax Rails with Ajax- e-Business Models-e-Marketing-online payments-Security.**(9)**

TOTAL : 45

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.*

3. *Jeffrey C. Jackson," Web Technologies: A Computer Science Perspective", Pearson Education, Reprint 2011.*

4. *Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, Fourth Edition 2013.*

19CSOE04 - INTRODUCTION TO DATA WAREHOUSING AND DATA MINING

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the basic concepts, architecture, data models of database management systems and data warehouse.*

CO2 : *Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.*

CO3 : *Find frequent item set and generate association rules for the given transactions.*

CO4 : *Analyze different types of data using classification and clustering techniques.*

BASIC CONCEPTS OF DATABASE SYSTEM

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. **(8)**

DATA MINING

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.**(9)**

DATA WAREHOUSING

Data Warehouse - Introduction-Multidimensional Data Model-Data Warehouse Architecture -Data Warehouse Implementation from Data Warehousing to Data Mining. **(8)**

DATA PREPROCESSING AND ASSOCIATION RULES

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 **(10)**

CLUSTERING AND CLASSIFICATION

Cluster analysis - Partitioning Methods - K-Means and K-Medoid algorithm - CLARA - CLARANS - Hierarchical clustering - BIRCH - Density based clustering - DBSCAN - Decision tree induction. **(10)**

TOTAL : 45

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.*

4. *George M. Marakas, "Modern Data Warehousing, Mining, & Visualization Core concepts", Pearson Education, First Edition, 2003*

5. *Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, Singapore, First Edition, 2001.*

19CSOE05 - INTRODUCTION TO EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Examine the characteristics and challenges in embedded system development*

CO2 : *Identify the parameters affecting CPU performance and develop optimized code*

CO3 : *Demonstrate the scheduling of given set of real-time tasks using the appropriate scheduling algorithm*

CO4 : *Design embedded system for simple applications*

INTRODUCTION

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. **(10)**

CPU PERFORMANCE

I/O Primitives - Busy -Wait I/O - Interrupts - Memory System Mechanisms: Cache, Memory Management Unit and Address Translation - Pipelining - CPU Power Consumption **(8)**

DEVELOPMENT AND DEBUGGING

Development environments - Debugging Techniques - Debugging challenges - System Level Performance analysis - Program Level Performance analysis - Program Optimization **(9)**

SCHEDULING

Scheduling states of a Process-Running Periodic Processes - Preemption - Priorities- Rate Monotonic Scheduling - Earliest Deadline First Scheduling - Priority Inversion - Data dependency. **(10)**

NETWORKS

Bus Standards: I2C, CAN Bus, Field Bus. CASE STUDY: Alarm Clock, Elevator Controller. **(8)**

TOTAL : 45

TEXT BOOK

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.*

19ITOE01 - DIGITAL COMPUTER BASICS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Explain various schemes of number system representations, code conversions and perform arithmetic operations.*

CO2 : *Describe Boolean Algebra, formulate and simplify Boolean expressions using K-Maps and illustrate the logic gates realization.*

CO3 : *Describe the working of basic combinational circuits and sequential circuits.*

CO4 : *Describe the structure and functioning of various memory schemes.*

NUMBER SYSTEMS

Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers.

Complements of Numbers - Signed Binary Numbers. Binary Codes : Binary-Coded Decimal (BCD) Code, Gray Code, ASCII Character Code, Error Detecting Code. BCD Addition - Decimal Arithmetic. Binary Storage and Registers. **(9)**

BINARY LOGIC AND BOOLEAN ALGEBRA

Definition of Binary logic. Boolean Algebra - Basic Definitions - Theorems and Properties of Boolean Algebra - Canonical and Standard Forms. Digital Logic Gates : Integrated Circuits. Gate-Level Minimization: Map Method - Four Variable K-Map - Product of Sums Simplification. Realization of Boolean functions using Gates **(9)**

COMBINATIONAL CIRCUITS

Adder : Half Adder - Full Adder - Binary Parallel Adder - BCD Adder. Subtractor : Half Subtractor - Full Subtractor. Code Conversion. Decoders - De-Multiplexer - Encoders - Multiplexers. **(10)**

SEQUENTIAL CIRCUITS

Storage Elements - Latches, Flip Flops - RS, D, JK and T flip -flops- Triggering of flip -flops - Characteristic Tables - Characteristic Equations. Registers - Shift Registers. Counters: Binary ripple counter - Up down binary counter. **(9)**

MEMORY AND PROGRAMMABLE LOGIC

Random Access Memory - Memory Decoding - Read Only Memory - Types of ROMs, Programmable Logic Array, Programmable Array Logic **(8)**

TOTAL : 45

TEXT BOOK

1. *M. Morris Mano and Michael D. Cieti,"Digital Design with an Introduction to the Verilog HDL, Pearson Education, Fifth Edition, 2013.*

REFERENCES

1. *M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, First Edition, 2008.*

2. *Thomas L.Floyd, "Digital Fundamentals", Pearson Education, Tenth Edition, 2017.*

19ITOE02 - PROGRAMMING IN JAVA

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the fundamental aspects of object oriented programming paradigm.*

CO2 : *Develop java programs using features like methods, classes, constructors, overloading and string handling.*

CO3 : *Write exception handling routines for practical applications.*

CO4 : *Describe multithreading, synchronization and networking features of Java.*

CO5 : *Demonstrate use of applets and database connectivity in developing practical Applications.*

OBJECT ORIENTED PROGRAMMING

Introduction to object oriented languages - Evolution of object oriented languages - Object oriented programming paradigm - Basic concepts of object oriented programming - Procedural Vs object oriented programming. **(6)**

INTRODUCTION TO JAVA

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 IO systems - String Handling : String and String Buffer. **(12)**

EXCEPTION HANDLING

Exception Handling: Fundamentals of Exception handling and types - Built in Exceptions - User defined Exceptions. **(5)**

MULTI THREADS

Multithreaded Programming: Thread Model -Thread properties -Thread priorities - Synchronization- Inter thread communication- Networking :Inet address- Datagrams - Sockets - URL connections. **(11)**

APPLET AND DATABASE CONNECTIVITY

Introduction to Abstract Window Tool kit - Applet class - HTML applet tags - Parameter passing - Audio clip interface - Event class: Keyboard and Mouse events handling. **(11)**

TOTAL : 45

TEXT BOOK

1. *Herbert Schilt :"Java 2 - Complete references ", Tata McGraw Hill, Ninth Edition, McGraw Hill Education, 2014.*

REFERENCE

1. *Deitel H.M and Deitel P.J, "Java - How to Program", Prentice Hall of India, Ninth Edition, 2012.*

19ITOE03 - FUNDAMENTALS OF DATABASE SYSTEMS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the database system concepts and explain the key features of Relational data models.*

CO2 : *Describe the features of Entity Relationship diagram and draw Entity Relationship diagram for the given real world application*

CO3 : *Design a normalized database system and carry out data retrieval using SQL.*

CO4 : *Demonstrate various transaction concepts and various concurrency control mechanisms*

DATABASE SYSTEMS

Data Vs Information-Introducing the database and DBMS- Importance of Database Design- Files and File systems-Problems with File System Data Management, Database Systems. Relational Database Model: Logical view of Data- Keys- Integrity Rules- Relational Set Operators- Data Dictionary and the system catalog -Codd's relational database rules. **(10)**

RELATIONAL MODEL

Entity Relationship Model: Entities-Attributes-Relationship-Connectivity and cardinality- Existence Dependence-Relationship Strength-Weak Entities-Relationship participation- Relationship Degree-Recursive Relationship-Developing an ER Diagram. **(8)**

STRUCTURED QUERY LANGUAGE

Introduction to SQL- Data Definition Commands- Data Manipulation Commands-Advanced Data Definition and SELECT Commands - Virtual Tables -Creating Views- Joining Database Tables. **(8)**

DATABASE DESIGN

Database Tables and Normalization- Need for Normalization- Normalization Process- Improving the Design-Surrogate Key Considerations, High level Normal Forms, Normalization and Database Design-Denormalization. **(10)**

TRANSACTION MANAGEMENT

Transaction Concepts: Transaction Properties- Transaction Concurrent Executions. Concurrency control with Locking Methods: Lock Granularity-Lock Types-Two-Phase Locking to Ensure Serializablity-Deadlocks-Database Recovery Management-RAID.

