COIMBATORE INSTITUTE OF TECHNOLOGY

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

COIMBATORE - 641 014, TAMILNADU, INDIA

DIAMOND JUBILEE

(1956 - 2016)

DEPARTMENT OF COMPUTING

M.Sc. (DECISION AND COMPUTING SCIENCES)

Curriculum and Syllabi

(Semesters I to X & Electives)

Under Choice Based Credit System

(For the students admitted during 2022 - 2023 and onwards)

COIMBATORE INSTITUTE OF TECHNOLOGY

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

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 CIT 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 COMPUTING
COIMBATORE INSTITUTE OF TECHNOLOGY

VISION AND MISSION OF DEPARTMENT OF COMPUTING

VISION

Department of Computing endeavors to make the students, world class software engineers, data scientists and decision makers with prudence of pioneering the solutions to the challenges of the nation and the world.

MISSION

The Mission of Department of Computing is

M1 : To impart sound conceptual knowledge along with intensive practical training and real time industry/ research project exposure to the students.

M2 : To provide a learning ambience to enhance innovations, problem solving skills, leadership qualities, team-spirit and ethical responsibilities.

M3 : To establish Industry Institute Interaction program to provide exposure of latest tools and technologies used in the IT organizations and enhance the entrepreneurship skills.

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DEPARTMENT OF COMPUTING

M.Sc. DECISION AND COMPUTING SCIENCES

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 **Expertise in Decision Making :** Evolve as decision scientists with an in-depth knowledge of multiple business domains across all functional areas.

PEO2 **Expertise in Software Development :** Be competent to develop software products by strategic blending of computing technology and management expertise that facilitate informed decision making.

PEO3 **Leadership and Lifelong Learning :** Demonstrate leadership qualities through acquisition of intrapreneurship and entrepreneurship traits and engage in active contribution to society through innovative solutions of global impact.

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DEPARTMENT OF COMPUTING

M.Sc. DECISION AND COMPUTING SCIENCES

PROGRAMME OUTCOMES

PO1 : Apply mathematical and statistical modelling for analysis of business problems that aid management to make data driven decisions.

PO2 : Perform quantitative and qualitative data analytics in functional areas of business like marketing, human resource management, finance, etc.

PO3 : Visualize and infer meaningful insights to facilitate strategic and operational decisions.

PO4 : Apply foundations of business management blended with computing science to address issues in decision-making.

PO5 : Develop smart enterprise applications applying software engineering principles and business domain knowledge.

PO6 : Design and develop software products and services for strategic decision making, business analytics and intelligence.

PO7 : Align and utilize information technology infrastructure, analytics and decision-making skills effectively to realize the organization's goals.

PO8 : Contribute and collaborate effectively in any role in multi-disciplinary teams.

PO9 : Recognize professional, social and ethical values imbibed in the business and technical environments.

PO10 : Engage in lifelong learning to be empowered with management expertise and by structured adoption of technological advancements.

PO11 : Aspire to be an intrapreneur/entrepreneur by transforming the idea into successful business venture with due consideration to financial, technical and management aspects.

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Department of Computing

M. Sc. DECISION AND COMPUTING SCIENCES

(Five year Integrated Programme)

Curriculum from the Academic Year 2022 – 2023 onwards

Semester I

Course Code	Course Name	L	T	P	C	CAT
Theory						
22MDC11	Technical English	2	0	1	2	HS
22MDC12	Applied Algebra and Calculus	3	1	0	4	BS
22MDC13	Statistical Methods	3	0	0	3	BS
22MDC14	Principles of Management	3	0	0	3	PC
22MDC15	Problem Solving and Programming in C	3	0	0	3	PC
Practicals						
22MDC16	Mathematical and Statistical Computing Laboratory	0	0	4	2	PC
22MDC17	C Programming Laboratory	0	0	4	2	PC
22MDC18	Foundations of Computer Science Laboratory	0	0	4	2	PC
22MDC19	Employability Skills	0	0	2	1	EEC
	Total Credits				**22**	

Semester II

Course Code	Course Name	L	T	P	C	CAT
Theory						
	Language Elective	2	0	1	2	HS
22MDC21	Probability Distributions and Applications	3	0	0	3	BS
22MDC22	Organisational Behavior	4	0	0	4	PC
22MDC23	Data Structures and Algorithms	3	0	0	3	PC
22MDC24	Computer Organization and Operating Systems	3	0	0	3	PC
Practicals						
22MDC25	Applied Probability Laboratory	0	0	4	2	PC
22MDC26	Data Structures and Algorithms Laboratory	0	0	4	2	PC
22MDC27	Python Programming Laboratory	0	0	4	2	PC
22MDC28	English for Employability	0	0	2	1	EEC
	Total Credits				**22**	

Curriculum and Syllabi
Semesters III - X and Electives

Semester III

Course Code	Course Name	L	T	P	C	Category
	THEORY					
22MDC31	Applied Statistics for Business Decisions	3	1	0	4	BS
22MDC32	Financial Analysis and Reporting	3	1	0	4	PC
22MDC33	Digital Marketing	3	0	0	3	PC
22MDC34	Database Management Systems	3	0	0	3	PC
22MDC35	Object Oriented Programming	3	0	0	3	PC
	PRACTICALS					
22MDC36	Digital Marketing Laboratory	0	0	4	2	PC
22MDC37	Database Management Systems Laboratory	0	0	4	2	PC
22MDC38	Object Oriented Programming Laboratory	0	0	4	2	PC
	Total Credits				**23**	

Semester IV

Course Code	Course Name	L	T	P	C	Category
	THEORY					
22MDC41	Predictive Analytics	3	0	0	3	BS
22MDC42	Operations Research for Business	3	1	0	4	PC
22MDC43	Financial Engineering	3	0	0	3	PC
22MDC44	Advanced Data Structures and Algorithms	3	0	0	3	PC

22MDC45	Artificial Intelligence	3	0	0	3	PC
	PRACTICALS					
22MDC46	Predictive Analytics Laboratory	0	0	4	2	PC
22MDC47	Financial Engineering Laboratory	0	0	4	2	PC
22MDC48	Advanced Data Structures and Algorithms Laboratory	0	0	4	2	PC
22MDC49	Personality Development	0	0	2	1	EEC
	Total Credits				**23**	

Semester V

Course Code	Course Name	L	T	P	C	Category
	THEORY					
22MDC51	Human Resource Management and Analytics	3	1	0	4	PC
22MDC52	Software Engineering	3	0	0	3	PC
22MDC53	Computer Networks	3	0	0	3	PC
22MDC54	Machine Learning	3	0	0	3	PC
	Elective - I	3	0	0	3	PE
	PRACTICALS					
22MDC55	Full Stack Application Development lab	0	0	4	2	PC
22MDC56	Machine Learning Laboratory	0	0	4	2	PC
	Elective Laboratory - I	0	0	4	2	PE
22MDC57	Managerial Communication Skills	0	0	2	1	EEC
	Total Credits				**23**	

Semester VI

Course Code	Course Name	L	T	P	C	Category
	THEORY					
22MDC61	Economic Foundations of Business	3	0	0	3	PC
22MDC62	Systems for Decision Support	3	0	0	3	PC
22MDC63	Cloud Computing	3	0	0	3	PC
22MDC64	Deep Learning	3	0	0	3	PC

Semester V

	Elective - II	3	0	0	3	PE
	PRACTICALS					
22MDC65	Cloud and Mobile Application Development Laboratory	0	0	4	2	PC
22MDC66	Deep Learning Laboratory	0	0	4	2	PC
	Elective Laboratory - II	0	0	4	2	PE
22MDC67	Hackathon	0	0	2	1	EEC
	Total Credits				**22**	

Semester VII

Course Code	Course Name	L	T	P	C	Category
22MDC71	Project Work and Viva Voce-I	0	0	0	18	EEC
	Total Credits				**18**	

Course Code	Course Name	L	T	P	C	Category
	THEORY					
22MDC81	Modelling and Simulation	3	0	0	3	PC
22MDC82	Game Theory and Decision Analysis	3	0	0	3	PC
22MDC83	Production and Operations Management	3	0	0	3	PC
	Elective – III	3	0	0	3	PE
	Elective – IV	3	0	0	3	PE
	PRACTICALS					
22MDC84	Game Theory and Decision Analysis Laboratory	0	0	4	2	EEC
22MDC85	Minor Project (Decision Tool Development)	0	0	4	2	PC
	Elective Laboratory - III	0	0	4	2	PE
	Total Credits				**21**	

Semester IX

Course Code	Course Name	L	T	P	C	Category
	THEORY					
22MDC91	Project Management	3	0	0	3	PC
22MDC92	Business Ethics and Entrepreneurship Development	3	0	0	3	PC
22MDC93	Data Privacy and Security Analytics	3	0	0	3	PC
	Elective – V	3	0	0	3	PE
	Elective – VI	3	0	0	3	PE
	PRACTICALS					
22MDC94	Data Privacy and Security Analytics Laboratory	0	0	4	2	PC

	Elective Laboratory IV	0	0	4	2	EEC
	Elective Laboratory V	0	0	4	2	
	Total Credits				**21**	

Semester X

Course Code	Course Name	L	T	P	C	Category
22MDC101	Project Work and Viva Voce- II	0	0	0	18	EEC
	Total Credits				**18**	

ELECTIVE COURSE

Course Code	Course Name	L	T	P	C	Category
	MANAGEMENT STREAM					
	General Management					
22MDCE01	Business Process Management	3	0	0	3	PE
22MDCE02	Business Environment	3	0	0	3	PE
22MDCE03	Legal Aspects of Business	3	0	0	3	PE
22MDCE04	Strategic Management	3	0	0	3	PE
22MDCE05	Technology and Innovation Management	3	0	0	3	PE
	Finance					

22MDCE11	Equity Valuation	3	0	0	3	PE
22MDCE12	Credit Risk Analytics and Management	3	0	0	3	PE
22MDCE13	International Financial Management	3	0	0	3	PE
	Marketing					
22MDCE21	Customer Relationship Management	3	0	0	3	PE
22MDCE22	Brand Management	3	0	0	3	PE
22MDCE23	Marketing Analytics	3	0	0	3	PE
	Human Resources					
22MDCE31	Strategic Human Resource Management	3	0	0	3	PE
22MDCE32	Performance Management	3	0	0	3	PE
22MDCE33	Compensation Management	3	0	0	3	PE
	Operations & Logistics					
22MDCE41	Total Quality Management	3	0	0	3	PE
22MDCE42	Logistics Strategy and Planning	3	0	0	3	PE
22MDCE43	Supply Chain Management	3	0	0	3	PE
	COMPUTER SCIENCE STREAM					
	Advanced Analytics and Intelligent Systems					
22MDCE51	Graph Theory for Data Science	3	0	0	3	PE
22MDCE52	Healthcare Analytics	3	0	0	3	PE

22MDCE53	Social Network Analysis	3	0	0	3	PE
22MDCE54	Natural Language Processing	3	0	0	3	PE
	Distributed and Network Systems					
22MDCE61	Blockchain Technologies	3	0	0	3	PE
22MDCE62	Distributed Computing	3	0	0	3	PE
22MDCE63	Embedded Systems	3	0	0	3	PE
22MDCE64	Sensing and Sensors	3	0	0	3	PE
22MDCE65	Internet of Things	3	0	0	3	PE
	Software Engineering					
22MDCE71	Software Testing and Quality Assurance	3	0	0	3	PE
22MDCE72	Human Computer Interaction and Interface	3	0	0	3	PE
22MDCE73	Software Architecture and Design Patterns	3	0	0	3	PE
	Cyber Security					
22MDCE81	Cyber Security Analytics	3	0	0	3	PE
22MDCE82	Digital Forensics	3	0	0	3	PE
	Professional Electives - Laboratory Courses					
22MDCEL1	Business Intelligence Laboratory	0	0	4	2	PE
22MDCEL2	Natural Language Processing Laboratory	0	0	4	2	PE
22MDCEL3	Computational Intelligence Laboratory	0	0	4	2	PE

22MDCEL4	Software Engineering Laboratory	0	0	4	2	PE
22MDCEL5	Internet of Things Laboratory	0	0	4	2	PE

HS - Humanities and Social Sciences, BS - Basic Sciences, PC - Professional Core, PE - Professional Elective, EEC - Employability Enhancement Course.

NOTE :

- Equal weightage for Decision Science and Computer Science is given in the design of the curriculum, which complement each other to address the industry needs.
- Students of this Programme can specialize in Decision Science and/or Computing Science by choosing interested elective courses given under different streams.

22MDC11 TECHNICAL ENGLISH

L	T	P	C
2	0	1	2

ASSESSMENT: THEORY

COURSE OUTCOME:

CO 1: Compose appropriate dialogues, construct descriptive paragraphs and review, for a given communication context

CO 2: Categorize the barriers to communication and formulate solutions for a Communication context. Generate functional expressions and construct dialogues, for a given situation, like introducing oneself, asking questions, disagreeing, expressing preferences, asking for and giving directions.

CO 3: Specify appropriate responses and construct a summary, for a given short conversations and Monologues for listening

CO 4: Interpret the given technical graphical representation and compose passages. summarize and paraphrase technical texts in about 250 to 300 words.

CO 5: Apply the rules of the grammar viz., word formation, Verbs, Tenses, Question Tags, Prepositions, Articles, Conjunctions, Concord, Idiomatic Expressions, One Word Substitutes, Homophones and Homonyms, Linking words, adjectives and degrees of comparison, use appropriate patterns in the given sentence.

FOCUS ON LANGUAGE: GRAMMAR & VOCABULARY

Tenses – Question Tags – Prepositions – Articles – Conjunctions – Subject Verb Agreement – Idiomatic Expressions - Word Formation: Prefixes & Suffixes - One Word Substitutes – Homophones and Homonyms – Contracted form of Verbs – Emphasis - Linking Words – Common Errors and Redundancies – Adjectives - Degrees of Comparison

(5 hours)

TECHNICAL COMMUNICATION

Importance of Technical Communication - Objective & Characteristics of Technical Communication – General and Technical Communication – Process of Communication - Levels of Communication – Flow of Communication –Visual Aids in Technical Communication - Barriers to Communication: Noise – Classification of Barriers –Non-verbal Communication: Kinesics – Proxemics- Chronemics - Social Media Etiquette

(5 hours)

READING

Reading Comprehension – Skimming and Scanning – Summarizing – Sequencing of Sentences - Intensive & Extensive Reading- Note Making – SQ3R Reading Technique.

(4 hours)

WRITING

Gadget Review – Types of Paragraphs – Description – Describing Structures – Information Transfer - Describing Trends – Paragraph Construction - Paragraph Patterns – Kinds of Paragraph – Writing a First Draft, Revising & Finalizing - Steps to Effective Précis Writing - Dialogue Writing – Essay Writing.

(6 hours)

LISTENING

Meaning and Art of Listening-Importance of Listening & Empathy in Communication – Reasons for Poor Listening – Traits of a good listener – Listening modes - Listening and Filling Information – Identifying parts from a discussion.

(4 hours)

SPEAKING

Introducing Oneself- Asking Questions –Retelling an Incident – Small Talk – Disagreeing – Expressing Preferences – Asking for and Giving Directions -Achieving Confidence, Clarity & Fluency – Vocal Cues - Barriers to Speaking – Types of Speaking – Persuasive Speaking – Public Speaking - Effective Presentation Strategies – Planning - Outlining & Structuring – Nuances of Delivery – Controlling Nervousness & Stage Fright – Making an Oral Presentation -Visual Aids in Presentation – Applications of MS Power Point.

(6 hours)

Total : 30 hours

Text Books:

1. Sudharshana N. P & Savitha C, "English for Technical Communication", CUP, 2016.
2. Meenakshi Raman, Sangeeta Sharma, "Technical Communication – Principles and Practice", Oxford University Press, New Delhi, 2015.

Extensive Reading:

1. C.M.Sharma, "Twelve Short Stories" OUP, 2000. (Only Essay Questions)

Reference Books:

1. Jack C Richerds, "Interchange - 2", CUP, Fourth Edition, 2015.
2. Sudharshana N. P & Savitha C, "English for Engineers", CUP, 2018
3. Ronald Carter, Michael McCarthy. "Cambridge Grammar of English" Cambridge University Press, 2011.
4. Michael McCarthy and Felicity O'Dell, "English Vocabulary in Use", Cambridge University Press, 2012.
5. Mark Ibbotson. "Cambridge English for Engineering" Cambridge University Press, 2012.

22MDC12- APPLIED ALGEBRA AND CALCULUS

L	T	P	C
3	1	0	4

PRE-REQUISITES
Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME:

CO 1: Gain knowledge about the basic concepts in financial mathematics and application of numerical methods in solving equations occurring in business modelling
CO 2: Apply matrix methods to solve real world problems
CO 3: Apply differential calculus to solve optimization problems in economics and business
CO 4: Apply integral calculus to solve real world problems in economics and finance
CO 5: Perform empirical data analysis

ALGEBRA

SEQUENCES AND SERIES: Arithmetic, geometric and harmonic sequences-Finite and infinite series. Convergence and divergence of infinite series-Simple examples - nth term test for divergence and p-series convergence.

Applications of series in financial mathematics: Simple and Compound Interest-Nominal and Effective Interest Rates-Continuous Compounding -Future Value and Present Value-Annuities-Ordinary Annuity: Future and Present Value, Annuity Payment, Principal Sum, Period and Interest Rate, Annuity Due, Deferred Annuity and Perpetuity.

(6 hours)

SOLUTION OF EQUATIONS: Algebraic and transcendental equations - Bisection Method and Newton Raphson method-Real World Applications of Newton Raphson Method: Finding the Break Even Point of a Firm and finding the interest rates of Annuities.

(4 hours)

MATRICES AND VECTOR SPACES:

MATRICES: The Inverse of a Matrix-Properties and Algorithm to find the Inverse of a Matrix: Gauss Jordan Method- Solving a system of Linear Equations Using Matrix Inverse. Eigen values and Eigen vectors - Cayley Hamilton theorem (without proof) - Application to find the inverse and higher powers of a matrix - Diagonalization - Quadratic forms - Orthogonal reduction to Canonical form. Applications of Matrices: The Leontief Input Output Model in Economics, Leslie's Population Growth Model, Homogeneous Coordinates and their applications to Computer Graphics. **(9 hours)**

VECTOR SPACES: Vector spaces and Subspaces - Linear dependence and independence of vectors- Linear transformations- Linearly independent sets and Bases - Dimension of a vector space

(4 hours)

CALCULUS

Differential Calculus: Definition of limit and derivative of a function. Applications to marginal analysis in Business and Economics, Relative Rate of Change and Elasticity of Demand - Maxima and Minima of function of single variables - Applications to Optimization of area and perimeter, Relation between Average Cost and Marginal Cost, Maximizing Revenue and Profit and Inventory Control. Functions of Several Variables - Partial Derivatives- Homogeneous functions and Euler's Theorem - Optimization of functions of two variables - Constrained Optimization using Lagrange Multipliers. **(8 hours)**

Integral Calculus: Integration as a process of Summation - Application of Area between two curves to find the Net Excess Profit - Application to study Lorenz Curves in Economics - Calculation of present value of an income stream using definite integrals. Special Functions: Beta and Gamma Functions - Double and triple integrals - Applications: Area - Volume.

(6 hours)

EXPERIMENTAL DATA ANALYSIS

Curve fitting: Least Square Method. Interpolation: Newton's method - Lagrange's method. Numerical Differentiation: Application to Maxima and Minima of functions. Numerical Integration: Trapezoidal rule - Simpson's 1/3rd rule. Applications to Real World Problems and finding Area, Volume and Numerical Solutions of Ordinary Differential Equations: Taylor's Series - Runge Kutta Fourth order methods - Milne's Predictor - Corrector Method.

(8 hours)

Theory : 45 hours
Tutorial: 15 hours
Total: 60 hours

TEXT BOOKS

1. Ahmad Nazri Wahidudin, "Financial Mathematics and Its Applications", Ventus Publishing ApS, ISBN 978-87-7681-928-6, 2011.
2. David C Lay "Linear Algebra and its Applications", Fourth edition Pearson 2012.
3. R.A.Barnett, M.R.Ziegler and K.E.Bylen, Calculus for Business, Economics, Life Sciences and Social Sciences, 12th Edition, Prentice Hall, 2011.
4. L.D.Hoffman and G.L.Bradley, Calculus for Business, Economics and the Social and Life Sciences, 10th Edition, McGraw Hill, Higher Education, 2010.

REFERENCE BOOKS

1. Kandasamy, P.et al., "Engineering Mathematics", Volume - I & II (8th Fully Revised Edition), S. Chand & Co, 2008.
2. Kandasamy .P et al., "Numerical Methods", (First Revised Edition) Tata McGraw Hill Publishing company Ltd., 2008. (para 5)
3. Veerarajan T, "Engineering Mathematics (For First Year)", (first revised edition), Tata McGraw Hill Publishing company Ltd, 2008.
4. Venkataraman. M.K., "Engineering Mathematics", (First year), The National Publishing Company, 2008.

22MDC13 – STATISTICAL METHODS

L	T	P	C
3	0	0	3

ASSESSMENT : THEORY

COURSE OUTCOME:

CO 1 : Present and summarize data using statistical tool
CO 2 : Apply basic concepts in probability theory to data and derive useful measures for easy interpretation of the probability structure of data
CO 3 : Apply various methods of sampling from population data
CO 4 : Demonstrate the association between two variables and use regression analysis in prediction.

DATA TYPES AND SCALES

Structured and Unstructured Data-Cross-Sectional, Time Series, and Panel Data-Types of Data Measurement Scales: Nominal, Ordinal, Interval and Ratio Scale-Raw data and grouped data – Primary and secondary data – Methods of collection –Classification of data – Tabulation –frequency distribution-**Data visualization**: **Charts:** Scatter Plot, Bar Chart- Pie Chart, Coxcomb Chart - **Graphs:-**Histogram, Frequency Polygon and Curve, Ogive curves and histograms-Stem and Leaf plots.

(9 hours)

SUMMARY STATISTICS

MEASURES OF CENTRAL TENDENCY: arithmetic mean-weighted arithmetic mean, median, mode, geometric mean and harmonic mean- Merits, demerits and uses- Relationship between mean, median and mode-Relationship AM, GM and HM, computation of the measures for grouped and ungrouped data -Percentile, Decile and Quartile

MEASURES OF DISPERSION: range, mean deviation and standard deviation – coefficient of variation and its use- Inter Quartile Range(IQR)-Outliers-Box Whisker Plot and its uses- Tree map–Measures of shape - Skewness and Kurtosis and their uses.

(9 hours)

PROBABILITY

Bayes's Theorem and its applications– Moments of a random variable-raw and central moments. Mathematical expectation-mean and variance – Inequalities: Markov, Chebyshev, Chernoff, Jensen and Cauchy-Schwarz -Important discrete distributions-Discrete Uniform Distribution, Binomial, Poisson, The Poisson approximation to the Binomial- Continuous distributions: Continuous Uniform Distribution and Normal distribution, its properties and applications-The Normal approximation to the Binomial-Normal Probability Plot and Q-Q plot.

(9 hours)

SAMPLING

Population and sample- sampling and its need –sampling Vs. complete enumeration –parameter and statistics-Probability sampling and –random sampling- simple random sampling, lottery method and random number table method- stratified random sampling-sampling distribution and standard error of a statistic. Bootstrap sampling.

(9 hours)

CORRELATION AND REGRESSION

Standardisation of variables-Methods: Z-score, 0-1 scale(min-max scale), standard deviation method and range method-Definition of correlation - Scatter plot –Karl Pearson's correlation coefficient its properties– Definition

of Regression – Simple regression-Regression of x on y and y on x - fitting regression equation by the method of least squares-properties of regression coefficients -Spearman's rank correlation coefficient-Multiple regression with two independent variables-Multiple and Partial correlation coefficients in three variables and their properties. **(9 hours)**

Total : 45 hours

Text Books:

1. U.Dinesh Kumar, "Business Analytics", Wiley India Pvt. Ltd., 2017
2. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Ninth Edition, Prentice Hall, Delhi, 2002.

Reference Books

1. Michael Baron, "Probability and Statistics for Computer Scientists", 2nd edition, CRC Press
2. Gupta,S.C. – "Fundamentals of Statistics", 7th revised and enlarged edition, - Himalaya Publishing House, New Delhi, 2013.
3. Peter Bruce and Andrew Bruce, "Practical Statistics for Data Scientists", O'Reilly, 2017
4. Gun, A.M., Gupta, M.K. and B. Dasgupta, "Fundamentals of Statistics", Vol.1.World Press, Kolkatta, 2013.

22MDC14 –PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : **THEORY**

COURSE OUTCOMES:

CO 1 : *Demonstrate the necessity and importance of effective management for the success of any activity.*
CO 2 : *Apply the Management concepts to solve problems in the given business scenario*
CO 3 : *Identify the usage of management techniques in decision making*
CO 4 : *Describe various theories related to management and understand the management decision making process in particular.*
CO 5 : *Gather and analyse both qualitative and quantitative information from a business scenario to isolate an issue and formulate best control methods.*

OVERVIEW OF MANAGEMENT : Management : Definition – Nature and Purpose – Evolution of Management Thought – Management: Science or Art – Approaches to Management.Management and Society : Organisation and External Environment – Social Responsibility of Business – Ethics in Business – Trends and Challenges in Global Scenario.Case Study.