(9)

TOTAL : 45

TEXT BOOK

1. *Peter Rob, Coras M.Colonel, "Database Systems: Design, Implementation and Management", Thompson Learning Course Technology, Tenth Edition, 2012.*

REFERENCES

1. *Abraham Silberschatz, Henry F.Korth,S.Sudharshan,"Database System Concepts", McGraw-Hill, Sixth Edition, 2013.*

2. *Ramez Elmasri, Shamkant B. tJavathe, "Fundamentals ofDatabase Systems", Pearson Education, Sixth Edition, 2013.*

3. *Raghu Ramakrishnan, Johannes Gehrke, "Database ManagementSystems", McGraw Hill Education, Third Edition, 2014.*

4. *Thomas M.Connolly and Carolyn E.Begg, "A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2004.*

19ITOE04 - CLOUD COMPUTING FUNDAMENTALS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Understanding the client- server, distributed collaborative and cloud computing architecture along with cloud storage and services.*

CO2 : *Classify the different virtualization environments and techniques.*

CO3 : *Illustrate various services deployed from a cloud architecture supported by different providers.*

CO4 : *Analyze the major security challenges and privacy problems in the cloud and virtual environment.*

INTRODUCTION

Understanding Cloud Computing- history of cloud computing: Client/Server computing, Peer to peer computing, Distributed computing and Collaborative computing.- Understanding cloud architecture, cloud storage and services-Pros and cons of cloud computing. **(9)**

VIRTUALIZATION

Introduction-Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques - Virtualization and Cloud Computing - Pros and Cons of Virtualization - Technology Examples **(9)**

CLOUD COMPUTING ARCHITECTURE

Cloud reference model: Architecture, Infrastructure / Hardware as a service, Platform as a service-Software as a service, Types of cloud: Public clouds, Private clouds, Hybrid Cloud, Community Clouds. **(9)**

CLOUD SERVICES

Discovering Cloud services Development services and tools: Amazon, Google App Engine, IBM, Salesforce.com, Other Cloud Services development tool **(9)**

CLOUD SECURITY

Security Overview - Cloud SecurityChallenges - Software as a Service Security - Security Governance - Risk Management - Security Monitoring - Security Architecture Design - Data Security - Application Security - Virtual Machine Security. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Michael Miller "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online",1st Edition, Pearson Education, New Delhi, 2009.*

2. *Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013. (Virtualization, Cloud Computing Architecture)*

3. *John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010. (Cloud Security)*

REFERENCES

1. *Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.*

2. *Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2002.*

3. *Kai Hwang, Geoffrey C Fox,Jack GDongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2002.*

19ITOE05 - INFORMATION SECURITY FUNDAMENTALS

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Identify and analyze the security threats and attacks and applydevice suitable security policies and standards.*

CO2 : *Assess the risks and apply suitable risk control strategies.*

CO3 : *Employ appropriate intrusion detection and prevention systems to ensure information security.*

CO4 : *Discuss various national and international laws of information security and its framework.*

INTRODUCTION, NEED FOR SECURITY

Introduction to Information Security - The History of Information Security- Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing Components - Balancing Information Security and Access - The Systems Development Life Cycle - The Security Systems Development Life Cycle. The Need for Security: Introduction Business Needs First -Threats -Attacks. **(5)**

RISK MANAGEMENT AND INFORMATION SECURITY

Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points - Recommended Practices in Controlling Risk. **(6)**

POLICIES, STANDARDS, PRACTICES AND BUSINESS CONTINUITY

Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and itscontrols, NIST SecurityModels, Design of Security Architecture - Security Education, Training and Awareness Program - Continuity Strategies. **(6)**

SECURITY TECHNOLOGY

Introduction - Intrusion Detection and Prevention Systems: IDPS Terminology, Use of IDPS, Strengths and Limitations of IDPS - Honey Pots, Honey Nets, and Padded Cell Systems - Scanning and Analysis Tools, Access Control Devices **(8)**

BIOMETRIC CONTROLS

Biometrics - Nature of Biometrics Identification/Authentication Techniques - Biometric Techniques - Matching and Enrollment Process in Biometrics - Benefits Over Traditional Authentication Methods. **(6)**

SECURITY OF WIRELESS NETWORKS

Attacks on Wireless Networks: Other Security Risks in Wireless Networks, Management and Mitigations for Wireless Networks Attacks. **(7)**

LAWS AND LEGAL FRAMEWORK

Introduction - Information Security and the Law: The Rising Need -Understanding the Laws for Information Security:A Conceptual Framework - The Indian ITAct - Laws for Intellectual Property Rights (IPR) -Health Insurance Portability and Accountability Act (HIPAA) - Building Security into Software/System Development Life Cycle. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Course Technology, New Delhi, Fourth Edition, 2012 Reprint.*

2. Nina Godbole, "Information Systems Security-Security Management, Metrics, Frameworks and Best Practices", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.(Biometric Controls, Security of Wireless Networks, Laws and Legal Framework)

REFERENCES

1. Thomas R.Pettier, "Information Security Fundamentals", Auerbach Publications, Second Edition, 2013.

2. Vicki Krause and Harold F.Tipton, "information Security Management Handbook", Auerbach Publications, Sixth Edition, 2008.

3. Mark Merkow and Jim Breithaupt,"Information Security - Principles & Practices", Second Edition, Pearson Education, 2014.

19ITOE06 - INTRODUCTION TO HUMAN COMPUTER INTERACTION

L	T	P	C
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ASSESSMENT : THEORY

COURSE OUTCOMES

CO1 : *Describe the importance and need for effective user friendly Graphical User Interfaces (GUI).*

CO2 : *Choose suitable interactions devices/tools to meet application specific requirements.*

CO3 : *Design Graphical User Interfaces(GUI) using apt components and apply the design guidelines for user-friendly navigation and presentation.*

CO4 : *Asses graphical user interfaces for compliance against the screen design guidelines.*

INTRODUCTION

Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design **(9)**

THE GRAPHICAL USER INTERFACE & DESIGN PROCESS

GUI: Popularity of graphics - The concept of direct manipulation - Graphical system - Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface.

Design process: Human Interaction with computers - Importance of Human Characteristics - Human Consideration - Human Interaction Speeds and Understanding Business Junctions. **(9)**

SCREEN DESIGNING

Design Goals - Screen Planning and Purpose - Organizing Screen Elements - Ordering of Screen Data and Content - Screen Navigation and Flow - Visually Pleasing Composition - Amount of Information - Focus and Emphasis - Presenting Information Simply and Meaningfully - Information retrieval on web - Statistical Analysis - Technological considerations in Interface Design. **(9)**

WINDOWS & COMPONENTS

Windows: New Navigation Schemes - Selection of Window - Selection of DevicesBased on Screen Based Controls. Components: Text and Messages - Icons and Increases - Multimedia - Colors - Uses -Problems - Choosing colors. **(11)**

SOFTWARE TOOLS AND INTERACTION DEVICES

Specification Methods - Interface Building Tools - Keyboard and Function Keys - Pointing Devices Speech Recognition. **(7)**

TOTAL : 45

TEXT BOOKS

1. *Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.*

2. *Ben Shneidermann, "Designing the User Interface", Fifth edition, Pearson Education Asia, 2013. (Software Tools and Interaction Devices)*

REFERENCE

1. *Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition*

19ITOE07 - ENTERPRISE RESOURCE PLANNING CONCEPTS

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ASSESSMENT : THEORY

COURSE OUTCOMES

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.*

INTRODUCTION

Enterprise - An Overview - Introduction to ERP - Benefits Of ERP - ERP and Related Technologies - Business Process Reengineering (BPR) - Data Warehousing - Data Mining - OLAP--SCM. **(9)**

ERP IMPLEMENTATION

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. **(10)**

THE ERP BUSINESS MODULES

Business modules of an ERP Package - Finance - Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management - Sales and Distribution. **(9)**

THE ERP MARKET & ERP - PRESENT AND FUTURE

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. **(9)**

SAP

Gateway to SAP: Architecture of SAP R/3 -SAP Integrated-Three Tier Architecture - SAP Easy Access - Understanding ABAP Workbench **(8)**

TOTAL : 45

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)*

REFERENCES

1. *Ellen F.Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Course Technology Ptr, Fourth Edition, 2011.*

2. *Vinod Kumar Garg and Venkitakrishnan N.K., "Enterprise Resource Planning - Concepts and Practice", Prentice Hall of India, New Delhi, Second Edition, 2012.*

19CHOE01 - INDUSTRIAL SAFETY ENGINEERING

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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.*

19CHOE02 - RISK ANALYSIS AND HAZOP

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : *Identify individual hazards in a process and deduce the associated risks.*

CO2 : *Identify radiation intensity and effects of explosion*

CO3 : *Perform risk analysis of various types of problems*

CO4 : *Evaluate effect about key hazard identification techniques*

CO5 : *Apply risk analysis techniques and Hazop study*

INTRODUCTION AND DISPERSION MODELS

Risk analysis introduction, quantitative risk assessment, rapid risk analysis - Comprehensive risk analysis - Emission and dispersion - Leak rate calculation. Single and two-phase flow - Dispersion model for dense gas - Flash fire - Plume dispersion - Toxic dispersion model - Ealuation of risk. **(9)**

RADIATION INTENSITY

Radiation - Tank on fire - Flame length - Radiation intensity calculation and its effect on plant, people and property radiation VCVCE - Explosion due to over pressure - Effects of explosion, risk contour -Effects, explosion, BLEVE - Jet fire - Fire ball.**(9)**

RISK ANALYSIS

Overall risk analysis - Generation of meteorological data - Ignition data - Population data - Consequences analysis and total risk analysis - Overall risk contours for different failure scenarios - Disaster management plan - Emergency planning - On site and off site emergency planning, risk management ISO 14000, EMS models case studies - Marketing terminal, gas processing complex, refinery. **(9)**

HAZARD ANALYSIS

Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough - Mexico - Madras - Vizag - Bopal analysis **(9)**

CASE STUDIES

Hazop - Guide words, parameters, derivation - Causes - Consequences - Recommendation - Coarse Hazop study - Case studies - Pumping system - Reactor - Mass transfer system. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Ragavan K.V., Khan A.A., Methodologies in Hazard identification and assessment -Manual, CLRI publication, 1990.*

2. *Marcel.V.C., Major Chemical Hazard, Ellis Hawood Ltd., Chi Chester, UK, 1987.*

3. *Skeleton B., Process Safety Analysis, Institution of chemical Engineers, U.K., 1997.*

REFERENCE

1. *Daniel A Crowl., Louvar J.F., Chemical Process Safety: Fundamentals with Applications, Prentice Hall, New Jersey, 2002.*

19CHOE03 - GREEN TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : *Outline the green technology concepts and relevance in twenty first century requirements.*

CO2 : *Defend the environmental and sustainability issues, role of CSR and CER and Indian corporate structure and environment.*

CO3 : *Recall the indicators of sustainability and their use and can also find the alternate theories.*

CO4 : *Criticize the environmental reporting, ISO 14001, ISO 14064, financial initative by UNEP, etc.*

CO5 : *Analyse the green tax incentives and rebates, business redesign and its models.*

INTRODUCTION

The concept of green technology; evolution; nature, scope, importance and types; developing a theory; green technology in India; relevance in twenty first century. **(9)**

SUSTAINABILITY & ENVIRONMENT

Organizational environment; internal and external environment; Indian corporate structure and environment; how to go green; spreading the concept in organization; environmental and sustainability issues for the production of high-tech components and materials, life cycle analysis of materials, sustainable production and its role in corporate social responsibility (CSR) and corporate environmental responsibility (CER). **(9)**

ECOSYSTEM APPROACHES

Approaches from ecological economics; indicators of sustainability; ecosystem services and their sustainable use; bio-diversity; Indian perspective; alternate theories **(9)**

ACTS OF GREEN TECHNOLOGY

Environmental reporting and ISO 14001; climate change business and ISO 14064; green financing; financial initiative by UNEP; green energy technology; green product technology. **(9)**

GREEN ECONOMICS

Definition; green techniques and methods; green tax incentives and rebates (to green projects and companies); green project technology in action; business redesign; eco-commerce models. **(9)**

TOTAL : 45

REFERENCES

1. *Green Technology and Green Technologies: Exploring the Causal Relationship by Jazmin Seijas Nogarida, 2008.*

2. *Green Marketing and Technology: A global Perspective by John F. Whaik, 2005.*

3. *The Green Energy Technology Book by Leo A. Meyer.*

4. *Green Project Technology by Richard Maltzman and David Shiden.*

5. *Green Marketing by JacquelinOttman.*

6. *Green and World by Andrew S. Winston.*

19CHOE04 - CORROSION SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : *Classify the types of corrosion and theories and also relate the various controlled corrosion process.*

CO2 : *Examine the factors involved in the corrosion and control methods of various corrosion.*

CO3 : *Analyse the mechanism of corrosion and evaluate the effects like pH, temperature, flow rate on corrosion.*

CO4 : *Design and develop the corrosion control methods like cathodic protection, sacrificial anode and impressed current anodes and anodic protection.*

CO5 : *Predict the different corrosion testing, monitoring and inspection tests by surface analytical studies.*

INTRODUCTION

Introduction, classification, economics and cost of corrosion. emf series, galvanic series, corrosion theories derivation of potential Current relations of activities controlled and diffusion controlled corrosion process. Potential - pH diagram, Fe-H2O system, application and limitation. Passivation - Definition, anodic passivation theory of passivation, oxidation laws, effects of oxygen and alloying on oxidation rates. **(9)**

CORROSION CONTROL METHODS

Forms of corrosion - Definition, factors and control methods of various forms of corrosion such as pitting, inter granular, crevice, dezincification, stress corrosion, corrosion fatigue, fretting corrosion, hydrogen embitterment, corrosion processes and control methods in fertilizers, petrochemical, chemical building industries **(9)**

MECHANISM OF CORROSION

Environmental aspects, atmospheric corrosion - Classification, factors influencing atmospheric corrosion, temporary corrosion preventive methods, corrosion in immersed condition, effect of dissolved gases, salts, pH, temperature, and flows rates on corrosion, marine corrosion, underground corrosion. Biological corrosion, definition, mechanism of corrosion, control of bio-corrosion. **(9)**

CORROSION PREVENTION

Corrosion control aspects, electrochemical methods of protection-theory of cathodic protection design of cathodic protection, sacrificial anodes, impressed current anodes, anodic protection. Corrosion inhibitors for acidic, neutral and alkaline media, cooling water system - Boiler water system. Organic coating, surface preparation, natural, synthetic resin, paint, formulation and application. Design aspects in corrosion prevention, corrosion resistant materials. **(9)**

CORROSION TEST

Corrosion testing, monitoring and inspection, laboratory corrosion tests, accelerated chemical tests for studying different forms of corrosion. Electrochemical methods of corrosion rate measurements by DC and AC methods, corrosion monitoring methods, chemical and electrochemical removal of corrosion products, newer techniques to study corrosion processes, inspection methods by NDT. Surface analytical techniques such as AES, ESCA, SEM. Evaluation of paints by conventional and electrochemical methods. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Roberge P. R., Corrosion Engineering, McGraw Hill, New York, 2008.*

2. *Fontana M.G., Greene N.D., Corrosion Engineering, Third Edition, McGraw Hill, NewYork, 2005.*

3. *Uhling H. H., Revie R.W., Corrosion and Corrosion Control, John Wiley and Sons, Inc, 1985.*

REFERENCE

1. *Banarjee.S.N., An introduction to corrosion and corrosion inhibitors, Oxonian Press Ltd., New Delhi, 1985.*

19CHOE05 - INTRODUCTION TO CHEMICAL ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : *Express the fundamentals of chemical engineering and to solve problems.*

CO2 : *Ability to develop basic fluid concepts, transfer and separation operations.*

CO3 : *Design equipment for transport and separation processes.*

CO4 : *Apply material and Energy balance to precisely calculate material required for a process.*

CO5 : *Apply steady state balances to develop process flow sheets.*

OVERVIEW OF CHEMICAL ENGINEERING

Concepts of unit operations and unit processes, and more recent developments, The Chemical Industry-scope, features & characteristics. Flow sheets, and symbols for various operations. **(9)**

MATERIAL AND ENERGY BALANCE CALCULATIONS

Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge, and bypass, combustion reactions, Forms of energy, optimum utilization of energy, Energy balance calculations in simple systems. Introduction to Computer aided calculations-steady state material and energy balances, combustion reactions. **(9)**

BASIC FLUID CONCEPTS

Dimensions and Units, Velocity and Stress Fields, Viscosity and surface tension, Non Newtonian viscosity, Dimensional Analysis (Buckingham PI theorem), Types of flows, Methods of Analysis, Fluid Statics. pipe flow, Pumps, Agitation and Mixing, Compressors. **(9)**

HEAT TRANSFER OPERATIONS

Review of conduction, resistance concept, extended surfaces, lumped capacitance; Introduction to Convection, natural and forced convection, correlations; Radiation; Heat exchangers- Fundamental principles and classification of heat exchangers, Evaporators. **(9)**

MASS TRANSFER OPERATIONS

Fundamental principles and classification of Distillations, Adsorption, Absorption, Drying, Extraction, Membrane Process. Energy and Mass Conservation in process systems and industries. Introduction to chemical reactors. **(9)**

TOTAL : 45

REFERENCES

1. *G.T. Austin, R.N. Shreve, Chemical Process Industries, 5th Ed., McGraw Hill, 1984.*

2. *W.L. McCabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 6th Edition, McGraw Hill, 2001.*

3. *R. M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd Ed., John Wiley, New York,2004.*

4. *L.B. Anderson and L.A. Wenzel, Introduction to Chemical Engineering, McGraw Hill, 1961.*

5. *H.S. Fogler, Elements of Chemical Reaction Engineering, 4th Ed., Prentice-Hall, 2006.*

19CHOE06 - NANOMATERIAL SYNTHESIS AND CHARACTERIZATION LABORATORY

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : *To synthesize several nanomaterials in different methods in lab scale.*

CO2 : *To understand and operate the instruments for material characterization.*

CO3 : *To interpret the properties of synthesized nanomaterials by analyzing the results*

EXPERIMENTS

1. Chemical synthesis of Ag nanoparticles; UV-Visible absorption of the colloidal sol.

2. Chemical synthesis of CdS nanoparticles; Optical absorption spectra; Band gap estimation from the band edge.

3. Synthesis of ceria nanofibres by Solvothermal method.

4. Synthesis of silica nanoparticles using Stober method.

5. Synthesis of Au nanoparticles by simple chemical method.

6. Synthesis of Fe_3O_4 nanoparticles by simple reduction method.

7. Effect of reducing agent on the synthesis of metal nanoparticles.

8. Aqueous to organic phase transfer of Ag and CdS nanoparticles; Confirmation by UV-Visible absorption.

9. Effect of concentration on the synthesis of silver nanoparticles.

10. Effect of reducing agent on gold nanoparticles.

11. Fabrication of silver nanofilms.

12. Synthesis of polyvinyl alcohol fibres by electrospinning method.

13. Synthesis of Au and Ag nanoparticles at aqueous-organic liquid interface; UV-visible spectroscopy of the colloidal film; comparison with the corresponding colloidal sol.