(9 hours)

PLANNING : Purpose – Types of Plans – Steps in Planning – Objectives : Evolving concepts in Management by Objectives – Strategies, Policies and Planning Premises: Nature and Purpose – Strategic Planning Process – TOWS Matrix – Blue Ocean Strategy – Portfolio Matrix – Kinds of Strategies and Policies – Portor's Industry Analysis and Generic Competitive strategies – Premising and Forecasting – Decision Making: Importance and Limitations – Development of Alternatives – Limiting Factor – Heuristics in Decision Making – Evaluation and Selection of Alternatives – Programmed and Unprogrammed Decisions - Case Study.

(9 hours)

ORGANISING AND STAFFING: Nature of Organising – Organisational levels – Entrepreneuring and Intrapreneuring – Reengineering and Organisation – Structure and Process – Organisation Structure – Line and Staff Authority – Empowerment – Authority and Power – Decentralisation of Authority – Delegation –Effective Organising by avoiding mistakes.Staffing : Meaning and Purpose – Case Study.

(9 hours)

LEADING : Human Factors in Managing – Need for Motivation - System and Contingency approach to Motivation. Leadership: Definition – Ingredients – Trait Approach – Leadership Behaviour and Styles – Committees – Teams. Communication : Purpose – Process – Barriers – Electronic Media in Communication – Case Study.

(9 hours)

CONTROLLING : Control Process – Critical Control Points, Standards and Bench Marking – Control as a Feedback System – Feedforward or Preventive Control – Control of Overall Performance – Requirement of Effective Control – Budget as Control Device – Traditional Non Budgetary control devices –Opportunities and Challenges created by IT – Digital Economy- Digitising the Control System – Case Study.

(9 hours)
Total: 45 Hours

Text Book:

1. Harold Koontz and Heinz Weihrich, “Essentials of Management”, McGraw Hill, 11th Edition, 2020

Reference Books:

1. Prasad.L.M, “Principles and Practice of Management”, Sultan Chand and Sons, Tenth Edition.2020
2. Harold Koontz, Heinz Weihrich .J and Mark .V.Cannice, “Essentials of Management: An International, Innovation and Leadership Perspective”, Mc Graw Hill, Eleventh Edition,2020
3. Stephen.P.Robbins, “Management” , Prenctice Hall of India, Fifteenth Edition, 2020.
4. Rao.V.S.P, “Management Text and Cases” ,Excel Books,Second Edition. 2012

22MDC15 – PROBLEM SOLVING AND PROGRAMMING IN C

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **THEORY**

COURSE OUTCOMES:

CO 1 : *Design algorithmic solutions to the real-world problems*
CO 2 : *Choose and implement the concepts of Arrays, Pointers, Strings, Structures, Unions and Files in different applications*
CO 3 : *Analyse the given problem statement, and develop modular programming using functions and program structures*
CO 4 : *Develop efficient programs using pointers, structures, and unions*
CO 5 : *Develop applications with persistent data storage using various file handling techniques*

INTRODUCTION
Introduction to Problem Solving -Fundamental Algorithms -Flowcharts/Pseudo codes - Introduction to Programming-Programming design methodologies – Evolution of programming languages.

Introduction to C programming – Character Set - Identifiers and Keywords-Data Types-Variables and Constants –Declarations – Expressions – Statements – Symbolic Constants - Operators and Expressions - Precedence and Associativity of Operators - Type Conversion- Library functions. Data Input and Output–Error Diagnostics and Debugging Techniques - Command-line Arguments - Control Statements – Macros and Pre-processor Directives – Enumerations.

(11 hours)

ARRAYS AND STRINGS
Defining and Processing an Array – Multidimensional Arrays. Defining a String – Null Character – Initialization– Reading and Writing – Processing –Character Arithmetic – Searching and Sorting.

(8 hours)

FUNCTIONS AND PROGRAM STRUCTURE
Overview – Defining and Accessing a Function – Prototypes – Passing Arguments –Passing Arrays to Functions – Recursion. Storage classes – Automatic, External and Static Variables – Multi file Programs.

(8 hours)

POINTERS AND STRUCTURES
Pointer Fundamentals – Declaration – Null Pointer- Passing Pointers to a Function – Pointers and Arrays –Dynamic Memory Allocation – Operations on Pointers –Pointers and Multidimensional Arrays – Arrays of Pointers –Passing Functions to Other Functions – Pointers and Strings.
Structures: Defining and Processing Structures – typedef–Structures and Pointers – Passing Structures to Functions – Self-Referential Structures –Unions.

(12 hours)

FILE HANDLING
Need – Opening and Closing a Data File – Reading, Writing, and Processing – Unformatted Data File – Concept of Binary Files – Random Access of Files.

(6 hours)

Total: 45 Hours

Text Books:

1. M.T. Somashekara, D.S. Guru, K.S. Manjunatha, “Problem Solving with C”, 2nd Edition, PHI, 2018.
2. Schaum's outline series, "Programming with C", Tata McGrawHill Publication, 2nd Edition, 2010.

Reference Books:

1. R.G.Dromey, “How to Solve it by Computer”, 2nd Edition, Pearson Education, 2007.
2. Yashavant P. Kanetkar, “Let Us C”, BPB Publications, 16thEdition, 2019.
3. KernighanB.W. and Ritchie D.M., "C ProgrammingLanguage (ANSI C)", Pearson Education, 2004.

22MDC16 MATHEMATICAL AND STATISTICAL COMPUTING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **PRACTICAL**

COURSE OUTCOMES:

CO 1 : *Apply powerful features of Excel for business modelling, and for mathematical and statistical data analysis*
CO 2 : *Compute measures of central tendency and dispersion*
CO 3 : *Generate graphical and diagrammatic representation of statistical data*
CO 4 : *Analyse bivariate data using Excel's data analysis tools*
CO 5: *Write script files and analyse data using Excel's Analysis Toolpak*

Topics to be covered

INTRODUCTION TO EXCEL AND ITS FEATURES

1. Workbooks and Worksheets, entering data, relative and absolute addressing of cells, conditional formatting
2. Formulas and functions: Logical, Statistical, Financial, Date and Time, Lookup and Reference
3. Spreadsheet modelling using Excel
4. Pivot Tables, Tables, and Charts
5. Data Handling: Import, Sort & Filter, Data Tools, Forecast, Outline
6. Forms
7. Analysis ToolPak
8. Dashboard

EXERCISES ON MATHEMATICS AND STATISTICS USING EXCEL

1. Execute Mathematical Functions
2. Execute Statistical Functions
3. Perform Algebraic operations on matrices, Transpose of a matrix, Determinants, inverse of a matrix
4. Compute annuities, present and future values
5. Solve system of linear equations
6. Work with Row reduced echelon form and normal form.
7. Find Eigenvalues, Eigenvectors, and Rank of a matrix.
8. Apply of Leslie population growth model
9. Perform graphical and diagrammatic representation of statistical data, like scatter plot, bar diagram, pie, histogram and line diagram -1, line diagram -2
10. Apply statistical functions (and also directly) to calculate the measures of central tendency.
11. Apply statistical functions (and also directly) to calculate the measures of dispersion, skewness, and kurtosis
12. Work with Simple probability and random sampling
13. Compute probabilities of Binomial, Poisson and Normal distributions
14. Compute correlation coefficient and perform estimation of simple regression lines.
15. Perform correlation and regression analysis
16. Perform statistical analysis using Excel's Analysis ToolPak and visualizing dashboard

22MDC17 – C PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOMEs:

CO 1 : *Analyse the given problem, and generate solution by devising an algorithm and converting it into C program*
CO 2 : *Create decision making applications with the support of arrays and strings*
CO 3 : *Develop reusable solutions using functions and / or recursive functions in C*
CO 4 : *Generate efficient programming solutions using various concepts of Pointers, Structures and Functions*
CO 5: *Implement various file handling techniques in different applications*

CONCEPTS TO BE COVERED

1. Write programs using different forms of input and output statements using various data types and operators
2. Write programs to get familiarity on using conditional, control and repetition statements.
3. Develop application programs using one and two dimensional arrays.
4. Perform String manipulations by using built-in and user-defined functions.
5. Develop application programs using simple structure, and array of structures.
6. Write Simple programs to implement functions with / without arguments and with / without return type.
7. Implement modular programming using functions, nested functions, recursive function
8. Develop application programs by passing arrays, structures, arrays of structures, functions as parameters to the function.
9. Develop applications using pointers with arrays, functions, structures, array of structures, and self referential structures
10. Implement various dynamic memory allocation techniques.
11. Develop simple applications using union, enumeration type, preprocessor directives, and macros.
12. Develop Applications using file operations.

22MDC18 FOUNDATIONS OF COMPUTER SCIENCE LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **PRACTICAL**

COURSE OUTCOMES:

CO 1 : *Execute commands through command line interface and setup the system environment for a Windows system*
CO 2 : *Execute commands through command line interface in Linux and work with shell scripts*
CO 3 : *Apply advanced features of Word processing with MS Word and OpenOffice Writer*
CO 4 : *Prepare professional presentations using advanced features of MS Powerpoint and OpenOffice Impress*
CO5: *Create new websites or enhance the existing websites to be more responsive using HTML5, CSS, Javascript, jQuery, BOOTSTRAP, PHP and MySQL*

A. COMMAND-LINE INTERFACE IN WINDOWS

1) Run Folder management commands
2) Run File management commands
3) Work with Path settings and System environment variables settings

B. COMMAND-LINE INTERFACE COMMANDS IN LINUX

1. Work with vi Editor in Linux.
2. Learn the use of basic Linux commands.
3. Learn the use of redirection and File access permissions.
4. Work with filters.
5. Work with commands such as find, cmp, comm, uniq.
6. Write efficient Shell Scripts.

C. WORD PROCESSING : MS Word and OPEN OFFICE - WRITER

1. Work with Documents- Formatting Documents - Setting Page style- Creating Tables - Drawing- Tools - Printing Documents
2. Use Tools – Word Completion, Spelling and Grammar Checks, Mail merge, Templates, Using Wizards, Tracking Changes, Security, Digital Signature.

D. PRESENTATION: MS Power point & OpenOffice-Impress:

1. Create Presentations, Insert links and media, Master Templates & Re-usability, Slide Transition and Animation, Print Handouts, Record and Export presentations

E. INTERNET

1. Work with Google Forms, Google Docs, Google Sheet and Google Slides

F. BASIC WEBSITE DEVELOPMENT

1. Create web pages using HTML formatting tags, tables, images, lists and frames
2. Create interactive pages using anchors, image maps and forms
3. Design responsive web pages using CSS, and BOOTSTRAP
4. Create an online Registration form for a website and validate using jQuery
5. Construct a JSON structure for an application and validate it using JSON and use jQuery for parsing

6. Create a Single Page Application using Bootstrap and jQuery for designing the User Interface
7. Develop Java Script Programs for Arithmetic operations, String processing, Arrays, built-in functions, user defined functions, client side validations and even handling
8. Develop a fully functional web application using PHP and MySQL with validations

22MDC19 EMPLOYABILITY SKILLS

L	T	P	C
0	0	2	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

- ***CO 1 :*** *Solve timed objective question on logical reasoning and verbal ability*
- ***CO 2 :*** *Generate ideas and speak confidently, for a given specific speaking task on topics like describing a picture, movie reviews, storytelling, and extempore*
- ***CO 3 :*** *Use appropriate functional expressions, for a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions*
- ***CO 4 :*** *Produce language structures accurately and fluently, for a given 2 to5 minutes speaking activity like Extempore and Debate. Prepare a powerpoint presentation for 15 minutes, for a given technical topic*
- ***CO 5:*** *Specify appropriate responses and construct a summary for given short conversations and monologues for listening. Construct dialogues for a given social scenario, interpret the given graphic information and write creative paragraphs*

Self-Introduction - Barriers to Speaking and Listening - Introduction to Spoken English, Greetings, Thanking - Apologizing, Congratulating - Giving Directions, Shopping – Role Play

(6 hours)

Activity based on newspaper articles - Word Building - A picture and a few words activity - Current Events.

(4 hours)

Alphabet test – Alphabet Order, Alphabet Series - Letter Word Problem, Word Formation and Scramble - Series Completion –Para Jumbles- Synonyms and Antonyms- Types and Exercises- Sentence Completion –Types and Exercises.

(8 hours)

Reading Comprehension- Skimming and Scanning - Reading Prose – Bacon's Essays (Speaking Activity based on the essays) - Story Building- Extempore - Movie Reviews.

(4 hours)

Speech Sounds - Word Vocabulary - Reading Comprehension - Listening Practice- I - Dialogue Writing - Conversational Exercise – I - Focus on Language - Creative Writing Conversational Exercise – II - Listening Practice – II

(8 hours)

Total – 30 hours

BASIC GERMAN

L	T	P	C
2	0	1	2

ASSESMENT: THEORY

COURSE OUTCOME:

CO1: Understand the fundamental concepts of the Language
CO2: Write simple narration and description and speak to communicate idea
CO3: Demonstrate confidence in Social Interactions

EINFUHRUNG
BegrUung - Name - Vorname - Familienname – Anrede

(5 hours)

THEMA
Hallo !Wiegeht's? – Begegnungen - Guten Tag, ichsuche – ImSupermarkt - Arbeit und Freizeit - Familie und Haushalt

(7 hours)

GRAMMATIK-I
Position des Verbs : Aussage, W - Frage und - Ja/Nein - Frage; Artikel die der das - W - Frage; Konjugation in Prasens; - Nominativ : bestimmter, unbestimmter und negative Artikel - Akkusativ : unbestimmterundnegativerArtikel - Adjektive : Akkusativ-Erganzung.

(10 marks)

GRAMMATIK-II
ArtikelalsPronomen Dative - Erganzung : Personalpronomen und Ortsangaben; ImperativModalverben; Ortsangaben; Richtungsangaben; Zeitangaben; OrdinalzahlenPossessiv - Artikel; trennbare und nicht trennbareVerben; Wechselprapositionen

(8 hours)

TOTAL : 30 hours

TEXT BOOK

Studio d A1: Kurs - und Ubungsbuch (Deutsch alsFremdsprache) CornelsenVerlag.

REFERENCE BOOK

Tangarmaktuell1 :Kursbuch + Arbeitsbuch (Deutsch alsFremdsprache) Max HueberVerlag

BASIC FRENCH

L	T	P	C
2	0	1	2

ASSESSMENT: THEORY

COURSE OUTCOME:

CO1: Understand the fundamental concepts of the Language
CO2: Write simple narration and description and speak to communicate idea
CO3: Demonstrate confidence in Social Interactions

INTRODUCTION

(2 hours)

UNITÉ-1

Faire connaissance - inviter etrépondre à une invitation - décrire les personnes- articles définis et indéfinis - genre etnombre des noms et des adjectifs- interrogation et négation - conjugaison du présent. Paris. monuments et lieux publics - la vie de quatreparisiens de professions différentes.

(7 hours)

UNITÉ-2

Exprimer l' ordreetl'obligation demander et commander - evaluer et apprécier- féliciter et remercier - articles partitifs -adjectifsdémonstratifs et possessifsprépositions et adverbes de quantité et de l'imperatif. verbespronominaux - unerégiondeFrance la Bourgogne - vie quotidienne à la compagne.

(6 hours)

UNITÉ-3

Raconteretrapporter - donner son avis - se plaindre et réprimander - expliquer et justifier - pronomscompléments -futurproche - passé composé et imparfait. Plusieursrégions de France – différentsunivers. sociaux.

(7 hours)

UNITÉ-4

Demander l'autorisation - interdire - formuler des projects - discuteretdébattre. Pronoms< en >et< y > - pronomsrelatifs et superlatifs - conjugaison du futur - présentcontinu et passé récent.La vie administrative.etrégionale - problems economiques et écologiques - traditions et modernité.

(8 hours)

Total : 30 hours

TEXT BOOK

1. Le Nouveau Sans Frontières - Philippe Dominique, Jacky GirardetMichèleVerdelhan, Michel Verdelhan

REFERENCE BOOKS

1. Dondo Modern French Course ---MathurinDondo
2. Modern French Grammar---Margaret Lang and Isabelle Perez.

PROFESSIONAL ENGLISH

L	T	P	C
2	0	1	2

ASSESSMENT: THEORY

COURSE OUTCOME:

CO1: Apply the rules of grammar, namely Active and Passive voice, Direct and Indirect speech, Cause and effect, Purpose and Function, Prepositions, Conditional sentence, Modal Verbs and use suitable patterns in a given sentence or passage

CO2: Construct appropriate responses to greet, transfer, place the caller on hold, enquires, callbacks, unintentional disconnects, interruptions, using suitable language and telephoning etiquettes. Construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator for a given business communication scenario

CO3: Specify the type and barrier to listening, provide solutions and justify, for a given a communication context

CO4: Compose a Business Letters, Memo, Emails, Reports, Minutes of the Meeting, Technical Proposals, Instructions and Recommendation and Checklist using appropriate language and format for a given business communication context. Prepare a job application letter with resume, for a given job requirement

CO5: Construct dialogues with appropriate functional expression, for a given communication content viz., giving advice and Suggestions, Apologizing, Asking for and giving permission.

FOCUS ON LANGUAGE: ENGLISH GRAMMAR & VOCABULARY

Reported Speech – Active Passive Voice – If Clause – Modal Verbs – Verb Preposition Combinations – Confusing Words – Abbreviations and Acronyms – Business and Job Related Vocabulary – Relative Clause – Pronouns – Cause and Effect Expressions – Purpose and Function.

(5 hours)

BUSINESS ENGLISH

Telephoning Skills: Understanding Telephone communication – Telephonic Conversations and Etiquettes - Handling Calls – Leaving a Message – Making Requests –Asking for and Giving Information – Giving Instructions - Negotiations: Types of Negotiation –Six Basic Steps of Negotiations – Informal and formal Negotiations

(5 hours)

READING

Reading a Procedure – Researching for supporting Evidence – Categorizing Information - Cloze Comprehension – Critical Reading: Creative and Critical Thinking - – Reading Proverbs.

(4 hours)

WRITING

Business Letters – Job Application Letters – Describing a Product and Process – Minutes of the Meeting - Report Writing – Proposal Writing –Memos – Emails - Instructions & Recommendations – Checklist.

(6 hours)

LISTENING

Listening to a lecture and sorting information – Listening and filling a mind map – Listening to an interview to create a bio-sketch – Types of Listening – Barriers of Effective Listening – Intensive Listening.

(4 hours)

SPEAKING

Group Communication: Forms of Group Communication – Using Body Language in Group Communication – Discussions – Group Discussions - Organizational GD – GD as a Part of Selection Process - Interviews: Objectives of Interviews – Types of Interviews – Job Interviews – Apologizing – Discussing an Advertisement – Giving Advice and Suggestions – Asking for and Giving Permission – Meetings.

(6 hours)

Total 30 hours

TEXT BOOK

1. Sudharshana N. P & Savitha C, "English for Technical Communication", CUP, 2016.
2. Meenakshi Raman, Sangeeta Sharma, "Technical Communication – Principles and Practice", Oxford University Press, New Delhi, 2015, 2015.

REFERENCE BOOKS

1. Jack C Richerds, "Interchange - 2", CUP, Fourth Edition, Chennai, 2015.
2. Sudharshana N. P & Savitha C, "English for Engineers", CUP, 2018
3. Ronald Carter, Michael McCarthy. "Cambridge Grammar of English" Cambridge University Press, 2011.
4. Michael McCarthy and Felicity O'Dell, "English Vocabulary in Use", Cambridge University Press, 2012.
5. Mark Ibbotson. "Cambridge English for Engineering" Cambridge University Press, 2012.

22MDC21 PROBABILITY DISTRIBUTIONS AND APPLICATIONS

L	T	P	C
3	0	0	3

PRE-REQUISITES:
Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOMES

CO1: Apply various discrete and continuous probability distributions to data and also situations where they can be applied
CO2: Apply moment generating functions in understanding various properties of random variables
CO3: Apply statistical tests to make inferences on the properties of both discrete and continuous types of data
CO4: Make inferences based on Bayesian estimation

PROBABILITY DISTRIBUTIONS
Discrete:-Geometric distribution and its memory-less property, negative binomial distribution, Hyper-geometric distributions-The Binomial Approximation to the Hyper-geometric distribution, multinomial distribution. **Continuous**: exponential distribution and its memory-less property, gamma, Beta, Chi-square log normal distributions and Weibull distributions –applications and their properties.

(9 hours)

FUNCTIONS OF RANDOM VARIABLES
Moments and Moment Generating functions – properties-MGF of important distributions - Transformations of Variables (using Jacobians) and finding their distributions - method of direct transformation and method of moment generating functions- Joint and Marginal Probability mass functions(for discrete) and density functions(for continuous) for two and more than two random variables. Conditional probability distributions-conditional mean and variance-Covariance of random variables-Statistically independent random variables-mean and variance of linear combination of random variables

(9 hours)

ESTIMATION
Estimation of parameters using method of moments-Maximum Likelihood Point Estimation(MLE) –Properties of estimators-Unbiasedness, minimum variance, efficiency and sufficiency -Mean Square Error-Asymptotic properties-consistency-Fisher Information and Cramer-Rao's Inequality – Interval Estimation –Interpretation-Confidence interval for mean when variance is i) known and ii) unknown and determination of sample size-Concept of a Large-Sample Confidence Interval-Prediction Intervals

(9 hours)

SAMPLING AND TESTS OF HYPOTHESIS

Population and sample –Sampling distribution of a statistic-Derivation of sampling distribution of mean and S^2- t-distribution and F-distribution-Central limit theorems- Test of significance – Basic concepts – null hypothesis – alternative hypothesis – level of significance – Standard error and its importance – steps in testing-One and two tailed tests-The use of p-values for Decision making – Large sample tests and Small sample tests for : Single sample: Testing on a single mean with variance known and variance unknown-Two samples-tests on means –One sample test on a single proportion-two sample tests of two proportions-Goodness of Fit tests, One and two sample tests concerning variances-Tests of independence for categorical data, tests for homogeneity-testing of correlation coefficient and regression coefficients.

(9 hours)

BAYESIAN ESTIMATION

Bayesian Inferences-Prior and posterior distributions-Point Estimation Using the Posterior Distribution- Bayesian Interval Estimation-Bayes Estimates using Decision Theory framework: Bayes estimate under squared error loss function and absolute error loss function

(9 hours)
Total: 45 Hours

Text Books:

1. Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye,Probability & Statisticsfor Engineers & Scientists, Ninth Edition, Prentice Hall, 2002
2. Michael Baron, “Probability and Statistics for Computer Scientists”, 2nd edition, CRC Press, 2014.

Reference Books

1. Dinesh Kumar, “Business Analytics”, Wiley India Pvt. Ltd., 2017.
2. Sheldon Ross, “Probability and Statistics for Engineers and Scientists”, Elsevier Academic Press, 2009

22MDC22 ORGANISATIONAL BEHAVIOUR

L	T	P	C
4	0	0	4

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **THEORY**

COURSE OUTCOMES:

CO1: Design the conceptual framework of the discipline of OB and its practical applications in the organisational set up
CO2: Assign the roles of individuals and groups in achieving organisational goals effectively and efficiently
CO3: Critically evaluate and analyse various theories and models that contribute to the overall understanding of the discipline
CO4: Develop creative and innovative ideas that could positively shape the organisations
CO5: Apply tactics to handle different cultural and diverse backgrounds in the workplace

ORGANISATIONAL BEHAVIOUR: Organisation – Nature of Organisation Behaviour – Foundations of OB – Organisational arrangement for OB –Contemporary OB – Scope of Organisational Behaviour – Evolution of OB – OB Model – Case Study.
GROUP DYNAMICS: Nature of Groups – Types of Groups – Group Development – Pitfalls of Groups – Determinants of Group Behaviour – Case Study

(12 hours)

PERSONALITY: Nature of Personality – Determinants of Personality – The Big Five Personality Model – The Myers Briggs Type Indicator – OB Related Traits – Case Study.
PERCEPTION:: Meaning and Definition – Factors influencing Perception – Perceptual Process – Attribution Theory – Case Study.

(12 hours)

ATTITUDES AND VALUES: Nature of Attitude – Components of Attitude – Formation of Attitude – Function of Attitude – Work Related Attitude. Values – Importance – Terminal Vs Instrumental Values – Case Study.
MOTIVATION: Nature – Importance – Theories of Motivation: Hierarchy of Need Theory – Theory X and Theory Y – Two Factor Theory – McClelland's Theory of Need – Alderfer's ERG Theory – Herzberg's Theory – Expectancy Theory – Equity Theory – – .Case Study.

(12 hours)

ORGANISATIONAL CONFLICT: Nature of Conflict – Changing views of Conflict – Functional and Dysfunctional Conflict – Process and Levels of Conflict – Case Study.
ORGANISATIONAL CULTURE: Meaning and Definition – Cultural Dimensions – Effects of Culture – Changing Organisational Culture – Case Study.