14. Sol gel synthesis of $ZnO/TiO_2/CdO$ nanoparticles.

15. A bioroute to Au nanoparticles.

16. Sol-gel spin coating route to SnO_2 nanothin films: surface roughness measurement by AFM.

17. Hydrothermal synthesis of ZnS Nanorods: Nanorods formation by SEM analysis.

18. Fabrication and wettability characterization of nanostructured soft polymer surfaces.

19. Preparation of nanofluids.

20. Determination of viscosity of nanofluids.

21. Evaporation studies of nanofluids.

22. Measurement of stability of nanofluids.

23. Optical properties of nanofluids.

24. Measurement of onset of natural convection in nanofluids.

25. Thermal conductivity measurement of nanofluids.

TOTAL : 60

REFERENCES

1. *Sarit K. Das, Stephen U. Choi, Wenhua Yu, T. Pradeep, Nanofluids: Science and Technology, Wiley, 2007.*

2. *Vincenzo Bianco, Oronzio Manca, Sergio Nardini, Kambiz Vafai, Heat Transfer Enhancement with Nanofluids, CRC Press, 2017.*

3. *Amy S., Thermal Energy Storage Using Phase Change Materials: Fundamentals and Applications Fleischer, Springer, 2015.*

4. *Mohsen Sheikholeslami and Davood Domairry Ganji, Applications of Nanofluid for Heat Transfer Enhancement, Elsevier, 2017.*

5. *S.M. Sohel Murshed, Carlos Nieto de Castro, Nanofluids: Synthesis, Properties and Applications, Nova Science Publishers, 2014.*

6. *T. Pradeep, A Textbook of Nanoscience and Nanotechnology. Tata McGraw-Hill Education, 2003.*

7. *P.R. Chandran, M. Naseer, N. Udupa, N. Sandhyarani. Size controlled synthesis of biocompatible gold nanoparticles and their activity in the oxidation of NADH. Nanotechnology. 8, 23(1), 2011.*

8. *I.A. Ibrahim, A.A. Zikry, M.A. Sharaf. Preparation of spherical silica nanoparticles: Stober silica. J. Am. Sci. 6(11), 985-9, 2010.*

9. *X. Chen, S.S. Mao. Titanium dioxide nanomaterials: synthesis, properties, modifications, and applications. Chemical reviews. 11, 107(7), 2891-959, 2007.*

10. *Sarit K. Das, Stephen U. Choi, Wenhua Yu, T. Pradeep, Nanofluids: Science and Technology, Wiley, 2007.*

19CHOE07 - MULTIVARIATE STATISTICS LABORATORY

L	T	P	C
0	0	6	3

ASSESSMENT : PRACTICAL

COURSE OUTCOMES

After completion of the course, students are able to

CO1 : *Design experiments to obtain statistical principles of Univariate examples.*

CO2 : *Apply the concepts of statistics to draw conclusions from data*

CO3 : *Assess practical knowledge to carry out meaningful interpretation of data from real life*

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. Point and Interval Estimation for Normal and Chi-Square Distribution using Excel and R.

2. Point and Interval Estimation for T-Distribution and F-Distribution using Excel and R.

3. K-means Clustering.

4. One-way ANOVA Model in Excel and R.

5. Linear Regression

6. Logistic Regression

7. Naive Bayesian Classifier

8. Decision Trees

9. Simulation of Principal component analysis using Excel and R.

10. Simulation of Fischer Discriminant Analysis using Excel and R.

11. Modeling the Change by Differential Equations using R and Excel.

12. Modeling the Change by Difference Equations using R and Excel.

13. Multivariate Normal & Hoteling's T2 Distribution.

14. Multivariate Analysis of Variance (MANOVA).

15. Correspondence Analysis using R.

TOTAL : 60

REFERENCES

1. Apostol T.M. (1985) Mathematical Analysis, Narosa,Indian Ed.

2. Courant R. And John F. (1965) Introduction to Calculas and Analysis, Wiley.

3. Miller K.S. (1957) Advanced Real Calculas, Harper, New York.

4. Rudin, Walter (1976) Principles of Mathematical Analysis,McGraw Hill.

5. Malik S.C. (2005) Principles of Real Analysis, New Age International (p)Ltd.

6. Bartle R.G. (1976) Elements of Real Analysis

19MOE01 - GRAPH THEORY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will be able to understand the idea of graph theory and to solve the real time problem.*

CO2 : *To relate the Graph theory Algorithms' in their field of engineering and apply the same in the irrespective mainstream.*

CO3 : *To become familiar with Special graphs for modeling the networks.*

CO4 : *Able to design and solve Coloring concepts for defined problems.*

CO5 : *Model the networks using graph theory.*

GRAPHS ANDSUB GRAPHS

Graph-Standard Concepts in Graphs - Sub graphs - Complete Graph - Bipartite Graph - Isomorphism - Adjacency Matrix and Incidence Matrix-Walk, Trail and Path - Bipartite Graph - Connectedness - The Shortest Path Problem - Dijkstra's Algorithm **(9)**

TREES

Trees- Characterization - Blocks - Block Graphs - Cayley's Formula - Spanning Trees - Spanning Tree Algorithms - Kruskal's and Prim's Algorithm **(9)**

EULERIAN AND HAMILTONIAN GRAPHS

Eulerian graphs - Euler's theorem - Hamiltonian graphs - Dirac's and Ore's theorems - Closure of a graph - Bondy -Chvatal theorem - Traveling salesman problem - The Chinese Postman Problem - Fleury's Algorithm. **(9)**

COVERING AND COLORING

Covering - Independent Sets - Matching - Perfect Matching- Applications - The Personal Assignment Problem - Coloring - Chromatic Number - Four Color Problem - Chromatic Polynomials - Application. **(9)**

DIRECTED GRAPHS

Digraph - orientation - strongly, weakly and unilaterally connected digraphs - directed acyclic graph - adjacency matrix and incidence matrix of graph - Network Flows - Transport Networks - Max - Flow Min-Cut Theorem - Activity Network **(9)**

TOTAL : 45

TEXT BOOKS

1. Gary Chatrand and Ping Zhang, Introduction to Graph Theory, Mc Graw Hill Education (India), 2017.

2. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall of India Private Limited, 2004.

REFERENCES

1. Douglas B.West, "Introduction to Graph Theory" Second Edition, Prentice Hall of India Private Limited, 2001.

2. Balakrishnan. R, Ranganathan. K , "A Text book of GraphTheory", Second Edition, Springer Newyork, 2012.

3. Clark. J. and Holton. D.A, "A First Look at GraphTheory", Allied Publishers,1995.

4. Frank Harary, Graph Theory, 10th Edition, Narosa Publishing House, 2001.

19MOE02 - METHODS OF APPLIED MATHEMATICS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will be able to understand the idea of integral equations and to solve the real time problems.*

CO2 : *To familiarize the students with basic concept of ordinary differential equations, special functions and solve problems associated with engineering applications.*

CO3 : *To achieve an understanding of the basic concepts of boundary value problems and characteristic function representations and method of solving them.*

CO4 : *Able to construct and solve a mathematical model for heat flow problems in real life situation*

CO5 : *Able to use the concepts of Calculus of variations and basic concepts for solving equations involving functional*

INTEGRAL EQUATIONS

Relation between integral and differential equations - Green's function. Fredholum's equation with separable Kernals Hilbert Schmidt theory, interactive methods for solving equations of second kind. **(9)**

SECOND ORDER ORDINARY DIFFERENTITAL EQUATIONS AND SPECIAL FUNCTIONS

Singular points, Series solutions and the methods of Frobenius, Bessel Equation, Bessel Functions, modified Bessel functions and their properties, Ber and Bei functions. **(9)**

BOUNDARY PROBLEMS AND CHARACTERISTIC FUNCTION REPRESENTATIONS

Sturm - Liouviller problems. Orthogonal functions and expansions in series of Orthogonal functions. Stodola and Vianello method for Sturm - Liouviller problems, Fourier - Bessel and Legendre Series **(9)**

PARTIAL DIFFERENTITAL EQUATIONS

Linear and quasi - linear equations of the first and second order. Characteristics of first and second order linear equations. Heat flow equations. Problems in one, two and three dimensions - Fourier method. **(9)**

INTEGRAL TRANSFORM METHODS

Calculus of variations - Variational notation, Constraints and Lagarangian multipliers, variable and points, Rayleigh - Ritz method. **(9)**

TOTAL : 45

TEXT BOOKS

1. *M.K. Venkatraman, Higher Mathematics for Engineering and Science, Third Edition, The National Publishing Company, 2014.*

2. *F.B. Hildebrand: Advanced Calculus for applications second Edition (EEE).Prentice Hall of India P.Ltd., 2014.*

REFERENCES

1. *F.B. Hildebrand - Methods of Applied Mathematics, Second Edition. Prentice Hall of India P.Ltd., 2012.*

2. *David Borthwick : An introduction to partial differential equation Springer International Publishing 2017.*

3. *Mattias Blennow: Mathematical methods in Physics and Engineering, CRC Press, 2018.*

19MOE03 - LINEAR AND NON - LINEAR PROGRAMMING

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will be able to understand the idea of linear Programming problems and to solve the real time problems.*

CO2 : *To familiarize the students with basic concept of Transportation models and solve problems associated with engineering applications.*

CO3 : *To achieve an understanding of the basic concepts of Assignment problems and method of solving them.*

CO4 : *Able to construct and solve a Game theory models in real life situation*

CO5 : *Able to use the concepts of Non-linear Programming problems for solving Constrained and unconstrained equations.*

LINEAR PROGRAMMING

Formulation of LPP - Graphical methods for two variables - The Simplex method - Artificial Variables Techniques - Big M - method - The Two Phase method - Dual Simplex Method   **(9)**

TRANSPORTATION MODEL

Mathematical formulation of a Transportation problem - Methods for finding initial basic feasible solution - North West corner rule - Least cost method - Vogel's Approximation method - Modified distribution method - Degeneracy in Transportation problems.   **(9)**