(12 hours)

ORGANISATIONAL CHANGE AND DEVELOPMENT: Nature of change – Levels of change –Importance of change – Types of change – Forces of change – Resistance to change – Change Process – OD Interventions – Case Study.

INTERNATIONAL ORGANISATIONAL BEHAVIOUR: Cultural Differences and Similarities – Individual Behaviour in the Global Perspective – Interpersonal Behaviour across culture – Case Study.

(12 hours)

Total: 60 Hours

Text Book:

1. Aswathappa.K, Organisational Behaviour, Himalaya Publishing House, 12th Revised Edition,2016

Reference Books:

1. Stephen.P.Robbins, Timothy.A.Judge, Neharika Vohra, "Organizational Behaviour", Pearson, 18th Edition,2018
2. John.R..Schermerhorn James.G.Hunt and Richard.N.Osom, "Organisational Behaviour", Wiley Publication,7th Edition,2016.
3. Fred Luthans, "Organisational Behaviour: An Evidence Based Approach", McGraw Hill Irwin Publication,12th Edition,2011.
4. Newstrom.J.W, "Organisational Behaviour:Human Behaviour at Work", Tata McGraw Hill Publishing Company Limited, New Delhi, 12th Edition,2017.

22MDC23 – DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC15

ASSESSMENT: **THEORY**

COURSE OUTCOME

CO1: Evaluate algorithms in terms of time and space complexity using asymptotic notations
CO2: Design suitable algorithms for real world problems and implement using arrays, stack, and queue
CO3: Develop substantial solutions using linked list and tree structure for scenario based problems
CO4: Choose appropriate data structures and use them to design customized and solutions for a given real-life problem
CO5: Compare and evaluate the searching and sorting techniques based on complexity measures

ANALYSIS OF ALGORITHMS

Introduction to Performance Analysis – Template Functions - Recursive Functions - Space Complexity – Time Complexity – Asymptotic Notations.

(6 hours)

INTRODUCTION TO DATA STRUCTURES

Primitive data structures – ADT - Arrays: Arrays as ADT, one dimensional array, two dimensional array, multidimensional array, representation - sparse matrix.

(6 hours)

STACK AND QUEUE

Stack: Definition – Stack as ADT – Sequential representation - operations, Applications: Conversion & Evaluation of expression. Recursion: Definition, Properties, Examples. Queue : Definition-queue as ADT, Sequential Representation – Operations – Circular Queue – Priority queue. Applications: Categorizing data and Queue Simulation.

(12 hours)

LINKED LIST AND TREES

Linked List : Definition – Operations – Linked representation of stacks & queue – Circular Lists –Operations – Doubly Linked List - Application: Addition of polynomial. Trees: Terminologies –binary tree: Operations, Traversals, Representation – Threaded Binary Tree - Properties.

(12 hours)

SEARCHING AND SORTING STRATEGIES

Linear Search -Binary Search. Introduction –Bubble sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort. Searching: Linear search, Binary search.

(9 hours)
Total:45 Hours

TEXT BOOKS

1. Sartaj Sahni, “Data Structures, Algorithms, and Applications in C++”, McGraw-Hill, 1998 (Para 1)
2. Yedidyah Langsam, Moshe. J. Augenstein, Aaron. M. Tenenbaum, "Data Structures using C & C++", PHI Publications, 2nd Edition, 2006. (Para II-V)

REFERENCE BOOKS

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Publications, Second Edition, 2012.
2. Richard F.Gilbery, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Asia Pvt. Ltd, 2002.
3. Krishnamoorthy. R, "Data Structures using C", McGraw-Hill Education (India) Pvt. Ltd, 2010.

22MDC24 - COMPUTER ORGANIZATION AND OPERATING SYSTEMS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Demonstrate the basics of computer organization , registers and I/O organization

CO2: Demonstrate basics of Operating systems, process management and process synchronization

CO3: Estimate the system performance through scheduling algorithms

CO4: Recognize the memory allocation and deallocation for both static and dynamic storage

CO5: Discuss the simple File System Management

BASIC COMPUTER ORGANIZATION
Stored program organization - registers - instructions - - Instruction cycle - Memory reference instructions - input/output and interrupt - Design of Basic computer - design of accumulator logic - Programming the basic computer.

General register organization - stack organization - Instruction formats – Addressing modes - Data transfer and manipulation - Program control

(10 hours)

I/O ORGANIZATION
Peripheral devices - Input/output interface - Asynchronous Data Transfer - Modes of Transfer- Priority interrupt - Direct Memory Access - Input-output processor - Serial communication.

(8 hours)

INTRODUCTION TO OPERATING SYSTEM
Operating System: Objectives and Functions, operating system structure , Operating system operations, process management, memory management, storage management.
Process Management: Processes: process concept, process scheduling, operations on processes, inter process communication, Threads

(9 hours)

CPU SCHEDULING & PROCESS SYNCHRONIZATION
Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple-Processor Scheduling.
Process Synchronization: Background, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization. **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. **(9 hours)**

MEMORY MANAGEMENT & FILE MANAGEMENT

Background, Contiguous Memory Allocation, Paging, Segmentation, Demand Paging, Copy on write, Page Replacement, Allocation of frames, thrashing, Memory mapped files, Allocation of kernel memory Example : The Intel Pentium. File concept – Access Methods – Directory Structure – File system structure –File system Implementation – Allocation Methods – Free Space Management – NFS.

Case Study: I/O Management in Windows Operating System

(9 hours)

Total: 45 hours

TEXT BOOKS

1. M.Morris Mano, " Computer System Architecture ", 3Rd Edition, PHI, 2016
2. Silberschatz A., Peterson J.L and Galvin P., "Operating System Concepts", 10Th Edition, John Wiley Publishing Company, 2018.

REFERENCE BOOKS

1. Umakishore Ramachandran, William D. Leahy Jr., "Computer Systems: An Integrated Approach to Architecture and Operating Systems", International Edition, Pearson, 2011.
2. H.M. Deital, " An Introduction to Operating Systems", Pearson Education, 2001
3. William Stallings, "Operating systems Internals and Design Principles", 7th edition, PHI, 2016.

22MDC25 APPLIED PROBABILITY LABORATORY

L	T	P	C
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PRE-REQUISITES

Consent of the Instructor

ASSESSMENT: **PRACTICAL**

COURSE OUTCOME

CO1: Solve problems using R
CO2: Perform numerical analysis using R
CO3: Demonstrate the properties of probability distributions and perform statistical tests using MS-Excel and R
CO4: Perform Hypothesis testing using MS-Excel and R

Topics to be covered

R PROGRAMMING

1. Introduction to R Programming environment
2. Create Datasets in R: Data Structures-Vectors-Matrices-Arrays-Data frames-factors-Lists
3. Read and Write Data-read.Table, read.csv -Sub setting a vector - Subsetting a Matrix
4. Generate Basic Graphs-Bar, Pie Charts-Histograms-Box Plots
5. Basic Statistics-Descriptive Statistics-Frequency and Contingency Tables-Correlations and t-tests
6. Regression Analysis
7. Numerical analysis using R
   i) Numerical differentiation: Newton's formula, Lagrange's formula
   ii) Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule
   iii) Curve fitting: Linear, quadratic, polynomial and exponential
   iv) Numerical solution of ordinary differential equations using Runge-Kutta 4th order method

PROBABILITY DISTRIBUTIONS AND HYPOTHESIS TESTING USING EXCEL AND R

8. Probability Distributions using Excel and R

   Use functions in MS-Excel and R to calculate the probabilities and inverse probabilities and cumulative distribution functions for

   i) Binomial, Poisson, Normal,
   ii) Geometric, Negative Binomial and Hypergeometric distributions
   iii) Exponential, Gamma, Beta and
   iv) Normal and lognormal distributions
   v) t, F, Chi-square distributions

9. Perform Hypothesis testing Using Excel's Analysis ToolPak and R
   i) Testing Single mean, difference between two means large samples- Z test
   ii) Testing Single mean, difference between two means small samples- t- test
   iii) Single proportion, Difference between two proportions
   iv) Chi-square for i) goodness of fit and ii) independence of attributes
   v) Equality of Variances

22MDC26 – DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC15

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Choose appropriate data structure for a specified application and implement using C
CO2: Develop efficient programming solutions for various data structures such as stacks, queues in real-world applications
CO3: Trace and code recursive methods and compare with iterative methods
CO4: Generate dynamic solutions using various forms of linked lists and trees based on the suitability of applications
CO5: Find the best sorting and searching techniques for the given scenario and implement it

CONCEPTS TO BE COVERED

Consider various scenarios/ case studies / real-world applications to implement the following concepts.

1. Application of One-dimensional and Two-dimensional arrays.
2. Implementation of basic operations of stack.
3. Conversion of expressions and evaluation of expressions using stack.
4. Implementation of Recursive algorithms for suitable applications and comparing them with iterative solutions.
5. Implementation of basic queue operations, priority queue, circular queue.
6. Implementation of operations on Linked stack and Linked queue.
7. Implementation of solutions using Doubly linked list, and Circular linked list.
8. Implementation of operations on binary trees, and tree traversal methods.
9. Conversion of binary tree to Threaded binary tree.
10. Application of sorting and searching techniques.

22MDC27 – PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME:

CO1: Write, test and debug simple python programs
CO2: Develop Python programs with functions
CO3: Use Python lists, tuples, dictionaries for representing compound data
CO4: Read and write data from/to files in Python
CO5: Perform EDA, preprocessing and data analysis using Python packages

CONCEPTS TO BE COVERED

1. Introduction to Python, Demo on IDE.
2. Simple programs in Python
3. Operations and Expressions in Python
4. Algorithmic approach 1: Sequential
5. Algorithmic approach 2: Selection (if,elif,if…else,nested if else)
6. Algorithmic approach 3: Iteration (while and for)
7. Strings and its Operations
8. List and its operations
9. Sets and its operations
10. Dictionaries and its operations
11. Tuples and its operations
12. Functions, Recursions
13. Files and its operations with command line arguments.
14. Date and Time manipulation
15. User Interface design for applications
16. Packages for Data Analysis: Numpy, Pandas, Scipy, Matplotlib
17. Mini Project using Datasets: EDA, preprocessing and analysis

22MDC28 ENGLISH FOR EMPLOYABILITY

L	T	P	C
0	0	2	1

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : PRACTICAL

COURSE OUTCOME:

CO1: Solve timed objective questions on logical reasoning and verbal ability
CO2: Generate ideas and speak confidently, for a given speaking task on topics like JAM, Describing an Object, Book Review, and Extempore
CO3: Use appropriate functional language, for a given social situation viz., travel and transport complaining, giving instructions, advising and sympathizing, requesting and warning People
CO4: Generate valid points for and against the topic and present them with appropriate group behaviour, for a given HR topic
CO5: Plan and prepare a 20 min HR mock interview, for any job requirement

Ice Breakers - Just a Minute - Book Reviews - Describing an object – Extempore – Paraphrasing.

(6 hours)

Spoken English - Travel and Transport, Complaining - Giving Instructions, Advising and Sympathizing – Requesting and warning people

(5 hours)

Logical Sequence of Words- Exercises - Sequential Order of Things - Comparison Type Questions – Introduction and Exercises - Idioms and Phrases - Types and Exercises - Vocabulary through Mythology - One word Substitutes, Word Power Exercises - Common Errors in English - Sentence Correction

(7 hours)

Activity based on newspaper articles - Vocabulary – Homophones and Homonyms - Reading Prose – Reading Comprehension Activity

(4 hours)

Professional Communication - Mock Group Discussion – Mock Interview – Telephoning Skills – Personality Development Activities.

(8 hours)

Total - 30

22MDC31 - APPLIED STATISTICS FOR BUSINESS DECISIONS

L	T	P	C
3	1	0	4

PRE-REQUISITES: 22MDC13, 22MDC21

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Understand the concepts of Control Charts for variables and attributes using data from economics

CO2:: Apply Statistical methods and Decision Analysis tools to analyze data from time series Business.

CO3: Analyze the concept of non-parametric tests to solve business decision problems

CO4: Assess basic concepts of classifications of design of experiments which plays very important r in the analysis of variances

CO5: Categorize ideas of Index Numbers used in Economics and Business

Index Numbers

Definition, characteristics and uses of Index Numbers-Types of Index Numbers-Price, quantity and value indices- Simple and weighted aggregate index numbers - Laspeyre, Paasche, Marshall - Edgeworth, Fisher's Ideal Index Numbers-Tests of adequacy of Index Numbers. **(9)**

Time Series and Forecasting

Definition- Time Series. Components- -Time series decomposition models: multiplicative and additive models -Forecasting error-measurement using Mean Absolute Deviation(MAD), Mean Absolute Percentage Error (MAPE), Mean Squared Error(MSE) and Root Mean Square Error (RMSE)- Smoothing Techniques: Naïve forecasting, moving averages and weighted moving averages-Exponential smoothing -Simple and double Exponential Smoothing- Trend analysis- linear, quadratic and exponential trend-Seasonal Effects-Decomposition methods: method of simple averages, ratio to trend method and ratio to moving average method **(11)**

Statistical Quality Control and Decision Analysis

Statistical Quality Control: Nature of Control Limits-Purpose of Control Charts-Control Charts for Variables-Control Charts for Attributes

Decision Analysis: Decision making under certainty: Decision Table - Decision making under risk: Expected Monetary Value, Expected value of perfect information - Decision making under uncertainty: Criteria of Laplace, Maximin, Maximax, Hurwicz, Minimax Regret **(10)**

Designs Of Experiments: Analysis of Variance (ANOVA) technique-Design of experiments - basic concepts - treatment - experimental unit -experimental error - basic principle - replication, randomization and local control- One way Analysis of Variance: Completely Randomized Design- Randomized blocks design - description - layout - analysis-Latin Square Design-description-layout-analysis. **(9)**

Non Parametric Statistics: Introduction to Non parametric tests -Sign test - Signed Rank test-Rank-

Sum test-Wilcoxon-Mann- Whitmey test (U test), Kruskal Wallis test-Runs test **(6)**

Theory : 45 hours
Tutorial: 15 hours
Total: 60 hours

TEXT BOOKS

1. Ken Black, "*Business Statistics for Contemporary Decision Making*", 6th Edition, John Wiley &Sons.Inc, 2010 [Para 1,2,3 and 4]
2. R.P.Hooda, "*Statistics for Business and Economics"*, 5th Edition, Vikas Publishing House Pvt. Ltd., Noida, 2013 [Para 1]
3. Richard I. Levin, David S. Rubin, "*Statistics for Management*", 7th Edition Pearson Education, 2011.[Para 2 and Para 3]
4. Ronald E.Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, *"Probability and Statistics for Engineers and Scientists*", 9th Edition, Prentice Hall, 2012 (Para 3, 4 and 5)

REFERENCE BOOKS

1. D M Levine, M L Berenson, T C Krehbiel and P.K.Viswanathan- "*Business Statistics: A First Course*", 7th Edition, Pearson Education, Delhi, India, 2017
2. Dinesh Kumar U. "*Business Analytics*", Wiley, Second Edition, 2021

22MDC32 - FINANCIAL ANALYSIS AND REPORTING

L	T	P	C
3	1	0	4

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Understand the financial statements to make decisions

CO2:: Demonstrate the accounting procedures and understand the purpose of financial reports.

CO3: Apply the various methods of financial statement analysis

CO4: Analyze the financial statements on various aspects of financial performance

CO5: Evaluate the financial statements and Identify the inferior quality of financial reporting to make sound decisions

Financial Accounting: Definition- Three Activities - Generally Accepted Accounting Principles - Accounting Equation: Balance sheet, Income Statement and Retained Earnings. Recording Process: Debit and Credit - Steps in Recording Process - Making Journal Entries, Posting the Journal Entries to Ledger Accounts, Posting the Ledger to Trial Balance, Preparation of Trial Balance. **(Problems in preparation of Journal, Ledger and Trial Balance)**

(Theory: 9 hours , Tutorial : 3 hours)

Understanding the Financial Statements: Balance Sheet Items: Assets, Liabilities and Owner's Equity, , Income Statement Items: Revenue from operations, other income and Expenses and Cash flow Statement Items: Cash from Operating Activities, Cash from Financing Activities and Cash from Investing Activities - Need and Linkages of Financial Statements:- Preparation of Common Size Balance sheet and Income Statement.**(Problems in preparation of Common size statements)**

(Theory: 9 hours , Tutorial : 3 hours)

Annual Report Analysis: Reading an annual report for a listed entity - Parts of Annual Reports - Financial Highlights - Directors' Report - Management Discussion and Analysis - Standalone and Consolidated Financial Statements- Notes to Financial Statements- Related Party Transactions.

(Theory: 9 hours , Tutorial : 3 hours)

Financial Ratios: Profitability Ratios, Return Ratios, Liquidity Ratios, Stability Ratios, Efficiency Ratios - Interpretation of Ratios.**Working Capital Analysis:** Working Capital Calculation - Impact of Working Capital on business - Negative and Positive Working Capital - Perspective of the banker and owner in analyzing working capital - Calculating Cash Conversion Cycle - Analysis of Receivables, Inventory, Cash and Payables.**(Problems in Ratio Analysis and Cash Conversion Cycle)**

(Theory: 9 hours , Tutorial : 3 hours)

Quality of Financial Reporting: Measuring Quality of Earnings - Identifying the potential red flag.

Costing: Concepts of Cost - Elements of Cost - Classification of cost - Preparation of Cost Sheet

(Theory: 9 hours , Tutorial : 3 hours)

Theory: 45 hours

Tutorial: 15 hours

Total: 60 hours

TEXT BOOKS:

1. Thomas .R. Robinson and et.al, "*International Financial Statement Analysis*", John Wiley & Sons, Inc, 4th edition,2020
2. Jain ,Narang and Simmi Agarwal,, "*Cost Accounting*", Pragati Publishers,, Pune, 2022

REFERENCE BOOKS:

1. Horngren, Sundem, Elliot, "*Introduction to Financial Accounting*", Pearson Education, Eleventh Edition,,New Delhi,, 2022.
2. Maheshwari.S.N, "*An Introduction of Accounting*", Vikas Publishing House Pvt Limited , Twelfth Edition,2018...
3. Narayanaswamy, "*Financial Accounting:A Managerial Perspective*", PHI Learning Pvt Ltd,Seventh Edition, 2022..

22MDC33 Digital Marketing

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Recognize the key issues and themes in the adoption and application of digital marketing to business

CO2 : Explore Tactical and Operational challenges faced by firms in implementing digital marketing strategies

CO3: Apply the tools and techniques involved in digital marketing for better customer service and relationship

CO4: Analyze the confluence of digital marketing in the real-world scenario

CO5: Evaluate the success rate of Digital Marketing and create a reporting system.

Digital Marketing: History of Digital Marketing – Traditional Marketing Vs Digital Marketing – 4 P's of Marketing – Perceptual positioning map – Customer Lifetime value – Segmentation – **Aligning with business:** Customer centricity- Business model – Global strategy – Brand – Vision – Culture – Research and insight – KPI's – Barriers - Trend of ChatGPT in Digital Marketing. **(9)**

Digital Marketing Planning: Process – Phased approach – Goals – Strategies and objectives – Action plans – Controls – People – Budgeting and forecasting. **Content Strategy:** Content marketing – Content types – Process of content creation – Distribution – Measuring the value of contents. **(9)**

Search Engine Optimization: History – Researching SEO Strategy – Technical SEO – Site Structure – Content – Mobile – Location – Penalties – Organization structure and SEO. Paid Search: Basics – Setting Campaign – Measurement and Optimization – Advanced paid search – Managing Paid search campaigns. **(9)**

Social Media: Customer Service – SEO angle – Types of social media – Content – Social Advertising – Measurement. **CRM and Retention:** Meaning – Contact strategy – Cross selling and Upselling – Predictive analytics – CRM systems – Social CRM – Loyalty. **(9)**

Analytics and Reporting: Data Landscape – Reliability of data-based decisions – Analytics tools and technology – Attribution modeling – Reporting. **Presenting Strategy:** Decision making – Budget – Key channel benefits – Website – Trends and cycles – 6's framework for structuring. **(9)**

Total: 45 Hours

Text Book:

1. Simon Kingsnorth, " *Digital Marketing Strategy: An Integrated Approach to Online Marketing*", Kogan Page Publishers, Third Edition,2022.

Reference Books:

1. Ryan Deiss and Russ Henneberry, *Digital Marketing"*, Wiley Publishers, Second Edition, 2020
1. Damian Ryan, "*Understanding Digital Marketing - Marketing Strategies for Engaging the Digital Generation*", 3rd Edition, Kogan Page Ltd., Fifth Edition. 2021.
3. Seema Gupta, "*Digital Marketing*", McGraw Hill, Third Edition, 2022.
4. Dave Evans and Jake Mckee, "Social Media Marketing – The Next Generation of Business Engagement", Wiley India pvt. Ltd, New Delhi,Second Edition, 2012.

22MDC34 Database Management Systems

L	T	P	C
3	0	0	3

PRE-REQUISITES : Consent of the Instructor
ASSESSMENT : THEORY

COURSE OUTCOME

CO1: Understand the concepts of Database, Conceptual Model, Relational Model,SQL Queries and Transaction Management

CO2: Analyze real world scenarios and represent conceptual and logical design incorporating normalization rules and write optimized queries

CO3: Apply Relational Algebra and SQL to extract information for given real life scenarios

CO4: Provide database solutions in terms of higher normal forms considering the issues in concurrent transactions

INTRODUCTION

Databases and Database users, Database System Concepts and Architecture – Data models, Schemas and instances, Three schema architecture and Data independence, Database languages and Interfaces, Centralized and Client/Server architectures for DBMSs. **(5)**

DATA MODELLING USING ER MODEL

Main phases of database design, Entity types, Entity sets, Attributes and Keys, Relationship types, Relationship sets, Roles and Structural constraints, Weak Entity types, ER diagrams Naming conventions and design issues, Relationships types of degree higher than two, Case studies on ER diagrams. EER model – Subclass, Superclass and inheritance, Specialization and Generalization, Aggregation and Association. **(10)**

RELATIONAL DATA MODEL

Concepts, Constraints and Relational database schemas, Update operations, Transactions and Dealing with constraint violations, EER to Relational mapping. **Normalization :** Informal design guidelines for relational schemas, Functional Dependencies, Normal forms based on Primary keys, General definition of second and third normal forms, Boyce-Codd normal form, Inference rules for functional dependencies. **(10)**

SQL

Basic SQL, Data definition and Data types, Constraints in SQL, Basic retrieval queries, Insert , delete and update statements in SQL, Schema change statements in SQL, DCL and TCL commands. Advanced SQL - Complex retrieval queries, Nested queries, Correlated nested queries, Exists and Unique functions, Explicit sets and Renaming, Joins, Aggregate functions, Group by and Having clauses, Assertions and Triggers, Views.

Relational Algebra : Unary relational operations, Relational algebra operations from set theory, Binary relational operations, examples of queries in relational algebra. (**10)**

QUERY OPTIMIZATION AND TRANSACTION

Query Optimization: Transformation of relational expressions, Equivalence rules, Examples of transformations. Transaction: Concept, Simple Transaction Model, ACID properties, Transaction states, Serializability. Concurrency and possible problems: Lost Update, Inconsistent Read, The Phantom phenomenon, Lock based concurrency control. (10)

Total: 45 Hours

TEXT BOOKS

1. Ramez Elmasri, Shamkant B. Navathe, "*Fundamentals of Database Systems*", Seventh Edition, Pearson Education, 2018.
2. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "*Database System Concepts*", Sixth Edition, McGraw Hill, 2010.

REFERENCE BOOKS

1. Bipin C Desai, "*An Introduction to Database Systems*", Galgotia Publications.

22MDC35 – OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

PREREQUISITE: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1 : Given software requirements, Understand the problem by discovering appropriate classes and objects, identifying attributes and suitable OOP techniques

CO2 : Apply the Object-Oriented concepts to create a design using which solution can be derived which can be utilized to handle exceptions

CO3 : Develop the Java Application using the front-end design and suitable backend based on the design created

CO4 : Analyze the program using various test cases, object-oriented concepts

INTRODUCTION

Introduction to object oriented programming Paradigm- Introduction – Evolution of Higher Level Languages – Complexity of softwares and their Attributes - object oriented programming Paradigm - Introduction to Java Language – Evolution – Salient Features – Java, Internet and World Wide Web – The Java Environment The Java Language Preliminaries (7)

FUNDAMENTALS, OBJECTS AND CLASSES

Fundamental Programming Structures in Java – Objects and Classes – Object Construction – Packages - String Handling – String Constructors, String Length, Character Extractions, String Comparison, Searching, Modifying and Joining Strings, String Buffer Exceptions: Dealing with errors, Catching Exceptions, try, catch, throw, throws and finally (8)

INHERITANCE

Classes, super classes and subclasses – Object: The cosmic superclass – Generic Array List – Object Wrappers and Autoboxing – Method with a variable number of parameters – Enumeration Classes – Constructors – Method Overloading – Method overriding – Constructor overloading – Constructor overriding Interfaces - Inner Classes – Abstract class – final class, method and variable. (10)

COLLECTIONS

The Java Collections Framework, Interfaces in the Collections Framework, Concrete Collections, Maps, Views and Wrappers, Converting between collections and Arrays (7)

User Interface Components with Swings: Introduction to Layout Management - Text Input - Choice Components - Menus- Sophisticated Layout Management - Dialog Boxes. (6)

CONCURRENCY and EVENT DRIVEN PROGRAMMING

Concurrency: Threads – Thread States – Thread Properties – Synchronization. Database Connectivity: JDBC (7)

TOTAL: 45 Hours

TEXT BOOKS

1. M. T. Somashekara, D. S. Guru, K. S. Manjunatha, "*Object Oriented Programming with Java"*, Prentice Hall India Pvt., Limited, 2017 (Para – I).
2. Cay.S. Horstmann, "*Core Java Volume I—Fundamentals"*, 11th Edition, Pearson Education, 2018.
3. Herbert Schildt - "*Java: The Complete Reference"*, Eleventh Edition, McGraw Hill Education, 2018.

REFERENCE BOOKS

1. Joshua Bloch,"*Effective Java"*, Third Edition, Addison-Wesley Publications, 2018.
2. Herbert Schildt , "*Java: A Beginner's Guide",* 8th Edition, McGraw Hill Education, 2018.
3. "*Core and Advanced Java"*, Black Book. Dreamtech Press, 2018.
4. Paul Deitel, Harvey Deitel, —"*Java SE 8 for programmers"*, 3rd Edition, Pearson, 2015.

22MDC36 - DIGITAL MARKETING LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC18

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Interpret the impact of social media marketing

CO2 : Customize the website so that the business can be displayed in the Google search engine.

CO3: Correlate analytics into the digital marketing process to gain insights

CO4: Utilize social media for marketing.

CO5: Design the landing page with professional lead magnets and copywriting

CONCEPTS TO BE COVERED

1. Identify a business for which digital marketing is to be launched
   - Design the landing page
   - Create Lead Magnets
   - Perform Copywriting
2. Integrate Google Analytics
3. Email Marketing
   - Plan for Email campaign
   - Create Email templates and designs
   - Track the Email visitors
4. Content and Blog Marketing
5. Practice SEO (Search Engine Optimization) Techniques
6. Social Media Marketing
   - Paid Ads
   - Marketing through Facebook, Instagram, Twitter, LinkedIn, YouTube
7. Social Media Marketing Audit

22MDC37 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Formulate SQL queries using DML statements with the concepts of Sub queries, Joins, Group By, Order By to manipulate the data in real world applications.

CO2 : Apply single row functions, set operations, and create views, indexes, synonyms and sequences in logical databases appropriately.

CO3: Explore simple and advanced reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors for OLTP applications

CO4: Determine Entity Relationship diagram for a given application and create the database based using conversion rules using DDL statements

CO5: Develop real world database application projects by constructing the ER model, creating Tables and generating SQL and PL/SQL blocks

CONCEPTS TO BE COVERED

1. Design a conceptual model from the system requirements specification using ER diagram.
2. Create the relational database using mapping rules and specify referential triggered actions.
3. Implement DDL, DML and TCL statements.
4. Restricting and sorting of data.
5. Single row functions (String, Date and Time, Numeric, Conversion and General functions).
6. Aggregating data using Group By clause.
7. Retrieving data from multiple tables using Joins.
8. Sub queries (Single row, Multiple rows, Correlated, and Multiple column subqueries).
9. Set operations.
10. Views, Sequence, Index, Synonym
11. Simple PL / SQL Programs.
12. Advanced PL/SQL programs (integrated with SQL, Cursors, and Exceptions).
13. Functions, Procedures, Package, Triggers

Business Applications to be considered:

- Financial Accounting
- Marketing
- Sales Management
- Operations Management
- Human Resource Management
- Customer Relations Management
- Supply Chain Management
- Collaborative Workforce Management
- Social Networking Applications

22MDC38 – OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICALS

COURSE OUTCOMES

CO1: Given software requirements, Understand the problem by discovering appropriate classes and objects, identifying attributes and suitable OOP techniques

CO2 : Apply the Object-Oriented concepts to create a design using which solution can be derived

CO3: Investigate the solution with a database and suitable front end

CO4: Analyze the program using various test cases, object-oriented concepts

CO5: Develop the Java Application using the front-end design techniques based on the design created and handle all the possible exceptions

CONCEPTS TO BE COVERED

1. Design use case models and class models using UML notations
2. Creating Classes and Objects using different types of functions
3. Programs using Constructor and Destructor
4. Count the number of objects created for a class using static member function
5. Write programs using Inheritance
6. Write programs to implement Polymorphism
7. Create programs to implement Runtime Polymorphism using Abstract Class and Interface
8. Develop programs for the given scenario using Packages and implement suitable Exception handling mechanisms.
9. Devise problems to implement Multithreading concepts
10. Write programs to choose and implement appropriate Collections for the given scenario
11. Develop a web application using Swings for UI Development and connect it with a database using JDBC connectivity.

22MDC41 – PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

PRE- REQUISITES 22MDC13, 22MDC31

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Analyze various properties like mean vector, covariance, and correlation matrices of multivariate data

CO2 : Analyze time series data and use it for forecasting

CO3: Formulate and compute multiple linear regression model and understand its properties

CO4: Classify objects into different groups using discriminant function, logistic regression equation and cluster analysis techniques

CO5: Identify underlying factors in multivariate data sets using principal component analysis and factor analysis

MULTIPLE REGRESSION ANALYSIS (MLR)

Multivariate Data: Variables in Multivariate Data - Mean Vector, Covariance and Correlation Matrices and their properties - Estimation of missing values
Multiple Linear Regression Equation and Polynomial Regression Models- Estimation of the coefficients using method of least squares–Linear Regression using Matrices-Properties of Least Squares-Inferences in Multiple Linear Regression: ANOVA and testing the partial regression coefficients- Interpretation of R^2-Standardized Regression Coefficient and its interpretation-Inclusion of categorical or indicator variables in MLR –Multi-collinearity problem-Stepwise Regression **(10)**

TIME SERIES FORECASTING

Regression Model for forecasting - Forecasting Time Series data with Seasonal Variation - Auto-Regressive(AR) Models- AR Model Identification: ACF and PACF, Moving Average -MA(q)) and ARMA(p,q) Models-Auto-Regressive Integrated Moving Average (ARIMA) Process-Dickey Fuller Test-Augmented Dickey-Fuller Test-Transforming Non Stationary Process to Stationary Process using Differencing-ARIMA(p,d,q) model building-Ljung-box test for Auto-Correlations-Power of Forecasting: Theil's Coefficient **(10)**

DISCRIMINATION AND CLASSIFICATION

Discriminant Function Analysis- Fisher's discriminant function. Logistic Regression: Logistic Model Definitions of Odds and Logit-Estimation of the logistic regression coefficients - Making Predictions - Multiple Logistic Regression. **(8)**

PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS

Data Reduction Techniques-Definition of Population Principal Components –Principal Components obtained by Standardized variables -Rules to retain number of Principal Components using Scree Plot
Factor Analysis-Definitions-The Orthogonal Factor Model-Its Covariance Structure- Factor Loadings and Interpretations-Exploratory and Confirmatory Factor Analysis. **(9)**

CLUSTER ANALYSIS

Definition-Measures of Similarity or Dissimilarity-Hierarchical Clustering Methods-Single linkage - Complete Linkage-Average Linkage-Centroid-Ward's Hierarchical Clustering Methods-Non-hierarchical Clustering Methods-K-means Method. **(8)**

TOTAL: 45

TEXT BOOKS

1. Alvin C.Rencher "*Methods of Multivariate Analysis"*, 2nd Edition, Wiley Inter-science, 2002 [Para 1, Para 5]
2. R.E.Walpole,R.H.Myers,S.L.Myers and K.Ye, "*Probability and Statistics for Engineers and Scientists"*, 9th Edition, Prentice Hall, 2012 [Para 1 (MLR)]
3. Richard A.Johnson and Dean W.Wichern. "*Applied Multivariate Statistical Analysis"*, 6th Edition, Pearson Prentice Hall, 2007 [Para 3 and Para 4]
4. Dinesh Kumar U, " *Business Analytics*", Wiley, Second Edition, 2021 [Para 2]

REFERENCE BOOK

1. Joseph F. Hair Jr., William C. Black, Barry J.Babin and RolphE.Anderson,"*Multivariate Data Analysis"*, 7th Edition, Pearson, 2010.

22MDC42 - OPERATIONS RESEARCH FOR BUSINESS

PRE- REQUISITES 22MDC12

ASSESSMENT: THEORY

L	T	P	C
3	1	0	4

COURSE OUTCOMES

CO1: Solve Linear Programming, Transportation and Assignment based problems

CO2: Discuss the elementary Inventory models, Price break models and Safety stock problems

CO3: Solve Job sequencing and replacement problems

CO4: Design the optimal model to improve the efficiency and productivity of any organization using the cor of mathematical modeling of decision problems

CO5: Analyze any decision situation and offer solutions for the best utilization of limited resources

LINEAR PROGRAMMING:

Linear programming problem -Formulation – Two Variable LP Model - Graphical LP solution - Computer solution with Solver - Simplex method - Sensitivity Analysis. **DUALITY:** Primal–dual relationships – Economic Interpretation of Duality – Dual Simplex Method **(10)**

TRANSPORTATION MODEL: Vogels Approximation method. **ASSIGNMENT MODEL:** Hungarian Technique– Degeneracy - unbalanced problems. Solutions using Solver **(8)**

GOAL PROGRAMMING: Formulation - Algorithm. **INTEGER PROGRAMMING:** Construction of Gomory's Constraints – Fractional Cut method - Branch and Bound method - Applications. **DYNAMIC PROGRAMMING :** Characteristics of Dynamic Programming – Recursive Nature of Computation in Dynamic Programming – Forward, Backward Recursion **Applications:** Shortest Route problem – Cargo loading problem – Resource allocation problem - Investment and Budgeting Problems **(12)**

NETWORK MODEL: Minimum Spanning Tree Algorithm - Shortest Route Problem - Maximal Flow Model - CPM and PERT **(8)**

SEQUENCING – Basic assumptions – Johnson's procedure for Sequencing of: i) n jobs on 2 machines ii) n jobs in 3 machines and iii) n jobs on m machines. **REPLACEMENT** – Need for replacement of equipment – Failure mechanism of items – Replacement policy – Replacement of items that deteriorates gradually – Replacement f items that fail suddenly. **(6)**

INVENTORY: Need for the inventory – Costs involved in inventory – Concepts of average inventory, economic order quantity – Deterministic model: Fixed ordering quantity models – EOQ model with uniform demand, finite / infinite replacement with / without shortages –EOQ with one price break. Inventory control - Buffer stock - Determination of optimum buffer stock – EOQ system of ordering – Multi item EOQ model **(8)**

QUEUING THEORY : Elements of the Queueing Model - Poisson Queueing Models - Specialized Poisson Queues - Queueing Decision Models **(8)**

Total : 60

TEXT BOOKS

1. Hamdy A.Taha, *"Operations Research – An Introduction"*, Tenth Edition, Pearson Education Limited, 2017.

REFERENCE BOOKS

1. Frederick S.Hiller, Gerald, J.Leberman, Bodhibrata Nag and Preetam Basu, *"Introduction to Operations Research"*, 11th Edition, McGraw Hill, 2021

2. Kanti Swarup, P.K. Gupta, Mani Mohan, "*Operations Research"*, Sultan Chand & Sons, 20th Revised Edition, 2022.

3. S. D. Sharma *"Operations Research (Theory Methods & Applications)",* Kedar Nath Ram Nath, 2020.

4. J.C. Pant, "*Introduction to Optimisation: Operations Research*", 7th reprinted edition, Jain Brothers, Delhi, , 2015. Frank R.Giordano, Maurice D.Weir and William P.Fox. Mathematical Modeling, Thomson Brooks/Cole, Vikas Publishing House Pvt Ltd., New Delhi.[Para 1]

22MDC43 FINANCIAL ENGINEERING

L	T	P	C
3	0	0	3

PRE- REQUISITES: 22MDC32

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1 : Understand the Basic financial mathematics and financial markets and evaluate cash flows

CO2 : Apply the Capital market theory for stock performance evaluation

CO3 : Analyze the various models used in the financial markets to a real data in decision making

CO4 : Assess the Bond and Stock Price movements and predict the future price patterns

CO5 : Evaluate and arrive at a financial investment decision employing the knowledge of stock and derivatives

Introduction to Financial Engineering and Basic Financial Mathematics:
Overview of Financial Engineering and its role in finance – Financial Engineering and Computation – Financial Markets : Primary and Secondary.
Time Value of Money : Present and Future Value – Simple Compounding – Annuities – Amortization - Yields – IRR – NPV. (9)

Fixed Income Securities:
Treasury, Agency and Municipal Bonds – Corporate Bonds and its valuation – Bond Valuation: Price Behaviors – Day count conventions – Accrued interest – Yield for a Bond – Bond price volatility – Bond Duration – Bond immunization. (9)

Stocks:
Common Stock Valuation – Present value of dividends – Earnings approach – Efficient Market Theory – Industry Analysis : Industry Life Cycle and Industry Classification - Technical Analysis : Trend Indicators using Moving Average, Volatility Indicators using Bolinger Bands, Momentum Indicators using RSI,ROC and Moving Average. (9)

Derivatives:
Options : Option Basics – Exchange Traded Option – Basic option strategy – Hedge – Spread – Arbitrage in Option Pricing: The Arbitrage Argument – Relative Option Pricing- Put-call parity – Binomial Option Pricing model – Black Scholes Model. Forward Contract – Futures Contract – Futures options and Forward options – Currency swaps – Hedging and Futures – Hedging and Options. (9)

Portfolio Management:
Capital Asset Pricing Model – Arbitrage Pricing Theory – Markowitz Model - Efficient Frontier Theory - Sharpe's Model – Treynor's Model. (9)

Total : 45

Text Book:

1. Yuh Dauhl yuu, " *Financial Engineering and Computation : Principles, Mathematics and Algorithms*", Cambridge University Press, E- book 2020.

Reference Books:

1. Perry .H.Beaumont , *"Financial Engineering Principles*", John Wiley and Sons Inc, New Jersey, 2004.

2. Cornelis. W.Oosterlee and Lech.A.Grzelak, "*Mathematical Modelling and Computation in Finance"*, World Scientific Publishing, Europe , 2020

3. David Ruppert and David.S.Matteson. "*Statistics and Data Analysis for Financial Engineering*", Springer , Second Edition , 2015.

4. Marek Capinski and Tomasz Zastawniak, "*Mathematics for Finance : An Introduction to Financial Engineering"*, Springer, Second Edition, 2011.

22MDC44 - ADVANCED DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC23
ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Design and apply the concept of binary search trees and AVL trees in real time applications.

CO2: Identify and apply the techniques of m-way search tree and Red black trees in various problems in an efficient way.

CO3: Demonstrate the use of search techniques of graphs and heap operations in domain specific situational problems

CO4: Design and apply hashing algorithms to solve real time problems.

CO5: Identify the problem given and design the algorithm using suitable design techniques like Divide and Conquer, Greedy method, Dynamic Programming, Backtracking and Branch and Bound Technique.

TREES
Binary search tree: Definition, operations - AVL Tree: Balancing trees, node operations. **(8)**

MULTIWAY TREES
Definition - m-way search trees - B-trees - Red Black tree – operations, Trie structure **(9)**

GRAPHS
Representation - Breadth first search - Depth first search. **(3)**

HEAP AND HASHING
HEAP- Definition - heap data structures – heap algorithms – applications. Hashing : Basic concepts - hashing methods - hashing algorithms - collision resolution methods. **(10)**

ALGORITHM DESIGN TECHNIQUES
Divide and Conquer: General method – Binary search, Quick sort, Merge sort.
Greedy Method: General method - Knapsack problem -Prim's & Kruskal's algorithm, Tree Vertex Splitting.
Dynamic Programming: General method - Multistage graph- All pair shortest paths.
Back Tracking: General method - Eight queen's problem.
Branch and Bound: Control Abstraction, Bounding, Travelling Salesperson Problem **(15)**

TOTAL : 45

TEXT BOOKS

1. Richard F. Gilbery, Behrouz A.Forouzan, "*Data structures - A Pseudocode Approach with C*", Thomson Asia Pvt Ltd., 2002. (Trees, Multiway trees, Heap, Hashing)
2. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, "*Fundamental of Computer Algorithms*", Galgotia Publications, 2010. (Algorithm Design Techniques)
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivert, Clifford Stein *"Introduction to Algorithms*", Second Edition, Prentice Hall of India, Publications, New Delhi, 2007. (Graphs, Red Black Trees).

REFERENCE BOOKS

1. Anany Levitin , "*Introduction : The Design & Analysis of Algorithm*", Second Edition, Pearson Education,2007.

2. S.K.Basu, "*Design Method & Analysis of Algorithm"*, PHI Learning Pvt.Ltd, 2013.

22MDC45 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Describe Intelligent Agents such as searching, knowledge-based agents and Searching Strategies.

CO2: Build Knowledge based systems by identifying suitable searching strategies and knowledge representation.

CO3: Apply the concept of Artificial Intelligence for business transformation in various domains.

ARTIFICIAL INTELLIGENCE

Introduction: Definition- Foundations- History-State of Art. Intelligent Agents: Agents and Environments-Concepts and Rationality-Nature of Environments-Structure of Agents **(7)**

PROBLEM-SOLVING

Solving Problems by Searching : Problem Solving Agents—Examples – Searching for Solutions – Uninformed Search Strategies – Informed Search Strategies – Heuristic Functions. Beyond Classical Search: Local search algorithms and optimization problems – Local search in continuous spaces – Searching with non-deterministic actions - searching with partial observations. **(11)**

KNOWLEDGE BASED AGENTS

Logical Agents: Knowledge Based Agents – The Wumpus world – Logic – Propositional Logic -Propositional Theorem Proving. Constraint Satisfaction Problems: Definitions -Constraint Propagation: Inferences - Backtracking Search – Local Search **(9)**

KNOWLEDGE BASE REPRESENTATION

First Order Logic: Representation – Syntax and Semantics- Using First Order Logic – Knowledge Engineering in First Order Logic. Inference in First order Logic: Propositional versus First Order Inference – Unification and Lifting – Forward Chaining – Backward Chaining. Knowledge Representation-: Ontological Engineering - Categories and Objects-Events – Reasoning System for Categories. **(10)**

ARTIFICIAL INTELLIGENCE FOR BUSINESS

AI and Analytics Strategy for Business Transformation: A strategic Road Map for Initiating Analytics Adoption – Re-Engineering business to think Analytics - Assessing your Analytics Maturity Curve - Building a Robust Data Monetization Strategy. Applications of AI : Banking – Healthcare – Sports. **(8)**

TOTAL: 45

TEXT BOOK

1. Stuart Russell and Peter Norvig, "*Artificial Intelligence: A Modern Approach*" ,Pearson Eductaion Series, Prentice Hall Publishers, Third Edition, 2014.
2. Sameer Dhanrajani, "*AI and Analytics: Accelerating Business Decisions*", Wiley India Pvt. Ltd, First Edition, 2018.

REFERENCE BOOKS

1. Thomas Dean, James Allen , Yiannis Aloimonos, "*Artificial Intelligence : Theory and Practice*", Addison Wesley Pub.,Co
2. Nils J Nillsson, "*Principles of Artificial Intelligence"*, Morgan Kauffmann Publishers , 2014.
3. Patrick Hendry Winson, " *Artificial Intelligence*", Addition Wesley Publishers, Thrid Edition 1992

22MDC46 - PREDICTIVE ANALYTICS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC31,22MDC41
ASSESSMENT: PRACTICAL

COURSE OUTCOMES

CO1: Compute various Index Numbers used in Economics

CO2: Analyze time series data and perform non parametric tests.

CO3: Develop control charts for variables and attributes and analyze the data with ANOVA and non-parametric methods.

CO4: Analyze multivariate data using multiple linear regression, discriminant function, logistic regression equation models and cluster analysis tools.

CO5: Identify underlying factors in multivariate data by applying factor analysis and principal component analysis models

CONCEPTS TO BE COVERED

1. Compute simple and weighted aggregate index numbers - Laspeyre, Paasche, Marshell – Edgeworth , Fisher's Ideal Index numbers.
2. Apply Exponential Smoothing techniques, Trend Analysis techniques, Auto Correlation and Regression techniques to forecast the time series data generated for the system.
3. Generate control charts for handling quality controls in a statistical way (Shewhart chart,*p*-chart,*np*-chart,*c*-chart, CuSum Chart).
4. Analyze the given data using One-way and Two-way ANOVA.
5. Perform Non-parametric hypothesis tests using the techniques such as Sign test, Wilcoxon Signed Rank test, Mann-Whitney-Wilcoxon test.
6. For the given multivariate data, compute the summary statistics, Mean and Variances per group, Between-groups and within-group variance for a variable, covariance and correlation matrix.

7. Analyze the given data for predicting the classes or numerical values using multiple linear regression, stepwise regression, logistic regression and multiple logistic regression techniques,
8. Apply Principal Component Analysis and Factor Analysis to reduce the dimensions/features of the given dataset.
9. Apply Hierarchical and Non-Hierarchical (K-Means) methods to generate the clusters and allocate given input to the existing clusters.

22MDC47 FINANCIAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITES: 22MDC32, 22MDC42

CO1: Estimate volatility of financial asset returns from historical data

CO2: Investigate Financial Data analysis and modeling skills to make sound business decisions

CO3: Apply quantitative models for Portfolio management and decision making

CO4: Analyze the financial models computationally to price and hedge and make decisions.

CO5: Evaluate the time value of money and value the bonds and shares to make decisions

1. Creating Dynamic Financial Model using EXCEL for;
   - Financial Statement Linkages
   - Forecasting Financial Statements
   - Amortization and Repayment Schedule
2. Using Finance Functions in EXCEL and Python for Time Value of Money Calculation (PV, FV, Annuity, Compounding rate), NPV and IRR.
3. Calculation Bond Value and Equity Value in EXCEL and Python
4. Implementing Binomial tree for option strategy (two and three) in Python
5. Implementing Black Scholes model for option price in Python
6. Identifying Buy and Sell Signals in Charts using Technical Analysis (RSI, ROC, Moving Average) in Python
7. Calculating Expected Return using Capital Asset Pricing Model in Python and EXCEL
8. Portfolio Optimization using Sharpe's and Treyner's Model
9. Project using Mathematical models for financial concepts

22MDC48 ADVANCED DATA STRUCTURES LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC23, 22MDC44

ASSESSMENT: PRACTICAL

COURSE OUTCOME·

CO1: Apply tree data structures and its variants for real time applications.

CO2: Implement heap and hashing techniques in various scenarios.

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

CO4: Choose the suitable algorithm design technique based on the implementation complexity for given problems.

CO5: Devise and implement suitable design techniques for a given scenario.

CONCEPTS TO BE COVERED

1. Applications of Binary search trees and its operations
2. Operations on AVL tree including rotations
3. B-Tree and its operations
4. Operations on Red Black trees
5. Problems related to graphs and graph traversals
6. Construction of heap & its operation
7. Implementation and analysis of Hash Table with collision handling.
8. Implementation of Divide and Conquer technique using Binary search, Quick sort,Merge sort
9. Implementation of Greedy method using Knapsack, Prim's and Kruskal algorithms
10. Implementation of Dynamic Programming technique using Multistage graph.
11. Implementation of Back tracking technique using Eight Queen's problem.
12. Implementation of Branch and Bound technique using TSP.
13. Choose any 5 read world problems/case studies, Analyze and apply appropriate design techniques to solve them and justify the optimal applicability of the technique.

22MDC49 - PERSONALITY DEVELOPMENT

L	T	P	C
0	0	2	1

PRE- REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

- Ascertain the various concepts of Self like the Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self with respect to the Western (Occidental) and Eastern (Oriental) theories of the Self and Personality Development.
- Outline the significant effects of Self Confidence to build team confidence, given the foundation principles of SelfMotivation and Confidence.
- Assess the various personalities and Attitudes and choose the best attitude for making bold decisions in personal and professional contexts.
- Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life. ● Set Career goals and formulate strategies by Prioritizing, organizing and scheduling the required tasks.
- Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.

PERSONALITY DEVELOPMENT

One's Personality Sends Out a Signal That Others Read – Same Person: Consciously Different Personalities can be Powerful – There isn't One Right Personality; It Differs by Role – Learning about Personality Development from the Three Cases – Personality Analysis – Freudian Analysis of Personality Development – Swami Vivekananda's Concept of Personality – Development: Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self – Personality Begets. (7)

LEADERSHIP QUALITIES & INTERPERSONAL SKILLS:

Resolving Conflict – A Smiling Face – Appreciative Attitude – Assertive Nature – Communication Skills – Listening Skills – Developing Empathy – The Personality Attribute of Taking Bold Decisions – Personality Types and Leadership Qualities – Mapping the Different Personality Types – Personality Tests: Example of a Personality Test: Jung Typology Test – Personality Assessment (7)

ETIQUETTE

Social Etiquette – Corporate Etiquette - Personal Grooming – Using minimal Body Language – Leadership and Entrepreneurship: Corporate Training – Professionalism - Self-awareness – Creativity skills – Cognitive Development – Assertiveness – Positive Thinking and Attitude. (8)

GOAL SETTING AND TIME MANAGEMENT

Goal Setting – Immediate, Short Term and Long-Term Goals – Smart Goals – Strategies to Achieve Goals - Confidence Building, Self-esteem, Motivation - Time Management –Identifying Time Wasters – Time Management Skills. (8)

Total: 30

REFERENCE BOOKS

1. Mitra K.Barun, "*Personality Development and Soft Skills*", Oxford University Press, 2011.
2. Krishna Mohan, Meera Banerji. "*Developing Communication Skills*" Macmillan Publishers, 2012.
3. Sai Lakshmi. B, "*Poly Skills- A Course in Communication and Life Skills*" Cambridge University Press, 2012.
4. Simon Sweeney, *"English for Business Communication*", Cambridge University Press, 2013.
5. Meenakshi Raman, Sangeeta Sharma, *"Technical Communication - Principles and Practice*", 3rd edition, Oxford University Press, New Delhi, 2015.