ASSIGNMENT PROBLEM

Mathematical formulation of an Assignment problem - Hungarian Method - Unbalanced Assignment Models -Maximization case in Assignment Problems - Restrictions in Assignments - Travelling Sales man Problem.   **(9)**

GAME THEORY

Two person zero - sum Games - The Maxmini - Minimax Principle - Saddle Point and value of the game -Games without saddle points, Mixed Strategies - Matrix Oddment method for n×n games - Dominance Property - Graphical Method of 2×n or m×2 games.   **(9)**

NON - LINEAR PROGRAMMING

Non - linear Programming Algorithm - Unconstrained Non - linear Algorithms - Constrained Non -linear Lagrange multipliers, Kuhn - Tucker optimality conditions.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Operations Research An Introduction, Eight Edition, Hamdy A .TAHA, Pearson Prentice Hall 2016, New Delhi.*

2. *Resource management techniques by V.Sundaresan, Tenth Edition, 2016, A.R Publications, Chennai.*

REFERENCES

1. *Kanti Swarup, P.K. Gupta and Man Mohan, " Operations Research", Sultan Chand & Sons, Educational publishers, New Delhi. 20th Edition, 2019.*

2. *Frederick S. Hillier, Gerald J. Lieberman, "Introduction to Operations Research", Mc Graw Hill, (India) Private Limited, India, 11th Edition, 2021.*

19MOE04 - PROBABILITY AND RANDOM PROCESSES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will be able to understand the basic probability problems and to solve the real time problems.*

CO2 : *To familiarize the students with basic concept of probability distributions and solve problems associated with engineering applications.*

CO3 : *To achieve an understanding of the basic concepts of Correlation and regression and method of solving them.*

CO4 : *Able to solve a signal processing problems by using random process concepts.*

CO5 : *Able to use the concepts of Correlation functions and Power spectral densities for solving Electrical and electronics problem.*

THEORY OF PROBABILITY

Sample Space, Events, Axioms of probability, Conditional probability, Independent events, Theorem of total probability, Baye's Theorem. **(9)**

PROBABILITY DISTRIBUTIONS

Definition of Discrete and Continuous random Variables

Discrete distributions : Binomial, Poisson and Geometric - Properties and Simple problems

Continuous distributions : Normal, Uniform Exponential - Properties and Simple problems. **(9)**

CORRELATION AND REGRESSION

Correlation -Meaning and scope of Correlation - Scatter diagram, Karl Pearson's co-efficient of Correlation, Spearman's Rank Correlation, Multiple Correlation and partial correlation - simple problems.

Regression Analysis - Meaning and Scope of regression - Regression in two variables - Uses of Regression. **(9)**

RANDOM PROCESSES

Classification - Stationary process - Markov process - Poisson process - Random telegraph process. **(9)**

CORRELATION FUNCTIONS AND POWER SPECTRAL DENSITIES

Auto Correlation functions - Cross Correlation functions - Properties - Power spectral density - Cross spectral density - Properties.

(9)

TOTAL : 45

TEXT BOOKS

1. *S.C. Gupta and V.K. Kapoor, Fundamental of Mathematical Statistics, Tenth Revised Edition, 2020.*

2. *T. Veerarajan, Probability, Statistics and Random Processes, Second Edition, Tata Mc Graw - Hill 2017.*

REFERENCS

1. *Robert Hogg & Joseph McKean: Introduction to Mathematical Statistics, Pearson 8th Edition 2018.*

2. *Bhat, B. R.: Modern Probability Theory - An Introductory Text Book, Third Edition, New Age International 2015.*

3. Cochran,W.G: Sampling Techniques, Wiley Eastern Private Limited, 2007.

4. Sukhatme, P.V. and Sukhatme, B.V.(1977) : Sampling Theory of Survey with Applications, Asia publishing House.

5. Rakesh Dube, "Higher mathematics for Engineering and Science" Manakin Press, 2018.

6. Ibe,O.C.,"Fundamentals of Applied Probability and Random processes", 2nd Edition, Elsevier, 2019.

7. Peyton Peebles, "Probability Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, NewDelhi, 2017.

19POE01 - INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology.*

CO2 : *Understand the different classes of nanomaterials.*

CO3 : *Identify the principles of processing, manufacturing and characterization of nanomaterials and nanostructures.*

CO4 : *Outline the applications of nanotechnology and develop an ability to critically evaluate the promise of a nanotechnology device.*

BASICS OF NANOTECHNOLOGY

Introduction - Time and length scale in structures - Definition of a nanosystem - Dimensionality and size dependent phenomena - Surface to volume ratio - Fraction of surface atoms - Surface energy and surface stress- surface defects - Effect of nanoscale on various properties - Structual, thermal, mechanical, magnetic, optical and electronic properties.   **(9)**

DIFFERENT CLASSES OF NANOMATERIALS

Classification based on dimensionality - Quantum Dots, Wells and Wires - Carbon based nano materials (buckyballs, nanotubes, graphene) - Metal based nanomaterials (nanogold, nanosilver and metal oxides) - Nanocomposites - Nanopolymers - Nano ceramics - Biological nanomaterials.   **(9)**

SYNTHESIS OF NANOMATERIALS

Chemical Methods: Metal Nanocrystals by Reduction - Sol - gel processing - Solvothermal Synthesis - Photochemical Synthesis - Chemical Vapor Deposition (CVD) - Metal Oxide - Chemical Vapor Deposition (MOCVD). Physical Methods: Ball Milling - Electrodeposition - Spray Pyrolysis - DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE).   **(9)**

CHARACTERIZATION OF NANOSTRUCTURES

Introduction, structural characterization, X-ray diffraction (XRD-Powder/Single crystal), Small angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM) - Energy Dispersive X-ray analysis (EDAX) - Transmission Electron Microscope (TEM) - Scanning Tunneling Microscope (STM) - Atomic force microscopy (AFM), UV-vis spectroscopy (liquid and solid state) - Raman spectroscopy - X-ray Photoelectron Spectroscopy (XPS) - Auger electron spectroscopy(AES).   **(9)**

APPLICATIONS

Solar energy conversion and catalysis - Molecular electronics and printed electronics -Nanoelectronics - Polymers with a special architecture - Liquid crystalline systems - Applications in displays and other devices - Nanomaterials for data storage - Photonics, Plasmonics - Chemical and biosensors - Nanomedicine and Nanobiotechnology.   **(9)**

TOTAL : 45

TEXT BOOKS

1. *Nano technology: Basic Science and Emerging technologies, Mick Wilson, Kamali Kannargare., Geoff Smith Overseas Press (2005)*

2. *A Text book of Nanoscience and Nanotechnology, Pradeep T., Tata McGraw Hill Education Pvt. Ltd., 2012.*

3. *Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, 2002.*

4. *Introduction to Nanotechnology, Charles P.Poole,Frank J.Owens, Wiley Interscience (2003)*

5. *Textbook of Nanoscience and Nanotechnology, B.S. Murty, P. Shankar, Baldev Raj, B B Rath, James Murday, Springer Science & Business Media, 2013.*

REFERENCES

1. *Nanotechnology: A gentle introduction to the next Big idea, Mark A.Ratner, Daniel Ratner, Mark Ratne, Prentice Hall P7R:1st Edition (2002)*
2. *Fundamental properties of nanostructed materials Ed D. Fioran, G.Sberveglier, World Scientific 1994*
3. *Dupas C., Houdy P., Lahmani M.,Nanoscience: Nanotechnologies and Nanophysics, Springer-Verlag Berlin Heidelberg, 2007*

19POE02 - PHYSICS AND TECHNOLOGY OF THIN FILMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Recognize the fundamental growth and material parameters of thin films.*

CO2 : *Evaluate and use models for nucleation and growth of thin films.*

CO3 : *Asses the relation between deposition technique, film structure and film properties.*

CO4 : *Identify modern techniques for the characterization of thin films*

CO5 : *Demonstrate the applications of thin films*

Preparation of thin films : Preparation methods: electrolytic deposition, cathodic and anodic films, thermal evaporation, cathodic sputtering, chemical vapour deposition. Molecular beam epitaxy and laser abalation methods. Thickness measurement and monitoring: electrical, mechanical, optical interference, microbalance, quartz crystal methods. **(9)**

Growth Kinetics of Thin Films : General features.- nucleation theories - energy formation of a nucleus - critical nucleation parameters; spherical and non spherical (cap, disc and cubic shaped) Effect of electron bombardment on film structure. Post-nucleation growth, epitaxial films and growth. **(9)**

Analytical techniques of characterization : X-ray diffraction - Photoluminescence - UV-Vis-IR spectrophotometer - Atomic Force Microscope - Scanning Electron Microscope - Hall effect - Vibrational Sample Magnetometer - Secondary Ion Mass Spectrometry - X-ray Photoemission Spectroscopy - Auger emission spectroscopy. **(9)**

Properties of Thin films : Dielectric properties - experimental technique for the determination of dielectric properties - optical properties - experimental technique for the determination of optical constants - mechanical properties - experimental technique for the determination of mechanical properties of thin films - magnetic and superconducting properties. **(9)**

Applications : Optoelectronic devices : LED, LASER and Solar cell - Micro Electromechanical Systems (MEMS) - Fabrication of thin film capacitor - application of ferromagnetic thin films; data storage, Giant Magnetoresistance (GMR) - sensors - fabrication and characterization of thin film transistor and FET. **(9)**