22MDC51 – HUMAN RESOURCE MANAGEMENT AND ANALYTICS

L	T	P	C
3	1	0	4

PRE-REQUISITES
Consent of the Instructor
ASSESSMENT: THEORY
COURSE OUTCOME

CO 1: Demonstrate an understanding of key terms, theories, concepts and practices within the field of HRM

CO 2: Provide innovative solutions to problems in the fields of HRM

CO 3 : Analyse and implement the metrics and benchmarking for human capital

CO 4: Evaluate HRM related social, cultural, ethical and environmental responsibilities

CO 5: Develop competence in development and problem solving in the area of HR management

HRM: Meaning – Line and Staff Aspects – HR Department – Functions of HRM –Trends in HRM – Remote Working and HRM. Diversity Management: Threats and Managing Diversity – Affirmative action program – Reverse Discrimination. HRM Strategy and Analysis: Strategic Management Process – Types of Strategy – Strategic Human Resource Management – Strategic Map – HR Score Card – Characteristics of Balance Score Card – Case study. HR Analytics for Strategic Map and Balance Score Card: HR Metrics and Bench marking based on Strategy and strategy based metrics.

(Theory : 9 hours , Tutorial : 3 hours)

Talent Management : Process – Job Analysis –Job Descriptions – Impact of Digital and Social media in Talent management – Job Specifications – Job Requirement Matrix – Competency : Competency Skill Matrix – Human Capital Readiness Index(HCRI). HR Analytics for Talent Management and Competency: Questionnaire to identify organisation culture satisfaction score – HCRI for identifying competency level – Case Study. HR Analytics for Talent Management: HR Metrics and Benchmarking for Motivation of Talent, Talent Attraction and Talent Retention.

(Theory : 9 hours , Tutorial : 3 hours)

Work Force Planning and forecasting: Strategy for workforce planning – Methods for forecasting workforce needs .Recruiting: Effective Recruiting – Inside and outside sources – Recruitment through digital and social media – Recruiting diverse workforce. Employee Selection: Types of tests – Background investigations – Interviewing candidates: Types and features – Job Interview for Remote workings - Case Study. HR Analytics for Recruitment and Selection: HR Metrics and Bench Marking for recruitment management and selection.

(Theory : 9 hours , Tutorial : 3 hours)

Performance Management and appraisal: Process – Need – Techniques – Behaviourally Anchored Rating Scale (BARS) –Dealing with Rater error appraisal problems - Managing the appraisal interview. Compensation: Basic factors determining pay rates – Job evaluation methods - Competitive Pay plan - Competency based pay- Case Study. HR Analytics for Performance Management and Compensation: HR metrics and benchmarking to measure BARS, Performance appraisal and Compensation management

(Theory : 9 hours , Tutorial : 3 hours)

Training and Development: New Employees - Five step training process – Training, Learning and Motivation principles for trainers – Analysing Training needs -Types of training. Managing Global Human Resources: Human resource activities to inter country differences – Training and maintaining employees abroad- Case Study. HR Analytics for Training and Development: HR metrics and benchmarking for Learning and development.

(Theory : 9 hours , Tutorial : 3 hours)

Total Hours: Lecture: 45 hrs

Tutorial: 15 hrs

Text Book:

1. Gary Dessler, Human Resource Management, Pearson Publisher, 17th Edition, 2023.

Reference Books:

1. Subbarao. P, Human Resource Management, Himalaya Publishing House, 2018.
2. Rao.VSP, Human Resource Management, Taxman's Publications, 3rd Edition,2023.
3. Aswathaapa.K and Sadhna Dash, Human Resource Management, Mc.Graw Hill Publications, 2021.
4. David Decenzo, Stephen.P. Robbins, Fundamentals of Human Resource Management, Wiley Publisher, 12th Edition, 2016.

22MDC52 – SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

PRE- REQUISITES

Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Choose and practice the software development process based on the factors such as problem complexity, time and cost to develop the software system.

CO 2: Create the requirements model by specifying the use cases and actors involved in the scenario or by specifying the classes along with their responsibility and collaboration involved in the given problem to describe the requirements of the software system

CO 3 : Design the architecture of the system in the various perspectives such as component model, pattern model and User experience based on the type of the proposed software system.

CO 4: Design the test plans to conduct Component Level and Integration Level testing on the developed system

CO 5: Determine the size of the product by applying LOC or Function Point metrics.

INTRODUCTION

Software and Software Engineering – The Nature of Software – The Software Process - Process Models: Prescriptive Process Models - Agility and Process – Agility Principles – Scrum (8)

MODELING AND DESIGN CONCEPTS

Understanding Requirements – Requirements Engineering – Requirements modelling – Scenario based modelling – Class-based modelling

Design Concepts – Design Model - Architectural Design: Software Architecture – Agility and Architecture – Component-Level Design: Cohesion, Coupling – Specialized Component-level design - Pattern-Based Design - Design Patterns (12)

USER EXPERIENCE DESIGN

User Experience Design: User Experience Design Elements - The Golden Rules - User Interface Analysis and Design - User Experience Analysis - User Experience Design - User Interface Design - Design Evaluation - Usability and Accessibility (8)

SOFTWARE TESTING AND PROJECT MANAGEMENT

Software Testing – Component Level – White-box testing – Black-box testing - Integration testing Project Management Concepts - Software Project Management Complexities – Responsibilities of a Software Project Manager - Metrics for Project Size Estimation: Lines of Code, Function Point Metric - Project Estimation Technique: Basic COCOMO Model. (10)

SOFTWARE ENGINEERING FOR DATA SCIENCE

Data Science for Software Engineers – Software Engineering for Data Analytics - Case study. (7)

TOTAL : 45

TEXT BOOKS

1. Roger S Pressman, "*Software Engineering – A Practitioner's Approach*", Ninth Edition, McGraw Hill Edition, 2020. (Para 1,2,3)
2. Rajib Mall, "*Fundamentals of Software Engineering*", Fourth Edition, Prentice Hall India, 2014. (Para 4)
3. Miryung Kim, "*Software Engineering for Data Analytics*" IEEE Software, 2020. (Para 5)

REFERENCE BOOKS

1. Ian Somerville, " Software *Engineering*", Tenth edition, Pearson Education, 2016.
2. Pankaj Jalote, "*An Integrated Approach To Software Engineering*", 3rd edition, Narosa publishing house, Reprint 2013.

22MDC53 - COMPUTER NETWORKS

L	T	P	C
3	0	0	3

PRE-REQUISITES

Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

CO 1: Identify the types of communication required and the network models used for the communication.

CO 2: Analyse the layered functionality and data communication mechanisms used between nodes.

CO 3: Identify the routing protocols involved for packet transmission and demonstrate the role of each protocol

CO 4: Analyse and describe the transport layer mechanisms for different connections

CO 5: Apply various application layer protocols, demonstrate the best routing between nodes and describe the functionalities for a given application.

INTRODUCTION

Uses of computer networks – Network Technology from Local to Global – Network Protocols - Reference models - Physical Layer: Guided transmission media: Twisted pairs- Coaxial cable- Fiber Optics - Wireless transmission – Using the spectrum for transmission. (8)

DATA LINK LAYER

Data link layer design issues - Error detection and correction - Elementary data link protocols – Improving efficiency - MAC Layer: Channel allocation problem - Multiple access protocols: ALOHA – CSMA - BLUETOOTH (8)

NETWORK LAYER

Network layer design issues - Routing algorithms in a single network: The optimality principle - Shortest Path Algorithm - Distance Vector Routing - Link State Routing – Traffic Management at the network layer - Internetworking. (9)

TRANSPORT LAYER

The Transport service - Elements of transport protocols – Congestion Control – The Internet transport Protocols : UDP, TCP : Connection Establishment and Release – TCP Sliding Window. (9)

APPLICATION LAYER

Principles of Network Applications – Web and HTTP - Domain Name System - Electronic mail - Streaming Audio and Video – Content Delivery. (7)

Wireless transmission: Introduction- Frequencies for Radio Transmission – IEEE802.11: System architecture, protocol architecture. (4)

TOTAL : 45

TEXT BOOKS

1. Andrew S Tanenbaum and David J. Wetherall, "*Computer Networks*", Pearson Education, Asia, 6th Edition, 2022. (Para 1 - Para 5)
2. Jochen Schiller, "*Mobile Communications*", 3rd Edition, Pearson Education, 2017. (Para 6).

REFERENCE BOOKS

1. Behrouz A.Forouzan, "*Data Communications and Networking*", McGraw-Hill Science/Engineering/Math Publication, 6h Edition, 2021.
2. William Stallings, "*Data and Computer Communication*", Pearson Education, 8th Edition, 2014.

22MDC54 MACHINE LEARNING

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC12, 22MDC13, 22MDC21

ASSESSMENT: THEORY

COURSE OUTCOMES

CO1: Describe the concepts of learning, and the perspectives and issues in machine learning.
CO2: Apply the machine learning techniques like Bayesian, Decision Tree, and Reinforcement Learning to solve the real time analytical problems.
CO3: Compare various machine learning techniques and choose appropriate techniques by assessing the performance metrics.
CO4: Interpret the results of built machine learning models through an effective analysis to make strategic decisions.
CO5: Recognize the importance of MLOps for the machine learning model life cycle management in the production environment.

INTRODUCTION

Towards Intelligent Machines – Well-Posed Machine Learning Problems- Examples of Applications in Diverse Fields-Data Representation – Domain Knowledge for Productive Use of Machine Learning-Forms of Learning. Supervised Learning: Learning from Observation – Bias and Variance – Occam's Razor Principle and Overfitting Avoidance-Heuristic Search in Inductive Learning – Ensemble Learning – Estimating Generalization Errors – Metrics for Accessing Regression Accuracy – Metrics for Accessing Classification Accuracy. (9)

STATISTICAL LEARNING

Machine Learning and Inferential Statistical Analysis – Descriptive Statistics in Learning Techniques – Bayesian Reasoning – k-Nearest Neighbor Classifier – Discriminant functions and Regression Functions – Linear Regression with Least Square Error Criterion – Logistic Regression for Binary classification Tasks – Multiclass Logistic Regression – Minimum Description Length Principle – Regression by Support Vector Machines (9)

NEURAL NETWORKS

Introduction – Neuron Models – Network Architectures – Weights Learning for a Linear Processing Unit – The Error-Correction Delta Rule – MLP Networks and Error-propagation Algorithm – Radial Basis Function Networks. (9)

DECISION TREE LEARNING

Decision Tree Learning and Tree-Based Ensembles: Introduction – The Basics of Decision Trees – Measures of Impurity for Evaluating Splits in Classification Decision Trees – ID3, C4.5, and CART Decision Trees – Pruning the Tree-Regression Trees – Learning Tree-Based Ensembles – Bagging – Random Forests- Boosting. (9)

REINFORCEMENT LEARNING

Reinforcement Learning: Introduction – Elements of Reinforcement Learning – Model Based Learning – Temporal Difference Learning- Generalization – Partially Observable States.

MLOps

Introduction to MLOps – People of MLOps- Key MLOps Features : A primer on Machine Learning – Model Development- Productionalization and Deployment – Monitoring – Iteration and Life Cycle – Governance MLOps Real-World Examples – MLOps in Practice: Marketing Recommendation Engines (9)

TOTAL : 45

TEXT BOOKS

1. M. Gopal, "*Applied Machine Learning*", MCGraw Hill Education Private Ltd., Second Edition, 2021.
2. Mark Treveil , Nicolas Omont , Clément Stenac, "*Introducing MLOps: How to Scale Machine Learning in the Enterprise ''*, O'Reilly Meida, First Edition, December 2020.

REFERENCE BOOKS

1. Marc Peter Deisenroth, . A. Aldo Faisal, Cheng Soon Ong, "*Mathematics for Machine Learning* ", Cambridge University Press, 2020
2. Jeff Prosise, "*Applied Machine Learning and AI for Engineers: Solve Business Problems That Can't Be Solved Algorithmically*", O'Reilly Media, First Edition, Paperback, 2022.
3. Tom M. Mitchell, "*Machine Learning*", McGraw Hill, 1997.
4. Bishop C, " *Pattern Recognition and Machine Learning*", Berlin: Springer- Verlag, 2006.

22DCS55 - FULL STACK APPLICATION DEVELOPMENT LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 20MSS25

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

CO1: Create websites considering both client and server side programming.
CO2: Develop web applications using the front-end Angular framework.
CO3: Develop simple web applications using ReactJS.
CO4: Build a Web Server in Node framework.
CO5: Develop fully functional web applications using Django.

CONCEPTS TO BE COVERED

- Design web pages using built-in and custom Angular Components, Directives and Filters.
- Design and develop Notes/e-commerce applications using Angular.
- Implement CRUD operations on a basic E-Commerce site using ReactJS.
- Develop a Messaging App using ReactJS.
- Add web sign-in to an app using Node.js.
- Implement a TODO manager program using Node.js.
- Connect to a NoSQL Database and perform CRUD operations.
- Develop a fully functional web application (prediction/recommendation systems) using Django / Flask framework.

22MDC56 MACHINE LEARNING LABORATORY

L	T	P	C
0	0	4	2

PRE- REQUISITES: 22MDC45

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Apply the machine learning techniques like Bayesian, Decision Tree, and Reinforcement Learning to solve the real time analytical problems.

CO2:: Compare various machine learning algorithms and choose the appropriate one by assessing performance metrics.

CO3: Identify the suitable machine learning model for the given business problem.

CO4: Interpret the results of built machine learning models through an effective analysis to make strategic decisions

CO5: Develop complete machine learning solution by integrating with front end, for production environment

CONCEPTS TO BE COVERED

1. Develop Regression models to predict values for the real time system. Apply Cross Validation for evaluating the performance of the models.
2. Build classification models using the following methods and evaluate the models using various performance metrics.
    - Decision tree
    - Naïve Bayes Classifier
    - k-Nearest neighbor Classifier
3. Implement K-means clustering and Hierarchical clustering. Compare the results of these two algorithms and comment on the quality of clustering.
4. Appy Dimensionality Reduction techniques on a large data set, and compare the classifier performance using performance metrics.
5. Implement Ensemble learning methods like bagging, boosting and random forest for classification problems.
6. Implement the non-parametric locally weighted regression algorithm to fit data points. Select the appropriate data set for your experiment and draw graphs.
7. Design, Develop and Implement an end-to-end machine learning application, with front end and visualization capabilities.

Note: Use benchmark datasets from UCI, Machine Learning repository, Kaggle, etc,
Suitable problems should be chosen from various business functional areas and domains.

22MDC57 MANAGERIAL COMMUNICATION SKILLS

L	T	P	C
0	0	2	1

ASSESSMENT: PRACTICAL
COURSE OUTCOME

CO1: Conceive appropriate verbal responses from the learners to a given social situation, using the guidelines to effective speaking skills and body language.

CO2: Generate troubleshooting solutions to develop team building and interpersonal skills with case studies that focus on body language and empathy.

CO3: Develop appropriate responses for business phone calls and formulate effective resolutions to professional conflicts that arise out of cross-cultural communication gaps in a given managerial context

CO4: Compose appropriate written responses to professional problems faced by a team at the workplace arising out of ineffective communication skills.

CO5: Generate valid points for and against a HR topic and present them with appropriate group behavior. For any job requirement, plan and prepare for a 20-minute mock interview.

INTRODUCTION

Introduction – Code and Content – Stimulus and Response: Source – The Encoding Process – The Channel – The Decoding Process – The Receiver – Speaking Skills – Effective Speaking Guidelines – Communicating Soft Skills: A Self-assessment – Closing Tips **(4)**

SOFT SKILLS

Introduction to Soft Skills – Lessons from the Three Case Studies – Change in Today's Workplace: Soft Skills as a Competitive Weapon – Antiquity of Soft Skills – Classification of Soft Skills: Time Management - Attitude – Responsibility – Ethics, Integrity, Values and Trust – Self-confidence and Courage – Consistency and Predictability – Teamwork and Interpersonal Skills - Communication and Networking – Empathy and Listening Skills – Problem Solving, Troubleshooting and Speed reading – Leadership – Body Language **(8)**

TELEPHONING SKILLS & NEGOTIATIONS

Preparing to make a telephone call – Receiving calls – Taking and leaving messages – Asking for and giving repetition – The secretarial barrier – Cross-cultural communication on the telephone – Fixing appointments – Changing arrangements – Ending a call – Cross-cultural communication on the telephone – Problem-solving on the telephone – Complaints – Negotiations: Types of negotiation – Preparation for a negotiation – Making an opening statement – Bargaining and making concessions – Accepting and confirming – Summarizing and looking ahead – Types of negotiator – Dealing with conflict - Rejecting – Ending the negotiation **(8)**

WRITING SKILLS TO CREATE AN IMPRESSION:

Introduction- Fifteen Principle to Increase Clarity in Communication – Edit-Edit-Edit: The Reader's Perspective – Clarity of Thought – Clarity of Text. **(3) SPEAKING**

Job Interviews: Introduction - Types of Interviews – Planning and Preparing for an Interview -Importance of body Language in Interview - Need for proper Articulation - Concluding an Interview - Telephonic or Video Interview - A Mock Interview - Group Discussion: Introduction - Ability to Work as a Team – Communication Skills - Active Listening

- Non-verbal Communication - Leadership and Assertiveness - Reasoning – Ability to Influence - Innovation. Creativity, and Lateral Thinking - Flexibility - Key Steps to Succeed in a Group Discussion - The Responsibility of the First Speaker - Concluding the Discussion -Dos and Don'ts during a Group Discussion **(7)**

Total : 30

REFERENCE BOOKS

1. Mitra K.Barun, "*Personality Development and Soft Skills*", Oxford University Press, 2011.
2. Krishna Mohan, Meera Banerji. "*Developing Communication Skills*" Mac Million Publishers, 2012.
3. Sai Lakshmi. B, "*Poly Skills- A Course in Communication and ife Skills*" LCambridge University Press, 2012.
4. Simon Sweeney, "*English for Business Communication",* Cambridge University Press, 2013.
5. Meenakshi Raman, Sangeeta Sharma, "*Technical Communication - Principles and Practice*", 3rd edition, Oxford University Press, New Delhi, 2015.

22MDC61 - ECONOMIC FOUNDATIONS OF BUSINESS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOMES:

CO 1: Understand the core economic terms, concepts and theories

CO 2: Apply economic concepts to contemporary social issues to achieve the expected business outcomes

CO 3: Analyze the impact of economic policy on the business growth

CO 4: Evaluate the Concepts of economics in the managerial decision-making process.

CO 5: Develop knowledge on the micro and macroeconomic approaches in business decisions.

Principles of Economics: Decisions, Interaction, Economy as a Whole Works. Economist as Scientist: Scientific Method, Assumptions, Economic Model, Microeconomics and Macroeconomics. Economist as policy advisor: Positive Vs Normative analysis, Economists disagree in scientific judgment. Values: Perception Vs Reality – Interdependence and trade: Comparitive advantage – Adam Smith and David Ricardo view on gain from trade **(9)**

The Market Forces of Supply and Demand: Market and Competition, Demand, Supply, Supply and Demand Equilibrium. Elasticity and Its Application: Elasticity of Demand, Elasticity of Supply, Applications of Elasticity of demand and supply **(9)**
Production and costs: Production function, Types of costs, costs in short run and in the long run.
Firm and market structure: Competitive Markets, Monopolistic Competition, Oligopoly and Monopoly. **(9)**

Monetary System: Functions of Money, Kinds of Money, Banks and the Money Supply. Money Growth and Inflation: Classical Theory of Inflation, Costs of Inflation. Measuring a Nation's Income: Economic Income and Expenditure, Gross Domestic Product, Components of GDP, Real versus NominalGDP. **(9)**

Aggregate Demand and Aggregate Supply: Key Facts about Economic Fluctuations, Explaining Short-Run Economic Fluctuations, Aggregate-Demand Curve, Aggregate-Supply Curve, Causes of Economic Fluctuations. Influence of Monetary and Fiscal Policy on Aggregate Demand: Monetary Policy Influences, Fiscal Policy Influences and Using Policy to Stabilize the Economy. **(9)**

Total : 45

TEXT BOOKS:

1. N. Gregory Mankiw, "*Principles of Macroeconomics*", South-Western Cengage Learning, USA,, 10th Edition 2023.
2. N. Gregory Mankiw, "*Principles of Microeconomics*", Cengage Learning, Stamford, USA, 10th Edition,2023.

REFERENCE BOOKS

1. Varshney R.L & Maheshwari.K.L, "*Managerial Economics*" Sultan Chand & Sons, 22nd Edition, 2018.
2. Mehta P.L," *Managerial Economics"*, Sultan Chand & Sons: 14th Edition,2016.
3. Oliver Blanchard, "*Macro Economics"*, Pearson Publications,7th edition, 2020.

22MDC62 SYSTEMS FOR DECISION SUPPORT

L	T	P	C
3	0	0	3

PRE-REQUISITES

22MDC31, 22MDC45, 22MDC54

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Integrate analytics, data science, and business intelligence to build modern decision support systems.

CO 2: Apply the latest technologies like deep learning, cognitive computing, World Wide Web, and cloud computing to develop decision support systems.

CO 3: Build advanced knowledge-based decision support systems using knowledge acquisition and representation, inference techniques, and intelligent systems.

CO4 : Choose appropriate computerized decision-making tools to develop data-driven optimized enterprise decision support systems for the given business problem.

CO 5: Identify ethical, political, and the organizational and societal implications of advanced decision support systems.

INTRODUCTION TO MODERN DECISION SUPPORT SYSTEMS

An Overview of Business Analytics, Decision Support Systems, Business Intelligence, Data Science, and Artificial Intelligence: Need for Decision Support and Analytics - Decision Making Process and Computerized Decision Support Framework - Evolution of Computerized Decision Support to BI/Analytics/Data Science - Overview of Analytics and AI - Business Applications of Artificial Intelligence - Application Case Studies for Statistical Modeling and Visualization (9)

PREDICTIVE ANALYTICS AND MACHINE LEARNING FOR DECISION SUPPORT

Predictive Analytics based Decision Support Application Case Studies: Data Mining -Support Vector Machines

Deep Learning: Applications of Shallow Neural Networks and Deep Neural Networks Cognitive Computing: IBM Watson as a Case Study (5)

Text Mining, Sentiment Analysis, and Social Analytics: Text Analytics and Text Mining Overview - Natural Language Processing - Sentiment Analysis – Web Mining Overview – Search Engines – Web Usage Mining – Social Analytics (7)

PRESCRIPTIVE ANALYTICS AND BIG DATA FOR DECISION SUPPORT

Prescriptive Analytics with Optimization and Simulation: Model-Based Decision Making - Structure of Mathematical Models for Decision Support - Certainty, Uncertainty, and Risk - Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking – Introduction to

Simulation – Application Case Studies. (9)
Big Data, Location Analytics, and Cloud Computing Technologies: Application Case Studies (3)

ROBOTICS, SOCIAL NETWORKS, AI, AND IoT

Robotics Overview – Illustrative Applications of Robotics Group Decision Making, Collaborative Systems, and AI Support: Making Decisions in Groups – Group Support Systems for Decision Making – Collective Intelligence and Collaborative Intelligence – Crowdsourcing as a Method for Decision Support Knowledge Systems: Expert Systems, Recommenders, Chatbots, Virtual Personal Assistants, and Robo Advisors (9)

CAVEATS OF ANALYTICS AND AI

Implementation Issues: From Ethics and Privacy to Organizational and Societal Impacts: Overview – Legal, Privacy, and Ethical Issues, Deployment of Intelligent Systems, Impact of Intelligent Systems on Organizations, Future of Intelligent Systems (3)

Total Hours: 45 Hours

TEXT BOOK

1. Ramesh Sharda, Dursun Delen, Efraim Turban, "*Analytics, Data Science, & Artificial Intelligence: Systems for Decision Support"*, 11th Edition, Pearson, 2020.

REFERENCE BOOK

1. Ramesh Sharda, Dursun Delen, Efraim Turban, *"Decision Support and Business Intelligence Systems"*, 9th Edition, Pearson, 2013.

22MDC63 CLOUD COMPUTING

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC24, 22MDC53

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Describe the fundamental principles of cloud computing and how it facilitates services in a scalable cost-effective manner.