TOTAL : 45

TEXT BOOKS

1. *A. Goswami, Thin Film Fundamentals, New Age international (P) Ltd. Publishers, New Delhi, 2006.*

2. *L.I. Maissel and Glang (Eds.), Handbook of Thin film Technology, McGraw-Hill, 1970.*

3. *K.L. Chopra, Thin Film Phenomena, McGraw-Hill (1983)*

REFERENCES

1. *Thin-Film Deposition : Principles and Practice, Smith Donald Donald L Smith Smith, McGraw-Hill Professional Pub, 1995*

2. *J.C. Anderson, The Use of Thin Films in Physical Investigation, Academic Press 1966.*

3. *J.J. Coutts, Active and Passive Thin Film Devices, Academic Press 1978.*

4. *George Hass, Physics of Thin Films: Volumes 1.:12, Academic Press 1963.*

5. *Kiyotaka Wasa, Makoto Kitabatake, Hideaki Adachi, Thin Films Material Technology, Springer-Verlag Berlin Heidelberg, 2004.*

19POE03 - SOLAR CELL FUNDAMENTALS AND MATERIALS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Demonstrate the knowledge about photovoltaics.*

CO2 : *Gain knowledge about principle of operation of solar cells*

CO3 : *Realization about semiconducting materials used in the manufacture of PV cells*

CO4 : *Outline the various advanced solar cell technologies, their current status and future technological challenges*

EVOLUTION OF SOLAR CELLS

Historical development; present and future global issues- commercialization/economic factors- basic components of PV systems - The solar spectrum - terrestrial and space spectra; air mass (AM0, AM1.5) - Introduction to 1st, 2nd and 3rd generation photovoltaics. **(9)**

SOLAR CELL FUNDAMENTALS

Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell - light absorption- creating charge carriers forming the electric field - driving the charge carriers - solar cell parameters- electrical characteristics - the ideal solar cell, solar cell in practice, the quantum efficiency and spectral response, optical properties - basics of solar cell device design. **(9)**

SEMICONDUCTOR PROPERTIES

Overview of semiconductor properties relevant to solar cell operations- semiconductor band structure, carrier statistics in semiconductors, the transport equations, carrier mobility, carrier generation by optical absorption - band to band transitions, free-carrier absorption, recombination- bulk recombination processes, surface recombination, minority carrier life time. **(9)**

SILICON AND THIN FILM SOLAR CELLS

Si photovoltaics - single crystal silicon cells - semicrystalline and polycrystalline silicon cells - overview of various thin film solar cells: gallium arsenide solar cells - fabrication techniques, InP & cadmium telluride based solar cells - copper indium diselenide solar cells - multijunction cells - environmental and health aspects. **(9)**

ADVANCED SOLAR CELLS

Advanced solar cell concepts - organic (polymer) photovoltaics - new concepts - quantum dots, wires, intermediate band, multiple exciton generation - Dye sensitized solar cells - perovskite solar cells - challenges in materials and device design - current and future research trends in PV. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Fonash S. J., "Solar Cell Device Physics", Academic, 2010.*

2. *Goetzberger, J. Knobloch, and B. Voss "Crystalline Silicon Solar Cells" Wiley, 1998.*

3. *Green M. A. "Third Generation Photovoltaics: Advanced Solar Energy Conversion" Springer, 2006 .*

REFERENCES

1. *Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt. Ltd., 2009.*

2. *Jha A.R., "Solar Cell Technology and Applications", CRC Press, 2010.*

19POE04 - ADVANCED MATERIAL PROCESSING TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

After completing the course successfully, the students will be able to,

CO1 : *Recognize the criteria for material selection based on properties of materials and to choose the required material for a specified application.*

CO2 : *Understand various metallurgical forming processes such as casting, rolling extrusion, drawing, development of grain structure and processing of different composite types.*

CO3 : *Demonstrate knowledge about powder metallurgy, ceramic and polymer processing methods.*

CO4 : *Identify and choose the required surface treatment technique for coating formation on account of enhancing the surface properties of the mechanical components for engineering applications.*

CO5 : *Understand the applicable joining and machining techniques and their limitations*

INTRODUCTION AND SELECTION OF MATERIALS

Motivation for selection - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability, corrosion and wear resistance - Relationship between materials selection and processing - Case studies - aero, auto, marine, machinery and nuclear applications. High and low temperature materials, superconductors, supramagnetic materials, high entropy alloys, nanomaterials and biomaterials. **(9)**

METALLURGICAL FORMING AND PROCESSING OF COMPOSITES

Metallurgical forming: Casting, rolling extrusion, drawing, development of grain structure for specific properties. Processing of composites: lay up methods, press/ autoclave / resin transfer moulding, Reinforced Reaction Injection Molding (RRIM), obtrusion and filament winding. **(9)**

POWDER METALLURGY, CERAMIC AND POLYMER PROCESSING

Powder metallurgy and ceramic processing: green fabrication methods, sintering, hot pressing, Hot Isostatic Pressing (HIP), spark plasma sintering, development of microstructure in powder processed materials. Polymer processing: extrusion, injection moulding, blow moulding, rotational moulding, vacuum forming and related processes processing of cellular polymers. **(9)**

COATING METHODS

Introduction to surface Engineering, Differences between surface and bulk properties, Properties of surfaces-wear, wettability. Chemical vapour deposition, physical vapour deposition, electro deposition, electroless deposition, thermal spray processes. Principle of various coating processes, process parameters, controlling the yield of coating and various surface properties of the coating. Criteria for selection of a surface coating technology. Product oriented surface coating technology. **(10)**

JOINING AND MACHINING

Joining: fusion welding, solid state welding, adhesive bonding, mechanical joining and recent advancements in welding. machining: Electromachining (electrochemical and electro-discharge), mechanical machining and recent advancements. **(8)**

TOTAL : 45

TEXT BOOKS

1. *Charles J.A., Crane, F.A.A and Furness, J.A.G., "Selection and use of Engineering Materials", 3rd Edition, Butterworth-Heinemann, 1977.*

2. *Betzalel Avitzu, "Metal Forming- Processes and Analysis", Tata McGraw Hill, 1977.*

3. *William F Hasford, Robert M Caddell "Metal Forming: Mechanics and Metallurgy" Cambridge University Press P. ltd, 2007.*

4. *Angelo P C and Subramanian R" Powder Metallurgy Science, Technology and Applications", Prentice Hall of India, New Delhi, 2012.*

REFERENCES

1. *Michael Barsoum, "Fundamentals of Ceramics", Mc Graw Hill Publishing Co., INC, 1997*

2. *Gowariker V R, Viswanathan N V, Jayadev Sreedhar, "Polymer Science", New Age International P Ltd., 2005.*

3. *David S. Rickerby, Allan Matthews "Advanced surface coatings: a handbook of surface engineering", Blackie, 1991.*

4. *Parmar, R.S, "Welding Engineering and Technology", Khanna Publishers, 2003.*

19COE01 - MEDICAL NANO TECHNOLOGY

	L	T	P	C
	3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

The students will be able to

CO1 : *Understand the essential features of nanomedicine*

CO2 : *Identify the medical based nanotools*

CO3 : *Assess health effects due to nanoparticle exposure*

ASSESSING NANOTECHNOLOGY HEALTH

Nanomaterials : The Current State of Nanotechnology Application - Nanotechnology Risks - Risk Analysis - Hazard Identification - Exposure Assessment for Nanomaterials - Risk Characterization - Risk Management - Best Practices for Nanomaterials in the Workplace - Safety Research - Needs for Engineered Nanoscale Materials **(9)**

RISK ASSESSMENT AND ENVIRONMENTAL PROTECTION

Context for Technological Risk - Need for Risk Assessment for Nanotechnology - Adaptive Risk Assessment for Nanomaterials - Origins and Development of Risk Assessment - Risk Assessment Used in Environmental Decision Making - Issues in Applying the Four Steps of Risk Assessment to Nanotechnology - Hazard Assessment - Exposure Assessment - Dose - Response Evaluation **(9)**

SUSTAINABLE NANOTECHNOLOGY DEVELOPMENT

Necessity of Risk Assessment in Nanotechnology - The Pace of Nanotechnology Development and the Paucity of Information - Potential for Wide Dispersion in the Environment Amid Uncertainty - Few Standards or Guidelines - Environmental Risk Issues - Carbon Nanotubes - Defining the Toxic Dose - Environmentally Friendly Nanotechnology - Life Cycle Analysis for Sustainable Nanotechnology **(9)**

HUMAN HEALTH, TOXICOLOGY, AND NANOTECHNOLOGY RISK

Mechanisms of Toxicity - Types of Toxicological Studies - Pulmonary Toxicity Studies - Gastro intestinal Toxicity - In Vitro Studies - Dermal - In Vitro Toxicity Studies **(4)**

ENVIRONMENTAL RISKS

Antimicrobial Properties of Nanoscale Silver - Buckyballs, Titanium Dioxide - Short-term Toxicity Tests - Daphnia LC50 Assays - Studies of Nanomaterial Toxicity to Fish - Buckyballs and Bass-TiO_2 in Arsenic - Field Studies - Environmental Exposures - Nanoscale Zerovalent Iron **(9)**

NANOELECTRONIC DEVICES

Resonant tunneling diodes - Field effect transistors - Single electron transfer devices - Potential effect transistors - Light emitting diodes and lasers - Nanoelectromechanical system devices - Quantum dot cellular automata **(5)**

TOTAL : 45

TEXT BOOKS

1. *George W. Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2007*

2. *Vladimir V. Mithin et.al, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications" Cambridge University Press, 2012*

REFERENCES

1. *Mithin.V, Kochelap.V and Stroscio.M, "Introduction to Nanoelectronics", Cambridge University Press, 2008*

2. *Karl Gosar et.al, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum devices", Springer, 2005.*

19COE02 - ADVANCED DRUG DELIVERY SYSTEMS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will be able to know the fundamentals of Nanoscience and their applications in pharamacological industries*

CO2 : *The students will able to describe polymeric drug delivery systems and their encapsulation methodology to study targeted drug delivery with different polymeric systems*

CO3 : *The students will able to identify lipids-nanocarriers and their application in biological system*

CO4 : *The students will able to study site specific drug delivery for gene therapy*

THEORY OF ADVANCED DRUG DELIVERY

Fundamentals of Nanocarriers - Size, Surface, Magnetic and Optical Properties, Pharmacokinetics and Pharmacodynamics of Nano drug carriers. Critical Factors in drug delivery. Transport of Nanoparticles - In Vitro and Ex Vivo Models. **(10)**

POLYMERS Dendrimers- Synthesis -Nanoscale containers- Dendritic Nanoscafold systems Biocompatibility of Dendrimers, Gene transfection. pH based targeted delivery- chitosan and alginate. Copolymers in targeted drug delivery- PCL,PLA, PLGA. **(8)**

LIPID BASED NANOCARRIERS

Liposomes, niosomes and solid lipid nanoparticles. Ligand based delivery by liposomes. Cubosomes. **(9)**

MICROBES AND ANTIBODY BASED NANOCARRIERS

Bacterial dependent delivery of vaccines. Drug delivery and subcellular targeting by virus, Drug packaging and drug loading. Delivery of therapeutics by antibodies and antibodybioconjugates. **(9)**

SITE SPECIFIC DRUG DELIVERY

Concepts and mechanism of Site specific drug delivery- Microneedles, Micropumps, microvalves. Implantable microchips.

(9)

TOTAL : 45

REFERENCES

1. *Drug Delivery: Engineering Principles for Drug Therapy, M. Salzman, Oxford University Press, 2001.*
2. *Drug Delivery and Targeting, A.M. Hillery, CRC Press, 2002.*
3. *Drug Delivery: Principles and Applications, B. Wang, Wiley Intersceince, 2005.*
4. *Nanoparticle Technology for Drug Delivery, Ram B. Gupta, Uday B. Kompella Taylor & Francis, 2006.*

19COE03 - BIOSENSORS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

CO1 : *The students will able to understand protein based biosensors and their enzyme reactivity, stability and their application in protein based nano crystalline thin film processing*

CO2 : *The students will able to describe DNA based biosensors to study the presence of heavy metals in the food products*

CO3 : *The students will able to understand fluorescence, UV-Vis and electrochemical applications of biosensors*

CO4 : *The students will able to study about the fabrication of biosensors and its application as nanochip analyzer*

PROTEIN BASED BIOSENSORS

Nano structure for enzyme stabilization - Single enzyme nano particles - Nanotubes microporous silica - Protein based nano crystalline Diamond thin film for processing **(9)**

DNA BASED BIOSENSOR

Heavy metal complexing with DNA and its determination, water and food samples - DNA zymo biosensors **(9)**

ELECTRO CHEMICAL APPLICATION

Detection in biosensors - Flurorescence - Absorption - Electrochemical. Integration of various techniques - Fibre optic biosensors **(9)**

FABRICATION OF BIOSENSORS

Techniques used for microfabrication - Microfabrication of electrodes - On chip analysis **(9)**

BIOSENSORS IN RESEARCH

Future direction in biosensor research - Designed protein pores-as components of biosensors - Molecular design - Bionanotechnology for cellular biosensing - Biosensors for drug discovery - Nanoscale biosensors **(9)**

TOTAL : 45

REFERENCES

1.   *Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004*

2.   *Nanomaterials for Biosensors, Cs. Kumar, Willey - VCH, 2007*

3.   *Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006.*

19COE04 - NANOCOMPOSITES

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

The students will be able to

CO1 : *Study the different synthesis techniques of metal ceramic nanocomposites and their functionality*

CO2 : *Describe the processing techniques for heterometallic nanocomposites and to study their electromagnetical property*

CO3 : *Understand the design of super hard nanocomposites with improved mechanical properties*

CO4 : *Study the polymer based carbon nanotube composites, to study their mechanical properties and their industrial applications*

NANO CERAMICS

Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. **(9)**

METAL BASED NANOCOMPOSITES

Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties. **(9)**

DESIGN OF SUPER HARD MATERIALS

Super hard nanocomposites, its designing and improvements of mechanical properties. **(9)**

NEW KIND OF NANOCOMPOSITES

Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Electrical property of fractal based nanocomposites. Core-Shell structured nanocomposites. **(9)**

POLYMER BASED NANOCOMPOSITES

Preparation and characterization of diblock Copolymer based nanocomposites; Polymercarbon nanotubes based composites, their mechanical properties, and industrial possibilities. **(9)**

TOTAL : 45

REFERENCES

1. *Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun 2006.*

2. *Physical Properties of Carbon Nanotubes- R. Saito 1998.*

3. *Carbon Nanotubes (Carbon, Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus 1997.*

4. *The search for novel, superhard materials- Stan Veprek (Review Article) JVST A, 1999*

5. *Electromagnetic and magnetic properties of multi component metal oxides, hetero*

6. *Nanometer versus micrometer-sized particles-Christian Brosseau,Jamal Ben, Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003*

7. *Diblock Copolymer, - Aviram (Review Article), Nature, 2002*

19COE05 - BIOREFINERY

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME

The students will be able to

CO1 : *Understand various renewable feedstocks for biofuels production*

CO2 : *Understand the broad concept of second and third generation biofuel products from biomass and other low-cost agri-residues and biowastes.*

CO3 : *Analyze the design processes for biofuel production*

CHEMISTRY & BIOCHEMISTRY OF BIOMASS

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; trichoderma cellulases; bacterial cellulases; and comparison with degradation of high starch. **(9)**

BIODIESEL

Sources and processing of biodiesel, nature of lipids, fatty acids and triglycerides.Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodiesel, (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Environmental issues of biodiesel; major policies and regulations pertaining to the production, distribution, and use of biodiesel. **(9)**

BIOMETHANE OR BIOGAS

Hydrolysis; anaerobic digestion; methanogenesis (acetoclastic, hydrogenotrophic), rates of methane formation; and one and two stage fermentation.Thermal depolymerization.Use of exhaust gases (e.g. CO_2, H_2S and H_2) from geothermal power plants and industrial operations (e.g. coal and oil refineries) as an energy sources (methane and hydrogen) **(9)**

GASIFICATION & PYROLYSIS TECHNOLOGIES

Gasification processes and the main types of gasifier designs; production of electricity by combining a gasifier with a gas turbine or fuel cell.Combined- cycle electricity generation with gas and steam turbines, and generation of heat and steam for district heating systems or CHP, including kalina Cycle. Production of synthesis gas (i.e. CO, H_2, H_2O, CO_2) tar vapor and ash particles) for subsequent conversion to hydrogen and transport fuels; advanced gas cleaning technologies for biomass. Biological conversion of syngas into liquid biofuels. Fast pyrolysis technology to produce a range of fuels, chemicals, and fertilizers; biorefineries, and new uses for glycerine in biorefineries. **(9)**

POLICIES AND FUTURE R&D OF BIOFUELS & BIOENERGY

Analysis of both current and future EU regulations and directives on biofuels and bioenergy.Tax regulations. Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources. Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide. **(9)**

TOTAL : 45

TEXT BOOKS

1. *Robert C.Brown, "Biorenewable Resourses: Engineering", New Products from Agriculture, Wiley- Blackwell Publishing, 2003.*

2. *Samir K.Khanal, "Anaerobic Biotechnology for Bioenergy Production: Principles and Application", Wiley- Blackwell Publishing 2008.*

REFERENCES

1. *Martin Kaltschmitt; Hermann Hofbauer. "Biomass Conversion and Biorefinery", Springer Publishing, 2008.*

19HOE01 - PRINCIPLES OF MANAGEMENT

COURSE OUTCOMES

CO1 : *Design the Management function for a given organization*

CO2 : *Design and develop a strategic approach for the completion of the project*

CO3 : *Analyze the behavior of individuals and groups in organizations in terms of the key factors*

CO4 : *Formulate the procedure for recruitment, selection, training of staff to establish an organization*

Unit I - Introduction to Management: Meaning, Definition and Significance of Management-Basic functions of Management-Development of Management Thought **(9)**

Unit II - Management Concepts: Planning, Organizing, Staffing, Directing and Controlling- MBO-Six sigma **(9)**

Unit III - Organizational Behavior: Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work **(9)**

Unit IV - Business Process Reengineering: Need for BPR, Various phases of BPR, Production and Productivity-Factors influencing Productivity **(8)**

Unit V - Human Resource Management: Evolution of Management- Development of Managerial skills-Human Resource Management - Objectives -Job analysis -Recruitment -Selection and Placement and Training Development **(10)**