CO 2: Build systems for big data analytics, IoT and cognitive computing by implementing necessary cloud services.

CO 3: Apply cloud to solve real time business problems using mobile, IoT, and social media.

Choose appropriate tools and technologies from cloud for building machine learning and deep learning applications.

CO4 : Choose appropriate tools and technologies from cloud for building machine learning and deep learning applications.

CO5: Assess the performance of various cloud service offerings and choose appropriate cloud service providers considering the trust, security and privacy requirements

CLOUD, BIG DATA, AND COGNITIVE COMPUTING

Principles of Cloud Computing Systems
Elastic Cloud Systems for Scalable Computing - Cloud Architectures Compared with Distributed Systems - Service Models, Ecosystems, and Scalability Analysis - Availability, Mobility, and Cluster Optimization (9)

Cloud for Data Analytics, Internet of Things and Cognitive Computing
Big Data Science and Application Challenges - Data Science and Big Data Characteristics - Overview of Big Data Applications - The Internet of Things and Cloud Interactions - Data Collection, Mining, and Analytics on Clouds Neuromorphic Hardware and Cognitive Computing: Cognitive Computing and Neuromorphic Processors, SyNAPSE and Related Neurocomputer Projects at IBM, Google's TPU and Related AI Programs (9)

CLOUD ARCHITECTURE AND SERVICE PLATFORM DESIGN

Virtual Machines, Docker Containers, and Server Clusters
Virtualization in Cloud Computing Systems - Hypervisors for Creating Native Virtual Machines - Docker Engine and Application Containers - Docker Containers and Deployment Requirements - Virtual Machine Management and Container Orchestration - Eucalyptus for Virtual Clustering in Private Clouds - OpenStack Software for Building Private or Public Clouds (9)

Cloud Architectures and Service Platform Design
Cloud Architecture and Infrastructure Design - Amazon AWS Cloud and Service Offerings - Google App Engine and Compute Engine - Google Hardware/Software Support for Machine Learning Services - Microsoft Azure and Service Offerings - Salesforce Clouds for SaaS Services (6)

Clouds for Mobile, IoT, Social Media, and Mashup Services
Wireless Internet and Mobile Cloud Computing - IoT Sensing and Interaction with Clouds - Cloud Computing in Social Media Applications - Cloud Mashup Architecture for Agility and Scalability (7)

CLOUD PERFORMANCE, SECURITY, AND DATA PRIVACY
Introduction - Cloud Performance Metrics and Benchmarks: Auto-Scaling, Scale-Out, and Scale-Up Strategies,- Cloud Performance Metrics - Cloud Security and Data Privacy Protection - Cloud Security and Privacy Issues - Trust Management in Clouds and Datacenters

Case Study: Google DeepMind, IBM SmartCloud, IoT, and Cognitive Projects (5)

TOTAL: 45 Hours

Text Book

1. Kai Hwang, "*Cloud Computing for Machine Learning and Cognitive Applications"*, The MIT Press, 2017.

Reference Book

1.
2. Kai Hwang, Geoffrey C Fox, John J Dongarra, "*Distributed and Cloud Computing From Parallel Processing to the Internet of Things*", Morgan Kaufmann, 2012.
3. Dan C. Marinescu (Author), Morgan Kaufmann, "*Cloud Computing: Theory and Practice*", 3rd edition, 2022.
4. James E. Smith, Ravi Nair, "*Virtual Machines: Versatile Platforms for Systems and Processes*", Elsevier/Morgan Kaufmann, 2005.

22MDC64 - DEEP LEARNING

L	T	P	C
3	0	0	3

PRE- REQUISITES:22MDC54

ASSESSMENT: THEORY COURSE OUTCOME

CO 1: Describe the deep learning process using deep feed forward network, CNN and RNN mode

CO 2: Describe the regularization and Optimization techniques

CO 3: Apply appropriate deep network models along with optimization and regularization techniqu for the given analysis application

CO 4: Describe and apply the image enhancement, segmentation and representation techniques

DEEP FEED-FORWARD NETWORKS: Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation and other Differentiation Algorithms (7)

REGULARIZATION: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems Dataset Augmentation, Dropout.
OPTIMIZATION FOR TRAINING DEEP MODELS Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms Parameter Initialization Strategies
(10)

IMAGE PROCESSING
IMAGE SAMPLING AND QUANTIZATION- Basic Concepts - Representing Digital Images - Spatial and Intensity Resolution - Image Interpolation
IMAGE ENHANCEMENT - Spatial Domain -Histogram Processing- Histogram Equalization - Histogram Matching - Local Histogram Processing - Using Histogram Statistics for Image Enhancement
- The Mechanics of Spatial Filtering - Spatial Correlation and Convolution - Vector Representation of Linear Filtering - Generating Spatial Filter Masks -Smoothing Linear Filters - Order-Statistic (Nonlinear) Filters.
IMAGE SEGMENTATION - Fundamentals - Point, Line, and Edge Detection - Detection of Isolated Points - Line Detection - Edge Models - Basic Edge Detection - More Advanced Techniques for Edge Detection-Edge Linking and Boundary Detection. (12)

CONVOLUTIONAL NETWORKS The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning. (8)
SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory (8)

TOTAL: 45 Hours

TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville*, "Deep Learning",* MIT Press, 2016.
2. Rafael C.Gonzalez and Richard E.Woods*, "Digital Image Processing",* Pearson Education, Third Edition, 2008*.*

REFERENCE BOOKS

1. Deng & Yu*," Deep Learning: Methods and Applications",* Now Publishers, 2013*.*
2. Michael Nielsen*, "Neural Networks and Deep Learning",* Determination Press, 2015*.*

22MDC65 - MOBILE AND CLOUD APPLICATION DEVELOPMENT LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC53, 22MDC63

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO 1: Design and build a fully functional store-worthy Android app that is aware of the resource constraints of mobile devices.

CO 2: Demonstrate knowledge on creating, managing, and working with virtual machines using a virtualization tool

CO 3: Utilize public cloud services and offer services in the cloud for the given scenarios.

CO 4: Illustrate containerization by developing suitable applications

CO 5: Consume machine learning services offered by popular service providers to build real-time analytics applications.

CONCEPTS TO BE COVERED

Mobile Application Development:

Tools: Android/React Native/ Flutter

1. Build a basic UI-driven App
2. Create Android services
3. Develop application carrying out data management with SQLite3
4. Develop a basic networking application
5. Implement SMS and GPS based applications
6. Implement image manipulation
7. Use Proximity and Location services (Android NFC, Bluetooth, Google Maps) in a suitable application

Cloud Application Development:

I. Virtualization - Virtual Box

1. Create virtual machines of different configurations
2. Establish communication between host and virtual machine
3. Establish communication between virtual machine to virtual machine
4. Show the virtual machine migration from one node to the other.

II. Public Cloud

1. Explore Amazon S3 and EC2
2. Create virtual machines in Amazon, run a sample java application on the EC2 instance
3. Develop and deploy an application in the Google App Engine
4. Demonstrate the working of Docker containers by developing a suitable application.
5. Deploy a mobile application in a cloud platform.

III. Mini Project

Design, develop and implement an end-to-end machine learning project. Offer it as a service. Or use cloud based machine learning services offered by the leading cloud providers like AWS SageMaker, Azure Machine Learning, Google Cloud AutoML, etc

21MDC66- DEEP LEARNING LABORATORY

L	T	P	C
0	0	4	2

PRE- REQUISITES:21MDC56, 21MDC64

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO 1: Apply and Implement the deep feed forward network, CNN and RNN models for analyzing the complex real world systems.

CO 2: Apply and Implement the regularization and Optimization techniques for improving the deep forward network model.

CO 3: Execute the image representation, enhancement and segmentation techniques for the given analysis applications.

CONCEPTS TO BE COVERED

1. Implementation of Viewing digital images, bits and bytes, sampling and quantization.
2. Apply scaling, translation and rotation, sums and differences with the grayscale and color images.
3. Implementation of Histograms, Linear and Non-Linear filters.
4. Construct edge detection algorithms using Operators.
5. Build a multi-layer neural network, and analyze real data
6. Object detection using Convolution Neural Network
7. Perform Sentiment Analysis in network graph using RNN
8. Implementation of Long short term memory network

22MDC71 - PROJECT WORK AND VIVA VOCE - I

L	T	P	C
0	0	0	18

PRE-REQUISITES

Should have undergone all courses upto 6th Semester

ASSESSMENT: PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- Perform quantitative and qualitative data analytics in functional areas of business
- Analyze business problems using mathematical and statistical modeling and enable data driven decision making.
- Analyze the issues in software solutions
- Develop enterprise applications applying software engineering principles and business domain knowledge
- Visualize and infer meaningful insights to facilitate strategic and operational decisions
- Apply and demonstrate software development standards in the software industry
- Work in a team to develop solutions for real time applications and solve research issues

22MDC81 - MODELING AND SIMULATION

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT : THEORY

COURSE OUTCOME

CO1: Define Simulation, Systems, Models and perform basic manual simulations

CO2: To illustrate changes in the dynamic systems like queuing systems using simulation.

CO3: To predict the behavior of linear and non-linear systems using empirical modeling

CO4: To evaluate the behavior of deterministic and stochastic systems using Simulation techniques.

CO5: Interpret the model and apply the results to solve real world applications.

INTRODUCTION TO SIMULATION

When Simulation Is the Appropriate Tool - When Simulation Is Not Appropriate- Advantages and Disadvantages of Simulation-Areas of Application- Systems and System Environment- Components of a System- Discrete and Continuous Systems – Model of a System- Types of Models- Discrete-Event System Simulation- Steps in a Simulation Study Simulation example-Queuing-Inventory-General Principles of Simulation. (9)

STATISTICAL BASICS AND QUEUING MODEL SIMULATION

Useful Statistical Models- Discrete Distributions - Continuous Distributions- Poisson Process- Properties of a Poisson Process-Non-stationary Poisson Process- Empirical Distributions-Characteristics of Queuing Systems- Queuing Notation- Long-Run Measures of Performance of Queuing Systems- The Conservation Equation- Steady-State Behaviour of Infinite-Population Markovian Models - Single-Server Queues with Poisson Arrivals and Unlimited Capacity: M/G/1, Multi-server Queues - Steady-State Behavior of Finite-Population Models- Networks of Queues (9)

RANDOM NUMBERS

Random Number Generation: Generation of Pseudo-Random Numbers- Techniques for Generating Random Numbers- Linear Congruential Method- Combined Linear Congruential Generators- Tests for Random Numbers- Frequency Tests, Tests for Autocorrelation Random Variate Generation Inverse Transform Technique- Exponential Distribution- Uniform Distribution- Weibull Distribution- Triangular Distribution- Empirical Continuous Distributions- Continuous Distributions without a Closed-Form Inverse-Discrete Distributions- Acceptance-Rejection Technique- Poisson Distribution- Non-stationary Poisson Process- Gamma Distribution. (9)

ANALYSIS OF SIMULATION DATA

Input Modeling- Data Collection- Identifying the Distribution with Data-Histograms- Selecting the Family of Distributions-Quantile-Plots- Parameter Estimation- Preliminary Statistics: Sample Mean and Sample Variance- Suggested Estimators-Goodness-of-Fit Tests- Chi-Square Test-Kolmogorov--Smimov Goodness-of-Fit Test.

Verification and Validation of Simulation Models- Model Building, Verification, and Validation- Verification of Simulation Models-Calibration and Validation of Models- Face Validity-Validation of Model Assumptions-Validating Input-Output Transformations- Input-Output Validation: Using Historical Input Data- Input-Output Validation: Using a Turing Test.

OUTPUT ANALYSIS FOR A SINGLE MODEL

Comparison of Two System Designs-Independent Sampling with Equal Variances-Independent Sampling with Unequal Variances. Meta modeling. (11)

MANUFACTURING SYSTEMS AND MATERIAL HANDLING SYSTEM

Simulation of Manufacturing and Material-Handling Systems : Manufacturing and Material-Handling. Simulations- Models of Manufacturing Systems- Models of Material-Handling Systems- Goals and Performance Measures- Issues in Manufacturing and Material-Handling Simulations- Modeling Downtimes and Failures- Trace-Driven Models- Case Studies of the Simulation of Manufacturing and Material-Handling Systems (7)

Total : 45

TEXT BOOK

1. Jerry Banks,John S. Carson II,Barry L Nelson, David M Nicol, "*Discrete-Event System Simulation"*, Fifth Edition, Prentice Hall, 2009.

REFERENCE BOOKS

1. Law A.M. & Kelton, W.D," *Simulation Modeling and Analysis"*, 2nd ed, New York McGraw Hill Inc.1991

2. Geoffrey Gordon, "*System Simulation",* Prentice Hall publication, 2nd Edition, 1978, ISBN:81-203-0140-4.

3. Frank R.Giordano, Maurice D.Weir and William P.Fox. "*Mathematical Modeling"*, Thomson Brooks/Cole, Vikas Publishing House Pvt Ltd., New Delhi.[Para 1, II & III]

4. H.Sayama, "*Introduction to the Modeling and Analysis of Complex Systems",* Open SUNY Textbooks, Milne Library State University of New York at Geneseo,Geneseo, NY 14454, 2015.

5. Clive L.Dym," *Principles of Mathematical Modeling"*, 2nd Edition, Elsevier, 2004.

22MDC82 - GAME THEORY AND DECISION ANALYSIS

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

After studying the course, the students will be able to

CO1 : Apply maximin and minimax principles to compute the value of the game with and without saddle points and also using linear programming approach.

CO2 : Make decisions under various decision-making environments and also construct decision trees.

CO3 : Conduct a comprehensive survey of some methods for eliciting data for Multi-Criteria Decision-Making problems and also for processing such data.

CO4 : Learn fundamental concepts in stochastic processes, different types of stochastic process models, properties of Markov chains and its applications.

CO5 : Calculate project-schedule time and establish time-cost trade-off for the completion of a project.

GAME THEORY

Decision making – Description of a game – Basic elements of game theory – Two Person Zero-Sum Games – Characteristics of a game – maximin and minimax principles – Steps in solving the game – Saddle point method – Principle of dominance in games – Solutions to 2×2 games without saddle point: (Mixed strategies) – Method of Oddments (for 2×2 games) – Solutions to $2 \times n$ and $m \times 2$ games – Graphical Method – Algebraic Method – Method of Linear Programming – n-Person Zero-Sum games. **(9)**

DECISION ANALYSIS

Introduction – Decision-making Problem – Decision-making Process – Decision-making Environment – Decisions under Uncertainty – Decisions under Risk – Posterior Probabilities and Bayesian Analysis – Decision Tree Analysis – Decision-making with Utilities – Advanced Decision Trees – Chi-Square Automatic Interaction Detection (CHAID). **(9)**

MULTI-CRITERION DECISION MAKING

Multi-attribute Decision making – an overview – classification of Multi-Criteria Decision Making (MCDM) methods – deterministic, stochastic and fuzzy – MCDM application areas – MCDM methods: weighted sum model – weighted product model – Analytic Hierarchy process – Revised Analytic Hierarchy process – ELECTRE method – TOPSIS method. **(9)**

STOCHASTIC MODELS – MARKOV CHAINS:

Introduction to Stochastic Process - Poisson Process - Compound Poisson Process - Markov chains – Chapman-Kolmogorov Equations - Classification of States of Markov Chain – Long run properties – First passage times – Simple Problems. **(9)**

RESOURCE ANALYSIS IN NETWORK SCHEDULING

Introduction – Project cost – Time-cost Optimization Algorithm – Linear Programming Formulation – Updating – Resource Allocation and Scheduling – MOST – GERT – Precedence Planning – LOB **(9)**

Total : 45 hours

TEXT BOOKS

1. Kanti Swarup, P. K. Gupta, Man Mohan, "*An Introduction to Management Science Operations Research*", Sultan Chand & Sons, 18th edition, 2015.
2. Rama Murthy P. "*Operations Research",* New Age International, 2nd Edition, 2007, New Delhi.
3. Triantaphyllou, Evangelos. (2000). "*Multi-Criteria Decision Making Methods: A Comparative Study*". 10.1007/978-1-4757-3157-6, Kluwer Academic Publishers.
4. Dinesh Kumar U. "*Business Analytics*", Wiley, 2nd Edition, 2021.

REFERENCE BOOKS

1. Hamdy A. Taha, "*Operations Research - An Introduction*", Pearson, 11th Edition, 2022.
2. Sharma J K, "*Operations Research Theory and Applications*", Laxmi Publications, 6th edition 2017.
3. Frederick S.Hiller, Gerald J. Leberman, Bodhibrata Nag and PreetamBasu, "*Introduction to Operations Research*", McGraw Hill, 11th edition 2021.
4. Martin Osborne, "*An Introduction to Game Theory*", Oxford University Press, first edition, 2012.
5. E. Triantaphyllou, B. Shu, S. Nieto Sanchez, and T. Ray:" *Multi-Criteria Decision Making: An Operations Research Approach. Encyclopedia of Electrical and Electronics Engineering",* (J.G. Webster, Ed.), John Wiley & Sons, New York, NY, Vol. 15, pp.175-186, (1998)

22MDC83 – PRODUCTION AND OPERATIONS MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE: As per Instructor
ASSESSMENT: Theory

COURSE OUTCOME

CO1 : Articulate the primary problem of production and operations management

CO2 : Apply the various concepts of production planning and control for effective production process

CO3 : Analyze and apply various problem-solving techniques for effective decision making in Production process

CO4 : Determine the various tools and system for effective production and materials management

CO5 : Facilitate suitable materials handling principles and practices in the production process

Production and Operations Management: Introduction – Evolution of POM – Production system – Production Management – Operating System – Operations Management – Global Operations Management – Scope of Production and Operations Management. **Plant Location and Layout:** Meaning – Need for selecting suitable location – Factors influencing Plant Location – Location Theories – Location Models – Plant Layout – Classification of Layout – Design for Product layout, Process Layout and Service Layout – Organization of Physical facilities – Case Study. **(9)**

Materials Handling and Management: Introduction – Objectives of Materials Handling – Principles of Material Handling – Selection of Material Handling Equipment – Evaluation of Material Handling Systems – Types of Material Handling Equipment. **Materials Management:** Introduction – Scope of Materials Management – Material Planning and Control – Purchasing – Stores Management – Inventory control: Meaning, Objectives, Benefits, Techniques and Model – Standardization – Simplification – Value Analysis – Just-in-time manufacturing – Case Study. **(9)**

Production Planning and Control: Introduction – Need and Objectives –Phases and Functions of PPC – Operations Planning and Scheduling Systems – Aggregate Planning – Material Requirement Planning – Capacity Planning – Routing – Scheduling. **Time and Motion Study:** Productivity – Work Study – Method Study – Motion Study – Work Measurement – Time Study – Case Study. **(9)**

Maintenance Management: Introduction – Objectives – Types –Maintenance planning and scheduling – Maintenance Schedule Techniques. **Quality Control:** Introduction – Inspection – Types of Quality control – Objectives, Benefits and Tools of Quality Control – Quality Circles – Total Quality Management – ISO 9000 series –Case Study. **(9)**

Waste Management: Introduction – Reason for Generation and accumulation of waste – Identification and Control of Waste – Disposal of Scrap. **Automation:** Introduction – Types of automation – Computer

Integrated Manufacturing – Reasons for automation – Advantages and Disadvantages of automation – Automation strategies – Case Study. **(9)**

Total Hours : 45 Hours

TEXT BOOK

1. Anilkumar .S and Suresh.N , "*Production and Operations Management*(with skill development, caselets and cases)", New Age International Publishers, Second Edition , 2018.

REFERENCE BOOKS

1. Aswathappa.K and Sridhara Bhat.K, "*Production and Operations Management"*, Himalaya Publishing House, Second Edition, 2015.
2. Chary .S.N, "*Production and Operations Management",* McGraw Hill Publisher, Sixth Edition, 2019.
3. Joseph.G.Monks, "*Operations Management"*, Mcgraw Hill Publisher, Second Edition, 2020.
4. "*Modern Production/Operations Management"*, Wiley Publisher, Eighth Edition, 2007.

22MDC84 - GAME THEORY AND DECISION ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES: 22MDC83
ASSESSMENT: PRACTICAL
COURSE OUTCOME

CO1: Understand Game Theory Strategies and find solution to the given problem
CO2: Analyze and derive decisions using decision tree and random forest analysis methods
CO3: Design and perform decision analysis using MCDM, Markov chain principles and Six Sigma Concepts.
CO4: Analyze the outcome of Sensitivity Analysis using analysis methods in decision making.
CO5: Design game models for dynamic games and know how to solve it.

CONCEPTS TO BE COVERED

1. Solving Game Theory Problems for Pure Strategies using MS-Excel: Maxmin and Minmax criteria.
2. Solving Game Theory Problems for Mixed Strategies using MS-Excel: Maxmin and Minmax criteria.
3. Solving Game Theory Problems for Mixed Strategies using MS-Excel: Principle of dominance.
4. Solving Game Theory Problems using MS-Excel's Solver: Linear Programming.
5. Solving Game Theory problems using Graphical Method.
6. Repeating Exercises 1,2 using Python, R
7. Repeating Exercises 3,4 using Python, R
8. Solving Decision Analysis problems using MS-Excel Solver and Linear Programming.
9. Performing Sensitivity Analysis on Decision Trees.
10. Construction of Decision Trees using R Packages
11. Construction of Random Forest using R Packages
12. Analyzing Decision Trees and Random Forest using Rapid Miner software
13. Solving MCDM problems using Python, R
14. Computing n-step probabilities using MS-Excel and Python/R
15. Computing steady state probabilities using Markov chain in Python/R
16. Six Sigma Methodology using Python / R.
17. Solving Dynamic Games using PyGambit software.

22MDC85 - MINOR PROJECT - DECISION TOOL DEVELOPMENT

L	T	P	C
0	0	4	2

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL (PRESENTATION AND VIVA VOCE)

COURSE OUTCOME

CO1: Understand the business problem in detail.

CO2: Determine the logical and ordered process to address all the critical elements of the business problem

CO3: Analyze various solution alternatives, choose the best alternative for the problem based on the feasibility study and literature survey.

CO4: Evaluate the decision tool, test the functionalities, analyze the performance, discuss and interpret the results.

CO5: Create interfaces / dashboards for user interaction with the developed system.

Effectiveness in managing business decision-making will ultimately determine the success of the company. However, this is a challenge for companies of all sizes, particularly those that are growing rapidly. At this stage, a clear mechanism for managing, communicating, and confirming decision implementation is essential. Therefore, this minor project focuses on developing a decision tool with a broad scope and comprehensive vision for the chosen business problem.

In this minor project students have to:

- Select a specific business problem and develop a decision tool to effectively address it.

22MDC91 – PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE: Consent of the Instructor

ASSESSMENT: Theory

COURSE OUTCOME

CO 1: Describe a project life cycle and can skillfully map each stage in the cycle.

CO 2: Provide internal stakeholders with information regarding project cost, time and risk

CO 3: Analyze the phases of the project and create a project plan.

CO 4: Evaluate the progress and performance of the project and make necessary decisions

CO 5: Depict the time needed to complete a project considering factors such as task dependencies and lengths

Modern Project Management: Definition – Project Life Cycle – Qualities of a Project Manager – Importance of Project Management – Present Day Project Management – Steps in defining the project. **Estimating Project Time and Cost:** Factors influencing the quality of estimates – Estimating guidelines for Time, Cost and Resources – Top down and Bottom up estimation – Methods for Estimation – Types of cost – Refining estimates – Creating a database for estimating. **(9)**

Developing a Project Plan: Developing the project network – Work package to network – Constructing a project network – Activity-on-node fundamentals – Network computation process – Practical consideration to network – Extended network techniques.
Scheduling Resources and Costs: Resource Scheduling problem – Types of Resource Constraints – Classification of a scheduling problem – Resource allocation methods – Benefits of Scheduling resources – Resource schedule to develop project cost base line. **(9)**

Reducing Project Duration: Rationale for reducing project duration – Options for accelerating project completion – Constructing project cost duration graph. **Managing Risk:** Risk Management process – Steps. **(9)**

Leadership: Managing Vs Leading a project – Managing Project Stakeholders – Social network building – Ethics and project management. **Managing Project Teams:** Five stage team development model – Situational factors affecting team development – Building high performance project team – Project team pitfalls. **(9)**

Performance Measurement and Evaluation: Structure of a project monitoring information system – The project control process – Monitoring Time performance – Development of an earned value cost/schedule system – Indexes to monitor program – Forecasting final project cost – Other Control issues. **(9)**

Total: 45 Hours

TEXT BOOK:

1. Erik.W.Larson and Clifford.F.Gray, "*Project Management: The Managerial Process"*, Mc.Graw Hill Irwin, Eighth Edition, 2021

REFERENCE BOOKS:

1. Albert Lester "*Project Management Planning and Control, Elsevier Science"* ,Seventh Edition, 2017
2. Prasanna Chandra, "*Projects: Planning, Analysis, Selection, Financing, Implementation and Review"* , Mc.Graw Hill Education, Seventh Edition, 2009.
3. Gregory.M.Horine, "*Project Management",* Pearson Education, Fourth Edition,2017.
4. Sudhakar.G.P., "*Project Management: The Managerial Aspects"*,New Century Publication,First Edition, 2020.