TOTAL : 45

TEXT BOOKS

1. Harold Koontz, Heinz Weihrich and Ramachandra Aryasri, "Principles of Management" Tata Mcgraw Hill, New Delhi, 2013.

2. Mamoria, CB, "Personnel Management", Sultan Chand and Sons, New Delhi, 2013.

REFERENCES

1. Robbin Finchanm and Peter Rhodes, "Principles of Organizational Behavior" Oxford University Press, 2010.

2. CB Gupta "Management Theory and Practice" Sultan Chand and Sons, New Delhi, 2009.

3. VSP Rao "Management Text and Cases" Excel Books, New Delhi, 2009.

4. Fred Luthans "Organizational Behavior" Mc-Graw hill, New York, 2005.

5. Knanna OP "Industrial Engineering and Management", Dhanpat Rai publications, New Delhi, 2003.

19HOE02 : CURRENT TRENDS IN INDIAN ECONOMY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1 : *Outline the structure of our Indian Economic System*

CO2 : *Access the role of industrial sector in Indian economy*

CO3 : *Interpret the demographic trends for the current scenario*

CO4 : *Analyze the role of two tier for the achievement of common national goals*

Unit - 1 National Income and Agriculture Sector: Economics Development-Meaning-National Income and Per capita Income in India- Indian Planning-Agricultural Development of India: Major crops- Production-Productivity-Contribution to GDP and Exports **(8)**

Unit - II Industrial Sector: India's industrial development-Industrial policies of 1948, 1956 and 1991-Liberalisation-Public sector-Privatization-Disinvestment policy-Role and importance of large scale industries and small scale industries-Special economic zones-Contribution to GDP-Growth rate **(8)**

Unit - III Population: Growth and policy issues-Demographic trends-Vital statistics-India's population: size and growth rate-Demographic dividend-HDI-Population policy-Issues of Unemployment, Poverty and inequality in India **(10)**

Unit - IV Service sector: Service sector in India-Banking-Insurance-Telecommunication-IT sector-Software exports-BPO-Contribution to GDP **(9)**

Unit - V Federal System and Foreign Trade: Federal setup in India-Taxes: Direct and Indirect Tax-Value added Tax-Foreign direct investment-Merits and Demerits-India's imports and exports: Composition and direction-Foreign exchange reserve position-MNC's in India **(10)**

TOTAL : 45

TEXT BOOKS

1. *Ruddar Datt and Sundaram, KPM, Indian Economy, S.Chand and company, New Delhi-2015*

2. *Ramesh Singh Indian Economy, McGraw hill Education 7th Edition, 2015*

References: www.jagranjosh.com

19H0E03 - MONETARY ECONOMICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1 : *Evaluate the monetary measures formulated through static and dynamic role of money*

CO2 : *Design the driving force of circular flow of money*

CO3 : *Analyse how quantity theory of money fluctuate the price level*

CO4 : *Estimate the demand and supply of money based on the Interest rate*

Unit I Nature and significance of Money: Definition of Money-Functions of Money-Static and Dynamic role of Money-Circular flow of Money-Monetary standards-Gold standard-Paper currency standard-Principles of Note issue-Measures of Money supply **(9)**

Unit II Quantity Theory of Money: Fisher's quantity theory of Money-Assumptions-Cash Balance Approach (Cambridge Equations)- Equation of Marshall, Pigou and Keynes-Similarities and dissimilarities of cash balance and cash transaction approaches-Income and expenditure theory-Superiority of Income and expenditure theory-Demand for Money: Classical and Keynesian liquidity preference theory approach **(9)**

Unit III Inflation and Deflation: Meaning-Types-Causes of Inflation-Demand Pull and Cost push inflation -Inflationary Gap-Phillips Curve-Effects of Inflation-Deflation-Causes-Measures to control Inflation and Deflation-Stagflation **(9)**

Unit IV Commercial Banking and Financial Markets: Functions of Commercial Banks-Credit Creation-Meaning and constitute of Money Markets-Capital Market-Institutional structure of Capital Market-Primary Market-Secondary Market-Indian capital Market-Non-Banking financial intermediaries **(9)**

Unit V Central Banking and Monetary Policy: Central Banking-Functions-Organization-Instruments of Credit control-Monetary Policy: Meaning, Objectives, and Recent policy changes in RBI-Monetary Policy in a developing economy **(9)**

TOTAL : 45

TEXT BOOK

1. *Jhinghan ML "Monetary Economics:" Vrinda Publications, New Delhi, 2013.*

REFERENCES

1. *Sethi TT, "Monetary Economic Theory", S Chand & Co, New Delhi, 1996.*
2. *Mithani DN, "Money Banking and International Trade", Himalaya, Mumbai, 2013.*

19HOE04 - ENGLISH FOR ACADEMIC PURPOSE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1 : *Write a description and apply grammatical rules.*

CO2 : *Analyse a passage and enhance vocabulary.*

CO3 : *Formulate a research paper*

CO4 : *Listen to a lecture and prepare a summary.*

CO5 : *Construct dialogues using appropriate expressions.*

FOCUS ON LANGUAGE

Sentence construction- types of clauses- sequence- co ordination- subordination- paragraphing information - describing a system & procedure **(9)**

READING

Understand a writer's purpose - Use strategies to ascertain meaning from unfamiliar vocabulary encountered in context - Recall and use vocabulary regarding urbanization and megacities - To identify and outline main ideas in a passage - Skim a reading passage for main ideas - Summarize texts and images - Using a dictionary to obtain lexical, phonological and orthographical information - Identify and use target vocabulary words - Highlight important parts and texts. **(13)**

WRITING

Achieving appropriate tone and style in academic writing - writing a Research article - Types of Research Designs - Choosing a Research Problem- The Abstract - The Introduction - The Literature Review - 6. The Methodology - The Results - The Discussion - The Conclusion - Citing Sources - Proofreading.

LISTENING

Listening to conversation - lectures - topics - discussions - listening comprehension on specific topics - listening to recognize formal and informal spoken English **(11)**

SPEAKING

Seminar skills - Engage in verbal role playing in Formal and Informal situation. - Express advice and personal opinions with supporting information - Paraphrase stories and information - Expressing requests - Suggestions - Complaints - Apology - Giving and Accepting compliments - Making invitations - Refusing invitations **(12)**

TOTAL : 45

REFERENCES

1. *Wisniewska, I., Riggenbach, H.,& Samuda, V. (2007). Grammar dimensions*

2. *Form, meaning, and use (4th Ed.). Boston, MA: Heinele Cengage Learning Longman Introductory Course for the TOFEL Test*

3. *Original publications and web- based resources will be reviewed as necessary.*

19HOE05 - ENGLISH FOR COMPETITIVE EXAMS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1 : *Listen to TOEFL exercises and formulate appropriate answers.*

CO2 : *Speak using right grammar and appropriate pronunciation on general and academic topics.*

CO3 : *Analyze the passage and answer the question.*

CO4 : *Generate and organize ideas on a given topic*

LISTENING

Listening to conversation - Narration - Suggestion - Assumptions - Predictions - Implications - Problems - Academic conversations - Discussions - Lectures **(11)**

SPEAKING

Independent speaking - Integrated speaking - Speaking about a personal experience - Preferences - Report the speakers opinion - Explain a problem and solution - Give a summary of a academic lecture. **(13)**

READING

Read and understand short passages - Integrated reading tasks - Read the passage and choose the right summary of the passage - Reading for main ideas - Scanning the passage for synonyms - Making inferences - Identifying exceptions - Locating references. **(12)**

WRITING

Independent writing - Integrated writing - Writing short essays - Writing dialogues - Articles - Sentence construction **(9)**

TOTAL : 45

REFERENCES

1. *Sharpe J.Pamela. Barron's How to prepare for the TOEFL Test of English as a foreign Language. 11th Edition, Galgotia Publications Pvt. Ltd: New Delhi, 2004.*

2. *Sharpe J.Pamela. Barron's TOEFL iBT Internet- Based Test. 12th Edition, Galgotia publications Pvt.Ltd: New Delhi, 2009.*

19HOE06 - LIFE AND LITERATURE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1 : *Compose an essay on the prose piece*

CO2 : *Analyse the poem and write a critical appreciation of it*

CO3 : *Read the story and find the moral values implied in the stories*

CO4 : *Write a review the fiction*

Unit - 1 : Prose

The Postmaster by Rabindranath Tagore

Snapshot of a Dog by J G Thurber

On the Rule of the Road by A.G. Gardiner

The Village Schoolmaster by Oliver Goldsmith

Incident of the French Camp by Robert Browning (13)

Unit - 2 : Poems

Stopping By Woods on a Snowy Evening by Robert Frost

The Ballad of Father Gilligan by W.B. Yeats (9)

Unit - 3 : Short stories

The Model Millionaire by Oscar Wilde

The Ant and the Grasshopper by W. Somerset Maugham

The Doll's House by Katherine Mansfield, Biography

Albert Einstein and Steve Jobs (11)

Unit - 4 : Fiction

The Old Man and the Sea by Ernest Hemmingway

The Scarlet Pimpernel by Baroness Emma Orczy

Practice in creative writing, review writing (13)

TOTAL : 45

REFERENCES

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2. *Kumara Pillai. ed. A Book of Modern Short Stories. Macmillan: New Delhi, 2009.*

3. *Colleen and Darius Krishnaraj. ed. Convergence , A Book of Short Stories. Macmillan: New Delhi, 2009.*

4. *Ernest Hemmingway. The Old Man and the Sea. Arrow: Warwickshire, 2000.*

5. *Baroness Emma Orczy, The Scarlet Pimpernel. Hutchinson : 1995.*