22MDC92 -BUSINESS ETHICS AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME:

CO 1: Identify the role of an entrepreneur by analyzing various opportunities and challenges in developing a new venture

CO 2: Understand the development of entrepreneurship as a field of study and profession

CO 3: Apply an ethical understanding perspective to business situation

CO 4: Analyze the importance of sustainable competitive advantage with innovation and creativity

CO 5: Evaluate the critical roles of marketing research, competitive analysis and consumer-value in business plan

Introduction: Meaning – Elements – Determinants and Importance of entrepreneurship and creative behavior – Entrepreneurship and Micro, Small and Medium Enterprises – Role of Family business in India – The Contemporary role models in Indian Business; their values, business philosophy and behavioral orientations – Conflict in family business and its resolution. **(9)**

Sources of Business Ideas: Sources of Business ideas and tests of feasibility – Significance of writing the business plan/ project proposal – Contents of business plan/ project proposal – Designing business processes, location, layout, operation, planning and control – preparation of project report. **(9)**

Public and private system of stimulation: Public and private system of stimulation – support and sustainability of entrepreneurship – Requirement, availability and access to finance, marketing assistance, technology and industrial accommodation – Role of industries/entrepreneur's associations – Concept, role and functions of business incubators, angel investors, venture capital and private equity fund. **Mobilizing Resources:** Mobilizing Resources for start-up – Accommodation and utilities - Preliminary contracts with the vendors, suppliers, bankers, principal customers – Basic Start-up problems. **(9)**

Business Ethics: Introduction – Meaning – Scope – Types of Ethics – Features – Factors influencing Business Ethics – Significance of Business Ethics – Arguments for and against business ethics – Basics of business ethics – Corporate Social Responsibility and Business Ethics. **(9)**

Ethics and Corporate Governance: Concepts of Corporate Governance – Scope – Reports on Corporate Governance – Benefits and Limitations of Corporate Governance – Corporate Governance and Business and Ethics. **(9)**

(Total Hours : 45)

TEXT BOOK:

1. Abhik Kumar Mukherjee and Shaunak Roy, "*Entrepreneurship Development and Business Ethics"*, Oxford University Press, First Edition, 2019.

REFERENCE BOOKS:

1. Desai.V, "*Entrepreneurship Development and Business Ethics"*, Himalaya Publishing House,
2. Chandra.B and Biswas, "*Entrepreneurship Development and Business Ethics"*, Tee Dee Publications, First Edition, 2021.
3. Nagalakshmi,Suseela kanduri and et al, "*Entrepreneurship Development and Business Ethics",* Himalaya Publishing House, First Edition,2018
4. Soheli Ghose and Soulina Banerjee," *Entrepreneurship Development and Business Ethics"*, ABS Publishing House, First Edition,2022.

22MDC93 – DATA PRIVACY AND SECURITY ANALYTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC34, 22MDC53

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Describe the fundamental aspects of information security and number theory, different types of cryptosystems and privacy preserving machine learning techniques

CO 2: Apply symmetric, asymmetric, hash algorithms, differential privacy and federated learning techniques to preserve confidentiality, integrity and privacy of information

CO 3: Analyze and choose suitable crypto algorithms for the security requirement of a given computing system

INTRODUCTION

Security: Computer Security concepts – OSI Security Architecture - Security Attacks – Security Services – Security Mechanisms – Network Security model

Number Theory: Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's Theorem, Euler's Theorem, Extended Euclidean Algorithm, Testing for Primality (8)

CRYPTOSYSTEMS

Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Data Encryption Standard, Advanced Encryption Standard

Asymmetric Ciphers: Principles of public key cryptosystems, The RSA algorithm, Diffie Hellman Key exchange, Elliptic curve cryptography (12)

MESSAGE INTEGRITY AND AUTHENTICATION

Message Authentication Requirements, Message Authentication functions - Applications of Hash functions, Secure Hash Algorithm - Digital signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm (8)

PRIVACY-PRESERVING MACHINE LEARNING

Privacy considerations in machine learning, Privacy complications in the AI era, Threats and attacks for ML systems, Securing privacy while learning from data: Privacy-preserving machine learning. Advanced concepts of differential privacy or machine learning - Applying differential privacy in machine learning - Differentially private supervised learning algorithms - Differentially private unsupervised learning algorithms (9)

FEDERATED LEARNING

Horizontal and Vertical Federated Learning, Federated Averaging, Federated Transfer Learning, Federated Learning over Non-IID data (8)

TOTAL : 45

TEXT BOOKS

1. William Stallings, "*Cryptography and Network Security: Principles and Practices*", Fifth Edition, Prentice Hall, 2010.

2. Morris Chang J, Di Zhuang, Dumindu Samaraweera, "*Privacy-Preserving Machine Learning*", Manning Publications, 2022.

3. Yaochu Jin, Hangyu Zhu, Jinjin Xu, Yang Chen, "*Federated Learning- Fundamentals and Advances",* Springer, 2023.

REFERENCE BOOKS

1. Michael Whitman, Herbert J. Mattord, "*Management of Information Security*", Third Edition, Course Technology, 2010.

2. Clarence Chio, David Freeman, "*Machine Learning & Security*", First Edition, O-Reilly, 2018.

3. William Stallings, "*Network Security Essentials, Applications and Standards"*, 3rd edition, Pearson Education, 2007.

22MDC94 – DATA PRIVACY AND SECURITY ANALYTICS LABORATORY

L	T	P	C
0	0	4	2

PRE-REQUISITES:22MDC93

ASSESSMENT: PRACTICAL

COURSE OUTCOMES

CO 1: Construct symmetric and asymmetric algorithms to preserve confidentiality, integrity and authenticity of information resources

CO 2: Demonstrate network security tools including Packet capturing, Port scanning, and Mac Spoofing

CO 3: Apply Steganography algorithms under various media including text, images and audio

CO 4: Apply Machine Learning algorithms to detect various security attacks

CO 5: Devise defensive measures for securing information resources in Machine Learning Models using Federated Learning

CONCEPTS TO BE COVERED

1. Implementing Substitution and Transposition cipher.
2. Implementing DES, AES algorithms.
3. Implementing RSA, Key exchange algorithm, ECC algorithm.
4. Implementing Secure Hash algorithm, Digital Signature algorithm.
5. Learning to install and work with Packet capturing tool Wireshark.
6. Learning to install and work with Port scanning tool Nmap.
7. Learning to install and work with MAC Spoofing tool Smac.
8. Implementing Steganography techniques using Deep Neural Networks/Generative Adversarial Network.
9. Implementing ML techniques to accomplish Intrusion detection, Malware detection, Fraud detection and Vulnerability detection.
10. Implementing Privacy Preserving in ML using Differential Privacy / Secure Multi-party Computation / Homomorphic encryption / Federated Learning

22MDC101 - PROJECT WORK AND VIVA VOCE - II

L	T	P	C
0	0	0	18

PRE-REQUISITES

Should have undergone all courses till Semester IX

ASSESSMENT: PRESENTATION AND VIVA VOCE

COURSE OUTCOME

- Perform quantitative and qualitative data analytics in functional areas of business
- Analyze business problems using mathematical and statistical modeling and enable data driven decision making.
- Analyze the issues in software solutions
- Develop enterprise applications applying software engineering principles and business domain knowledge
- Visualize and infer meaningful insights to facilitate strategic and operational decisions
- Apply and demonstrate software development standards in the software industry
- Work in a team to develop solutions for real time applications and solve research issues

Management: General

22MDCE01 - BUSINESS PROCESS MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Identify the processes associated with the given business problem

CO 2: Infer Business Process Management as a cross-disciplinary field, striking a balance between business management and IT aspects

CO 3: Analyze the business process and identify the issues of the process.

CO 4: Determine the business process by applying the necessary changes

CO 5: Develop the IT solution to automate the business process

INTRODUCTION TO BUSINESS PROCESS MANAGEMENT (BPM)

Business Process Definition - Origin and History of BPM - The BPM Lifecycle **(7)**

PROCESS IDENTIFICATION AND MODELING

Focusing on Key Processes - Designing a Process Architecture - BPMN Initiation - Branching and Merging - Information Artifacts Resources. **(9)**

ADVANCED PROCESS MODELING

Process Decomposition - Process Reuse - Rework and Repetition - Handling Events - Handling Exceptions - Processes and Business Rules **(10)**

PROCESS DISCOVERY

The Setting of Process Discovery - Discovery Methods - Process Modeling Method - Process Model Quality Assurance. **(9)**

PROCESS ANALYSIS AND REDESIGN

Qualitative Process Analysis : Value-Added Analysis - Root Cause Analysis - Issue Documentation and Impact Assessment. Quantitative Process Analysis : Performance Measures - Flow Analysis - Queues - Simulation. Redesign: Definition and Need - Heuristic Process Redesign - The Case of a Health Care Institution - Product-Based Design **(10)**

TOTAL : 45

TEXT BOOK

1. Marlon Dumas, Marcello La Rosa, Jan Mendling and Hajo A. Reijers, "*Fundamentals of Business Process Management*", Springer-Verlag Publication, 2013.

REFERENCE BOOK

1. Forrest W. Breyfogle III, "*The Business Process Management Guidebook: An Integrated Enterprise Excellence BPM System*", Citius Publishing, 2013.

22MDCE02 - BUSINESS ENVIRONMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Compare between the primary, secondary and tertiary sectors of the economy.

CO 2: Classify the differing objectives of private and public sector businesses

CO 3: Contrast between the needs and wants of a society and can identify how these are satisfied through business activity.

CO 4: Evaluate the difference between the public and private sectors of an economy and can identify their differing objectives.

CO 5: Combine the primary, secondary and tertiary sectors of the economy.to make business decisions

Business Environment: Meaning, Types of Environment. Environmental Analysis: Stages, Approaches, Techniques. Nature and Scope of Business: Business System, Classification of business, Characteristics of business, classification of industries. Economic Environment: Nature, Structure, Economic Policies, Economic conditions – CaseStudy. **(9)**

Consumerism and Business: Consumer Rights, Exploitation of Consumers, Consumer Protection, UN Guidelines for Consumer Protection, Consumer Protection and consumerism in India, Consumer Protection Act 1986. Corporate Governance: Meaning, Importance, Reasons for the growing demand for CG- Case Study **(9)**

Industrial Policies & Regulations: Industrial Policy, Industrial Licensing. Competition Law: Competition Act 2002. Patents & Trademarks: Patent Protection in India, The Trade Marks Act 1999. Technological Environment: Innovation, Product and Process innovation, Technology and Competitive advantage- Case Study. **(9)**

Societal Environment: Business Ethics, Business and Culture, Cultural Traits, Technological developments and social change. Social Responsibility of Business: Meaning, Classical and contemporary views, Social Orientations of Business, Factors affecting Social Orientation. Responsibility to different Sections. Social Audit. - Case Study. **(9)**

Globalization: GATT/ WTO/The Uruguay Round, WTO & Developing Countries, WTO and India .MNCs: Definition and Meaning, MNCs & International Trade, MNC's in India. Globalization of World Economy, Globalisation of Business, Stages of Globalisation, Foreign Market Entry Strategies- Case Study. **(9)**

TOTAL : 45

TEXT BOOK

1. Francis Cherunilam, "Business Environment: Text & Cases", Himalaya Publishing, Mumbai,30th Revised Edition, 2022...

REFERENCE BOOKS

1. Justin Paul, "Business Environment", Tata McGraw Hill, New Delhi, Fourth Edition, 2018.

2. *SubbaRao P, "International Business: Text & Cases", Himalaya Publishing, Mumbai, Fifth Edition, 2021.*
3. *Aswathappa K, "Essentials of Business Environment", Himalaya Publishing, Mumbai, Sixteenth Edition, 2023.*

22MDCE03 - LEGAL ASPECTS OF BUSINESS

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Understand the implications of legal laws in improving business practices

CO 2: Ascertain the various Legal business case problems make decisions

CO 3: Analyze the situation of business environment and make business decisions

CO 4: Evaluate the best tax practices for the business in the legal perspectives

CO 5: Create knowledge about the legal perspective of the business

COMMERCIAL LAW

The Indian Contract Act 1872: Definition of contract, essentials, elements and types of a contract, Formation of a contract, performance of contracts, breach of contract and its remedies, Quasi contracts - Contract of Agency: Nature of agency, Creation and types of agents, Authority and Liability of Agent and principal; Rights and duties of principal and agents, termination of agency. Case Study **(9)**

The Sale of Goods Act 1930: Nature of sales contract, documents of title, risk of loss, Guarantees and Warranties, performance of sales contracts, conditional sales and rights of an unpaid seller - Negotiable Instruments Act 1881: Nature and requisites of negotiable instruments, Types of negotiable instruments, liability of parties, holder in due course, special rules for cheque and drafts, discharge of negotiable instruments-Case Study **(9)**

COMPANY LAW

Major principles- Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of directors, winding up of companies, Corporate Governance-Case Study. **(9)**

INDUSTRIAL LAW

An Overview of Factories Act - Payment of Wages Act- Payment of Bonus Act - Industrial Disputes Act-Case Study. **(9)**

GST In India

Introduction – Supply under GST – Charges of GST – Exemptions of GST – Place, Time and Value of Supply – Payment of Tax – Import and Export under GST – Refund under CST - Case Study. **(9)**

Total : 45

TEXT BOOK

1. N.D. Kapoor, *"Elements of Mercantile Law", S*ultan Chand and Sons (P) Ltd ,2023rd Edition ,2023.
2. Mahesh.P.Gour and Bansal.K.M,"*Indirect Tax Laws*", Taxmann Publsiher, Eighth Edition, 2023.

REFERENCE BOOKS

1. P.K. Goel, "*Business Law for Managers*", Dreamtech Press, Second Ediiton, 2022.
2. Akhileshwar Pathack, "*Legal Aspects of Business*", Tata McGraw Hill, Eighth Edition, 2022.
3. P.P.S. Gogna, *"Mercantile Law*", S. Chand & Co Ltd, India, Fifth Edition, 2015..

22MDCE04 - STRATEGIC MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor
ASSESSMENT: **THEORY**

COURSE OUTCOME

CO 1: Identify the organization's internal and external strategically relevant environments

CO 2: Acquire skill and abilities in formulating strategies and strategic plans.

CO 3: Analyze the competitive situation and strategic dilemma in dealing with dynamic global business environment

CO 4: Assess the practical and integrative model of the strategic management process.

CO 5: Evaluate the challenges faced in implementing strategies

Introduction: Nature and Value of Strategic Management, Benefits of Strategic Management, **Strategic Management Process**: Components. **Strategic Intent**: Vision, Mission, objectives and Values. **Strategic Planning Process**: Hierarchal levels of planning, Merits and limitations of Strategic Planning. (9)

External Environment: PESTLE Framework, Michael Porter's Industry Analysis and Competitive Analysis. **Internal Analysis:** SWOT Analysis, Value Chain Analysis, Assessing Internal environment through functional approach, Global Environment. (9)

Generic strategies: Low cost leadership, Differentiation, Focus. **Grand strategies:** Stability, Growth, Retrenchment, Combination strategies. **Functional strategies**: Operations, Finance, Marketing and Human resources (9)

Multi Business Strategy
BCG Growth Share Matrix, IABS matrix, Synergy Approach: Leveraging Core Competencies, **Corporate Parent Role**: Parenting Framework, Patching Approach. (9)

Strategic Implementation: Short term Objectives, Organisational Structure and their strategy, Strategic Leadership and Organisational Culture. **Strategic Control**: Establishing Strategic Controls, Premise Control, strategic surveillance, special alert control, implementation control and Balanced Scorecard methodology. (9)

TEXT BOOK:
1. John.A.Pearce, Richard .B.Robinson and Amita Mital,"*Strategic Management: Planning for Domestic and Global Competition*",Mc.Graw Hill Education, Fourteenth Edition ,2018.

REFERENCE BOOKS:
1. Upendra Kachru, "*Strategic Management*", McGraw Hill Education",Second Edition, 2017..
2. Charles W.L. Hill & Gareth R. Jones, "*Strategic Management-An Integrated Approach" South Western College Publishing*,Tenth Edition,.2012.

22MDCE05 - TECHNOLOGY AND INNOVATION MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Understand how technological innovation diffuse overtime

CO 2: Apply the knowledge of Technology and Innovation to real business cases

CO 3: Analyze the support of the organization for technology innovation

CO 4: Integrate external and internal technologies and innovations

CO 5: Develop Conceptual Knowledge and Practical skill regarding technological innovation

Introduction : The Importance of Technological Innovation - The Impact of Technological Innovation and Society - Innovation by Industry-Case Study. **(9)**

Industry Dynamics of Technological Innovation : Sources of Innovation - Types and Patterns of Innovation - Standards Battles and Design Dominance - Timing of entry-Case Study. **(9)**

Formulating Technological Innovation Strategy : Defining the organization's strategic direction - Choosing innovation projects
- Collaboration strategies - Protecting Innovation-Case Study. **(9)**

Implementing Technological Innovation Strategy : Organising for Innovation - Managing the New Product Development Process - Managing New Product Development Teams-Crafting a Deployment strategy-Case Study. **(9)**

Technology Based Entrepreneurship - Knowledge Spill over Entrepreneurship - Innovation in Large and Small Firms-Case Study. **(9)**

Total : 45

TEXT BOOK

1. Melissa Schilling, "*Strategic Management of Technological Innovation*", Mc.Graw Hill Publications, New York, Seventh Edition, 2023..

REFERENCE BOOKS

1. Scott Shane, "*Handbook of Technology and Innovation Management*", Wiley Publications. First Edition, 2009
2. Henry Chesbrugh, "*Open Innovations"*, Harvard Business School Press, USA, Revised *Edition, 2006.*
3. *Osterwalder and Pigneur, "Business Model Generation", Wiley Hoboken, NI, USA, First Edition, 2010.*

Management: Finance

22MDC11- EQUITY VALUATION

L	T	P	C
3	0	0	3

PREREQUISITE: 22MDC42

ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Understand the various theories of valuation and forecasting

CO 2: Apply techniques learned in the course as these are being used in practice by stock market participants

CO 3: Analyze the environmental context of the company being valued

CO 4: Assess valuation and intrinsic value and explain sources of perceived mispricing

CO 5: Evaluate definitions of value and justify which definition of value is most relevant to public company valuation

Introduction to Valuation and Common Valuation Methodologies - Why Valuation, Various Methods of Valuation, Introduction to Discounted Cash Flow Valuations, Relative Valuations and Other Methods, Advantages and Disadvantages of the various Methods. **(9)**

Discounted Cash Flow Valuation - Introduction to Dividend Discount Model, Free Cash Flow to Firm and Free Cash Flow to Equity Model, Cost of Equity, Cost of Capital, Practical Methods of Cost of Capital Calculations, Interpretation of Capital Asset Pricing Model and other methods of calculating cost of equity, Cash Flow Calculations and Interpretations, Usage of methods based on industries and companies **(9)**

Relative Valuations - Relative Valuation Metrics - Price to Earnings Ratio, Price to Book Ratio, Price to Sales Ratio, Enterprise Value ratios, Exercise on Relative Valuation using Banking Sector. **(9)**

Advanced Valuation Techniques - Introduction to distressed company valuation, Valuation and its applications in Mergers and Acquisitions, Transaction Comparable Methods. **(9)**

Valuation Exercises - Valuation model building using Microsoft Excel for a services company in India, Valuation model building using Microsoft Excel for a manufacturing company in India, including concepts of DCF Valuations and Relative Valuations. Other Exercises - Students to build a detailed model on their own **(9)**

TOTAL : 45

TEXT BOOK:

1.Aswath Damodaran, "*Investment Valuation"*, John Wiley & Sons, Inc., 3rd edition, 2012.

REFERENCE BOOKS

1. Benjamin Graham David Dodd, "*Security Analysis*", Sixth Edition, 2008.
2. John D Stowe et al., "*Equity Asset Valuation*", John Wiley & Sons, Inc., 2nd edition, 2007.
3. *James Valentine, "Best Practices for Equity Research Analysts: Essentials for Buy-Side and Sell-Side Analysts", McGraw Hill, 2011.*

22MDCE12 - CREDIT RISK ANALYTICS AND MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Identify the different types of credit risk and how they arise in a financial institution's various activities.

CO 2: Understand how credit risk can be quantified, monitored and controlled, exploring the role of credit portfolio management tools such as collateral, documentation and credit derivatives

CO 3: Apply best practice tools and techniques for fundamental credit analysis.

CO 4: Blueprint the borrowing needs, making robust risk assessments and making good credit decisions.

CO 5: Measure detailed credit analysis of any company (finance/ non-finance)

Meaning of Credit - Risk of Credit - Credit Market -Advantages and disadvantages of Credit - Credit Research and analysis - Importance of Credit Research. **(9)**

Rating Methodology and players - Different credit rating companies and credit rating scales - Risks in Fixed income and Terminology - Understanding auditors report - Understanding Management Risk - Debt Schedule understanding and interpretation Self sustainable understanding and interpretation - Bank Basel Report. **(9)**

Advance Ratios for Credit analysis : Cash flow, Debt specific, Liquidity - Adjustment in ratios -Credit Rating companies Procedures for comparing financials - CRISIL, ICRA, CARE - Additional comparison between CRISIL,ICRA and CARE. **(9)**

Term sheet understanding for SME and Education rating - SME rating process - Content and structure of credit rating report - Retail credit assessment - Working capital assessment (fund and non-fund based) - Cash flow/fund flow analysis - Credit Pricing. **(9)**

Rating Methodology of different sector : Banking sector, Infrastructure sector, Two wheeler sector and other sectors. **(9)**

Total : 45

TEXT BOOK:

1.Ken Brown and Peter Moles, "*Credit Risk Management"*, Edin burgh Business School, Heriot Watt University, 2013.

REFERENCE BOOKS:

1. Ciby Joseph, "*Advanced Credit Risk Analysis and Management*", Wiley, First Edition, 2013.
2. Arnold Ziegel, "*Fundamentals of credit and Credit analysis*", Create Space Independant Publishing, 2015.
3. Andrew Fight, "*Credit Risk Management*", Elsevier Butterworth-Heinemann, 2004.
4. Harold Scheule, Daniel Rosch and Bart Baesens, "*Credit Risk Analysis - The R Companion*", Wiley Publishers, 2016.

22MDCE13 - INTERNATIONAL FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: 22MDC32, 22MDC42
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Review the problems of dealing in foreign currency and the advantages and disadvantages of Overseas funding

CO 2: Extrapolate an integrative understanding of the foreign exchange market and the relationships Between interest rates, spot and forward rates and expected inflation rates

CO 3: Apply appropriate formats and technologies to financial communication.

CO 4: Analyze, apply and evaluate information within the global financial environment of foreign Exchange to solve problems and make informed decisions.

CO 5: Depict the range of hedging strategies including forward rate hedging and contingent Hedging

Foreign Exchange Market: Spot Market - Forward Market - Currency Futures and options market - Factors Governing Exchange Rate Behaviour - International Swap Market. **(9)**

Purchasing Power Parity Theory - Interest Rate Parity Theory - International Fisher Effect - Arbitrage process (problems). International Monetary System: The gold standard -Free-floating currencies between the wars - Bretton woods. International Financial Institutions: International Monetary Fund (IMF) - The World Bank - International Financial Architecture (IFA). **(9)**

Foreign Exchange Risk and Exposure - Types of Exposure - Translation Exposure -Transaction Exposure - Real Operating Exposure - Management of Exposure. International Capital Budgeting - Evaluating Foreign projects - APV and NPV Technique (Problems). **(9)**

Financing Multinational companies - Long terms Financing - Short Term Financing - Bank Financing - International Banking - Euro Dollars - Euro Currencies. International Working Capital Management - Objectives - International Cash Management - International Receivables Management - International Inventory Management. **(9)**

Foreign Direct Investment - Meaning - Determinants of Foreign Direct Investment - Foreign Portfolio Investment - Multinational Diversification - Forming International Portfolio - International Financial System. **(9)**

Total: 45 Hours

TEXT BOOK

V.K. Bhalla., "*International Financial Management",* Sultan Chand Publising.,Revised Edition e book, 2020.

REFERENCE BOOKS:

1. .Maurice .D. Levi, "*International Finance"*, Roultedge Publisher., Fifth Edition, 2009.
2. Sharan, V., "*International Financial Management"*, Prentice Hall of India Pvt. Ltd., Fouteenth Edition, 2012..
3. MAchiraju and Avadhani, "*International Financial Management'*, Himalaya Publishing House, 2016.

Management: Marketing

22MDCE21 - CUSTOMER RELATIONSHIP MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Critically review and interpret the theoretical aspects of CRM across the main areas of Sales, services and marketing.

CO 2: Ascertain data analysis and generate insights about how to better meet the needs of target segments and individual customers

CO 3: Investigate, analyze, demonstrate and present the salient aspects of a CRM implementation in work related environment

CO 4: Evaluate internal data about customers and analyze for decision making

CO 5: Construct a marketing mix tailored to the needs and interests of target segments and individual customers.

CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs-Case Study. **(9)**

CRM in Marketing - One-to-one Relationship Marketing - Cross Selling &Up Selling - Customer Retention, Behaviour Prediction Customer Profitability & Value Modeling, - Channel Optimization - Event-based marketing.

CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement-Case Study. **(9)**

Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM)-Case Study. **(9)**

Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use- Customer Relationship Analytics in customer service evaluation and supply chain management. **(9)**

CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced

approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement-Case Study. **(9)**

TOTAL: 45

TEXT BOOK:

1.Alok Kumar Rai," *Customer Relationship Management Concept & Cases"*, Prentice Hall of India Private Limited, New Delhi. Second Edition, 2013.

REFERENCE BOOKS

1. S. Shanmugasundaram, "*Customer Relationship Management*", Prentice Hall of India Private Limited, New Delhi, First Edition,2009
2. Kaushik Mukherjee, "*Customer Relationship Management"*, Prentice Hall of India Private Limited, New Delhi, Second Edition ,2009.
3. Jagdish Seth, et al,"*Customer Relationship Management"*. McGraw Hill Publishers, First Edition, 2001
4. V. Kumar & Werner J., "*Customer Relationship Management*,", Springer, Third Edition 2018.

22MDCE22 - BRAND MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Enumerate the key issues in managing a brand portfolio and making strategic brand decisions

CO 2: Demonstrate knowledge of the nature and processes of branding and brand management.

CO 3: Analyze and Discuss contemporary brand related problems and develop appropriate strategies and initiatives.

CO 4: Evaluate the scope of brand management activity across the overall organizational context and analyze how it relates to other business areas.

CO 5: Formulate and justify brand development decisions

INTRODUCTION:

Basics Understanding of Brands - Definitions - Branding Concepts - Functions of Brand -Significance of Brands - Different Types of Brands - Co branding - Store Brands-Case Study. **(9)**

BRAND STRATEGIES

Strategic Brand Management process - Building a strong brand - Brand positioning -Establishing Brand values - Brand vision - Brand Elements - Branding for Global Markets -Competing with foreign brands- Analytics in Brand marketing strategy. **(9)**

BRAND COMMUNICATIONS

Brand image Building - Brand Loyalty programmes - Brand Promotion Methods - Role of Brand ambassadors, celebraties - On line Brand Promotions-Case Study. **(9)**

BRAND EXTENSION

Brand Adoption Practices - Different type of brand extension - Factors influencing Decision for extension - Re-branding and re- launching-Case Study. **(9)**

BRAND PERFORMANCE

Measuring Brand Performance - Brand Equity Management - Global Branding strategies -Brand Audit - Brand Equity Measurement - Brand Leverage -Role of Brand Managers- Branding challenges & opportunities - Case Studies. **(9)**

TOTAL : 45

TEXT BOOK:

1. Kevin Lane Keller, "*Strategic Brand Management: Building, Measuring and Managing*", Prentice Hall, Fifth Edition Edition,2020

REFERENCE BOOKS:

1. Moorthi.YLR, "*Brand Management*", Vikas Publishing House, First Edition, 2012.
2. Kirti Dutta, "*Brand Management"*, Oxford Press, Second Ediiton, 2022.
3. Ram Kishen, "*Strategic Brand Management"*, Ane Books Pvt Ltd, First Edition, 2013.
4. Harsh.V.Verma, "*Brand Management",* Excel Books, Fourth Edition,2017.

22MDCE23 - MARKETING ANALYTICS

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Assess the use marketing analytics to predict outcomes and systematically allocate resources.

CO 2: Measure customer lifetime value and improve Customer Retention

CO 3: Analyze and Interpret outputs using regression and explore confounding effects and biases

CO 4: Evaluate strategic marketing alternatives based on whether they improve customer retention and lifetime value

CO 5: Design and conduct effective experiments that test your marketing campaigns--and then use the results to make future marketing decisions.

Marketing Analytics: Introduction to the marketing process-Resource Allocation–Steps in Resource Allocation–Resource Allocation and New product performance–Measuring ROI– UsingText Analytics to improve marketing strategy-Use case for Resource allocation and ROI **(9)**

Cluster Analysis: Customer Segmentation – Bases of Segmentation – Cluster Analysis in Segmentation – Steps in Cluster Analysis – Use Case for Cluster Analysis in segmenting customers – Multiple Regression in Marketing Mix models – Elasticity Models – Building a Comprehensive model – Variables of Comprehensive models–Koyck Model – Use Case for Application of Marketing Mix Elements . **(9)**

Customer Lifetime value: Quantifying customer relationship – Cohort and Incubate - CLV Model – Calculating CLV – Limitations of CLV Model –Model Based on Purchase occasion rate - Prospect Life Time Value –Issues with PLV- Customer Retention and CLV – Use case for application of CLV. **(9)**

Determining Cause and Effect through Experiments-Designing Basic Experiments-Designing Before - After Experiments-Designing Full Factorial – Field Experiments - Web Experiments – Designing an Experiment - Analyzing an Experiment - Pitfalls of Marketing Experiments - Maximizing Effectiveness: - Use Case in application of experimentation. **(9)**

Automation of Marketing Models: Marketing and Artificial Intelligence – Applications of AI to Marketing. Implementing Marketing Analytics: Organization Structure – Function and Process – Organization Metrics – Business Cycle and Marketing Cycle match – Marketing collaboration and Technology – Analytics process – Organization change – Use case in AI application in Marketing. **(9)**

Total: 45 Hours

TEXT BOOK

1. Rajkumar Venkatesan, Paul.W.Farris and Ronald . T.Wilcox, "*Marketing Analytics: Essential tools for Data Driven Decisions",* Darden Business Publiching, University of Virgina Press, London, First Edition,2021.

REFERENCE BOOKS

1. Mike Grigsby, Marketing Analytics : A Practical Guide to Improving Consumer Insights using Data Techniques, Kogan Page Publisher, Third Edition,2022.
2. Moutusy Maity and Pavankumar Gurazada, Marketing Analytics, Oxford University Press, First Edition, 2021.
3. Mirza Rahim Baig, Gururajan Govindan and Vishwesh Ravi Shrimali, Data Science for Marketing Analytics, Packt Publishing,Second Edition, 2021.

Management: Human Resources

22MDCE31 - STRATEGIC HUMAN RESOURCE MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Add the ability to manage global HR and manage and train the international employees.

CO 2: Derive HR activities with overall organizational strategy by developing, planning and applying contextualized Strategic solutions to specific organizational human resource challenges

CO 3: Analyze organizational and human resource strategies, and perform a strategic gap analysis

CO 4: Measure and quantify the contribution of HR activity at an organizational level

CO 5: Depict the differing strategic contributions of particular HR disciplines

Strategic Role of HRM - Planning and Implementing Strategic HR Policies - HR Strategies to increase firm performance - CaseStudy. **(9)**

Investment perspectives of HR -Investment Considerations - Investment in Training and Development - Investment Practices for improved Retention - Investments Job Secure work courses -Non traditional investmentapproaches-CaseStudy **(9)**

Managing Strategic Organizational Renewal - Managing change and OD - Instituting TQM Programmes - Creating Team Based Organizations - HR and BPR - Flexible work arrangement - Case Study **(9)**

Establishing Strategic Pay plans - Determining periods - Establishing Periods - Pricing Managerial and Professional Jobs - Compensation trends - Objectives of international compensation - Approaches to international compensation - Issues related to double taxation - Case Study. **(9)**

Managing Global Human Resources - HR and the internationalization of business - Improving international assignments through selections - Training and maintaining international employees - Developing international staff and Multinational teams - Strategic alliances -Sustainable global competitive advantage - Location of production facilities - Repatriation process- Case Study. **(9)**

TEXT BOOK

TOTAL : 45 HOURS

1. Charles R. Greer, "*Strategic Human Resource Management*", Pearson Education, Second Ediiton,2003

REFERENCE BOOKS

1. Rajini.G, "*Strategic Human Resource Managemen"t*, Lap Lambert Academic Publishing , First Edition,2011

2. Jeffrey.A.Mello, "*Strategic Human Resource Management"*, Cengage India Private Ltd, Fourth Edition,2019.
3. Mathur.S.P, "*Strategic Human Resource Management",* New Age International Pvt Ltd Publishers, First Edition, 2015.
4. Ashvine Kumar, "*Strategic Human Resource Management"*, Book Rivers 2022.

22MDCE32 - PERFORMANCE MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITES: **Consent of the Instructor**
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Define attributes of effective performance management systems.

CO 2: Construct an organization's performance management process that is compliant with law and supports organizational mission and strategy

CO 3: Select the necessary characteristics of accurate performance management tools.

Detect effective performance management policies and practices to improve organizational and employee performance

CO 4:

CO 5: Devise and sustain arguments for using appropriate performance management techniques, rewards and sanctions to improve performance.

Introduction to Performance Management: Definition of performance evaluation-Evolution of Performance management- Definitions and differentiation of terms related to performance management-Importance of performance management-Linkage of performance management to other HR processes-Case Study. **(9)**

An Overview of Performance Management: Aim and Purpose of Performance Management-Employee engagement and performant ce management - Principles of Performance management - Overview of performance management as a system - Dimensions of Performance management-CaseStudy. **(9)**

Theoretical Framework of Performance Management: Goal Theory, Control theory, Social Cognitive theory, Organizational justice theory and its applications in Performance Management-Case Study. **(9)**

Process of Performance Management: Overview of performance management process-Performance management process- Performance management planning process-Mid-cycle review process-End cycle review process-Performance management cycle at a glance. Planning and Development: Introduction - Performance management planning - The planning process- Performance Agreement-Drawing up the Plan-Evaluating the Performance Planning process-Case Study. **(9)**

Mechanics of Performance Management Planning and Documentation : The need for structure and documentation - Manager's responsibility in performance management planning and creation of performance management-Performance management process through automation-Issues in Performance management-Predictive analytics in identifying and analyzing lead and lag indicators for performance management. **(9)**

TOTAL : 45

TEXT BOOK:

1. Herman Aguinis, "*Performance Management*", SAGE Publications Inc,, FOURTH Edition, 2023.

REFERENCE BOOKS:

1. James.W.Smither and Manuel London, :"*Performance Management"*, Jossey-Bass ,Wiley Imprint, First Edition, 2009.
2. Rao.T.V," *Performance Management"*, SAGE Publications, Second Edition, 2016.
3. Robert Bacal, "*Performance Management"*, Tata McGraw Hill Publishers,Second Edition, 2012.
4. Linda Ashdown, "*Performance Management",* Kogan Page, Second Edition, 2018.

2MDCE33 - COMPENSATION MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Understand the financial and non-financial compensation fixed for executives in an organization

CO 2: Attain a clear idea in fixing the remuneration principles in the company

CO 3: Analyze the pay relationship with job, skills, competencies in an organization

CO 4: Evaluate the legal framework and the pay structure of the organization in comparison to the competitors.

CO 5: Promote knowledge in the issues related to compensation in the organization.

Introduction: Compensation Defined, Goals of Compensation System, Compensation Strategy Monetary & Non- Monetary Rewards, Intrinsic Rewards Cafeteria Style Compensation, Fringe Benefits and Supplementary Compensation-Case Study **(9)**

Internal Alignment: Definition of internal alignment, Internal pay Structures, Strategic choices in internal alignment design, choosing the best internal structure - Job evaluation: Major decisions in job evaluation, Job Evaluation Methods, Final result-Person-based structures: Salary Slabs, Flexible Structure, Salary Trends-CaseStudy **(9)**

Determining External Competitiveness: Definition of Competitiveness, Factors influencing compensation level - Legal framework: Payment of Wages Act, 1936, Minimum Wages Act, 1948, Payment of Bonus Act, 1965, Equal Remuneration Act, 1976-Case Study **(9)**

Reward and Compensation St**rategies:** Performance based pay, Skill based pay, Team based pay,Broad banding, Profit sharing -Compensation& Payroll: Basic, HRA, Variable pay, Designing PF Plans -Case Study **(9)**

Executive Compensation: Concepts, components, incentives, executive compensation in Indian context - Leave Policy: Scope, Types, Process-Personal income tax implications of salary: sec 88, 54E, 80C, Companies Act provisions relating to remuneration for senior executives-Analytics in identifying Lead and Lag indicators for compensation management. **(9)**

TOTAL : 45 HOURS

TEXT BOOK

1. Sharma.R.C and Sulabh Sharma, "*Compensation Managemen"t*, SAGE Publications, First Edition,2019.

REFERENCE BOOKS

1. Dipak Kumar Bhattacharyya, "*Compensation Management"*, Oxford University Press, Second Ediiton, 2014.

2. Kanchan Bhatia, "*Compensation Management"*, Himalaya Publsihing House,First Edition, 2019.

3. Alka Agarwal, "*Compensation Management"*,Galgotia Publsihing Company,First Edition,2022.

Management: Operations & Logistics

22MDCE41 - TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Learn the applications of quality tools and techniques in both manufacturing and service industry

CO 2: Determine analytical skills for investigating and analyzing quality management issues in the industry and suggest implement able solutions to those

CO 3: Detect an understanding on quality management philosophies and frameworks

CO 4: Attain an in-depth knowledge on various tools and techniques of quality management.

CO 5: Design the quality framework for a company

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality - Case Study **(9)**

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating - Case Study. **(9)**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types- Case Study (**9)**

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures - Case Study **(9)**

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, QualityAuditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors - Case Study. **(9)**

Total : 45 HOURS

TEXT BOOK:

1. Senthil Arasu.B and Praveen Paul. J, "*Total Quality Management*", Scitech Publications (India) PVT Ltd, Revised Second Edition, 2015.

REFERENCE BOOKS

1. Dale.H.Besterfield, et al, "*Total Quality Management*", Pearson Edn, Asia, Fifth Edition, Indian Reprint, 2018.
2. Vijayan.V and Ramakrishnan.H, "*Total Quality Management"*, Sultan Chand and Sons, First Edition,2014..
3. Mukherjee.P.N, "*Total Quality Management"*, Prentice Hall India Learning Pvt Ltd, First Edition,2006.

22MDCE42 - LOGISTICS STRATEGY AND PLANNING

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT : THEORY

COURSE OUTCOME

CO 1: Understand different modes of transportation and inter-models

CO 2: Determine optimal batch sizes and propose optimal transport routes

CO 3: Analyze and design the optimal logistics customer services levels

CO 4: Evaluate and make logistical planning and Strategy framework

CO 5: Design and allocate storage location for products in the warehouse.

Introduction to Logistics : Introduction to Logistics - Scope of logistics in business, Logistics and Supply Chain Management, Core and support activities of logistics; Logistical integration hierarchy; Integrated Logistics; Operating objectives; Barriers to internal integration; Logistical performance cycles; Supply chain relationships - Channel participants, Channel structure, Basic functions, Risk, power and leadership-Case Study. **(9)**

Logistics Systems Design : Logistics system design -Logistics reengineering, Logistical environmental assessment, Time based logistics, Anticipatory and Response based strategies, Alternative strategies, Logistical operational arrangements, Time based control techniques;Integration theory-Location structure, Transportation economies, Inventory economies,Formulating logistics strategy-CaseStudy. **(9)**

Logistics Strategy and Planning **:** Logistics strategy and planning - Logistics planning triangle, Network appraisal; Guidelines for strategy formulation - Total cost concept, Setting customer service level, Setting number of warehouses in logistics system, Setting safety stock levels, Differential distribution, Postponement, Consolidation, Selecting proper channel strategy-Case Study. **(9)**

Inventory, Purchasing and Location Decisions : Inventory and purchasing decisions; Multi facility location problems - Exact method, Heuristic methods, other methods; Logistics planning and design - Feasibility analysis, Project planning, Assumptions and data collection, Analysis, Development of recommendation, Implementation-Case Study **(9)**

Logistics planning and design : Planning and design techniques - Logistics adhoc analysis, Location analysis, Inventory analysis, Transportation analysis-Logistics Analytics **(9)**

TOTAL : 45 HOURS

TEXT BOOK

1. Bowersox & Closs, " *Logistical Management: The Integrated Supply Chain Process*", McGraw-Hill Companies, Third Edition, 1996..

REFERENCE BOOKS

1. Muthu Mathirajan, Parasuram Balasubramanion et al, "*Analytics in Operations/Supply Chain Management"*, I.K. International Publishing House Pvt Ltd., 2015.
2. David J Bloomberg, *"Logistics*", Pearson Education, 1st Ed, 2015.
3. Ganapathi SL, Nandhi SK, *"Logistics Management"*, Oxford University Press India, 2015.

22MDCE43 - SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

PRE-REQUISITES: Consent of the Instructor
ASSESSMENT: THEORY

COURSE OUTCOME

CO 1: Understand fundamental supply chain management concepts

CO 2: Ascertain the management of supply chain with corporate goals and strategies

CO 3: Analyze and improve supply chain process

CO 4: Evaluate and manage an effective supply chain

CO 5: Compile the importance of the supply chain analytics and optimization

Concepts of Supply Chain : Understanding supply chains - Supply chain decisions - Enablers and Drivers of Supply Chain Performance - Assessing and Managing Supply chain Performance - Supply chain metrics and Financial metrics relationship - Supply chain Processes and Strategies - Importance of Supply Chain Management-Service and manufacturing supply chain dynamics - Manufacturing supply chains - Bullwhip effect. **(9)**

Forecasting Drivers of Supply chain Performance : Forecasting introduction - Framework for a forecast system - Choosing right forecasting technique - Judgment methods (Composite Forecasts, Surveys, Delphi Method, Scenario Building, Technology Forecasting, Forecast by Analogy) - Causal methods (Regression Analysis -Linear & Non-Linear Regression, Econometrics) - Time series analysis (Autoregressive Moving Average (ARMA), Exponential Smoothing, Extrapolation, Linear Prediction, Trend Estimation, Growth Curve,Box – Jenkins Approach)CPFR **(9)**

Inventory management methods in supply chain **:** Decision framework for inventory management - Preliminary modelling, Two critical and ABC analysis -Single item, Single period problem - Single item, multi period problem - Multi item inventory models - Multi-echelon inventory system. Transportation Decision in Supply Chain: Motor carrier freight - Truck load mode - Steeping back - Building A Rate Model using LTL service - Rail and Cargo. Location and Distribution Decision in Supply Chain : Modelling with binary variables - Supply Chain network optimization - Risk pooling - Continuous location models: Gravity, iterative method - Multiple facility location. **(9)**

Supply Chain Processes and Strategies : Integrated supply chains design - Customer relationship process - Order fulfillment process - Supplier relationship process - Supply chain strategies - Strategic focus - Mass customization - Lean supply chains - Outsourcing and offshoring - Virtual supply chains.Resource planning and scheduling: Enterprise resource planning - Planning and control systems for manufacturers - Materials requirement planning - Drum - Buffer - Rope system - Scheduling - Scheduling service and manufacturing processes - Scheduling customer demand - Scheduling employees - Operations scheduling-Analytics for sequencing and scheduling **(9)**

Supply Chain Analytics : Understanding and defining supply chain analytics- Importance of analytics in

supply chain management Supply chain analytics in the flow involving material, money, information and ownership - Key issues in supply chain analytics. **(9)**

TOTAL: 45 HOURS

TEXT BOOK

1. Ravi Ravindran.A and Donald.P.Warsing, "*Supply Chain Engineering Models and Applications*", CRC press: Taylor and Francis Group, 2013.

REFERENCE BOOKS

1. Sunil Chopra, Peter Meindl & D.V. Kalra, "*Supply Chain Management: Strategy, Planning and Operation*", Pearson Education; 7th Edition. 2019
2. Christopher Martin, "*Logistics and Supply Chain Management*", Pearson Education Asia, Fifth Edition, 2016..
3. David Simchi-Levi, Ravi Shankar, "*Designing and Managing Supply Chain concepts, Strategies and Case Studies*", McGraw Hill Publication, Fourth Edition, 2022.

Advanced Analytics and Intelligent Systems

22MDCE51 - GRAPH THEORY FOR DATA SCIENCE

PRE- REQUISITES

Consent of the Instructor

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: *Describe various fundamental terminologies of graph theory with examples*

CO2: Categorize the Spanning trees, connectivity, circuits and planarity of graphs

CO3: Apply matrices in studying properties of coloring and directed graphs

CO4: Analyze various properties of graphs like connectedness, spanning trees and so on using algorithms including shortest path, DFS and planarity testing.

INTRODUCTION

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness – Components – Euler Graphs – Hamiltonian Paths and Circuits – Trees Properties of trees – Distance and Centers in Tree – Rooted and Binary Trees. (9)

TREES, CONNECTIVITY, PLANARITY

Spanning trees – Fundamental Circuits – Spanning Trees in a Weighted Graph – CutSets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets –Connectivity and Separability – Network flows – 1-Isomorphism – 2-Isomorphism –Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planar Graph. (9)

MATRICES, COLOURING

Incidence matrix – Submatrices – Circuit Matrix – Path Matrix – Adjacency Matrix –Chromatic Number – Chromatic partitioning – Chromatic polynomial – Matching –Covering – Four Color Problem. (9)

DIRECTED GRAPH

Directed Graphs – Types of Directed Graphs –Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs –Adjacency Matrix of a Digraph. (9)

ALGORITHMS

Connectedness and Components – Spanning tree – Finding all Spanning Trees of a Graph – Set of Fundamental Circuits – Cut Vertices and Separability – Directed Circuits. Shortest Path Algorithm – DFS – Planarity Testing – Isomorphism. (9)

TOTAL : 45

TEXT BOOKS

1. *NarsinghDeo, Graph Theory with Application to Engineering and Computer Science,Prentice Hall of India, 2003.*

REFERENCE BOOKS

1. *R.J. Wilson, "Introduction to Graph Theory", 4th Edition, Pearson Education, 2003.*
2. *J.A.Bondy and U.S.R.Murty, "Graph Theory with Applications", Publishing, 1982.*

22MDCE52 - HEALTHCARE ANALYTICS

L	T	P	C
3	0	0	3

PRE- REQUISITES
Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: To impart the fundamental concepts of healthcare data analytics

CO2:: To process the different types of healthcare data stored in health data sources.

CO3: To apply the appropriate biomedical image and text analysis techniques for analyzing biomedical image and clinical text data

CO4: To generate the prediction health care model using temporal, sensor and text mining techniques.

CO5: To implement the Applications and Practical Systems for Healthcare.

INTRODUCTION
Introduction- Healthcare Data Sources and Basic Analytics - Healthcare Data Sources: Electronic Health Records: Components of HER- Coding system- Benefits of EHR - Barriers to Adopting EHR - Challenges of Using EHR Data. (8)

HEALTHCARE DATA SOURCES
Biomedical Image Analysis-Biomedical Imaging Modalities, Object Detection, Image Segmentation, Image Registration, Feature Extraction. Natural Language Processing and Data Mining for Clinical Text-Natural Language Processing, Mining Information from Clinical Text, Challenges of Processing Clinical Reports, Clinical Applications. (8)

HEALTHCARE DATA ANALYTICS
Social Media Analytics for Healthcare- Social Media Analysis for Detection and Tracking of Infectious Disease Outbreaks, Social Media Analysis for Public Health Research, Analysis of Social Media Use in Healthcare. (8)

ADVANCED DATA ANALYTICS FOR HEALTHCARE
Temporal Data Mining for Healthcare Data-Association Analysis, Temporal Pattern Mining, Sensor Data Analysis, Other Temporal Modelling Methods. Information Retrieval for Healthcare-Knowledge-Based Information in Healthcare and Biomedicine, Content of Knowledge-Based Information Resources, Indexing, Retrieval, Evaluation. Privacy-Preserving Data Publishing Methods in Healthcare- Data Overview and Pre-processing, Privacy-Preserving Publishing Methods, Challenges with Health Data. (12)

APPLICATIONS AND PRACTICAL SYSTEMS FOR HEALTHCARE
Fraud Detection in Healthcare, Mobile Imaging and Analytics for Biomedical Data-Image Formation, Data Visualization, Image Analysis, Image Management and Communication. (9)

TOTAL : 45

TEXT BOOK

1. Chandan K. Reddy and Charu C. Aggarwal, "HealthCare Data Analytics", CRC Press.

REFERENCE BOOKS

1. Laura B. Madsen, "Data-Driven Healthcare: How Analytics and BI are Transforming the Industry", Wiley and SAS Business Series, 2014.

2. Trevor L. Strome, "Healthcare Analytics for Quality and Performance Improvement", John Wiley & Sons, Inc., 2013.

22MDCE53- SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Work on the internal components of the social network.

CO2:: Model and visualize the social network.

CO3: Mine the behavior of the users in the social network.

CO4: Predict the possible next outcome of the social network.

CO5: Preserving privacy in social networks and real time social network applications.

INTRODUCTION

Introduction to Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks **(9)**

MODELING AND VISUALIZATION

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data - Random Walks and their Applications -Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

(9)

MINING COMMUNITIES

Aggregating and reasoning with social network data, Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities - Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks. **(9)**

EVOLUTION

Evolution in Social Networks - Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation - Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

(9)

PRIVACY IN SOCIAL NETWORKS AND APPLICATIONS

Introduction - Privacy breaches in Social Networks - Privacy definitions for publishing data - privacy preserving mechanisms. APPLICATION: A learning based approach for Real Time Emotion Classification of Tweets - Assessing the opinion of users in Social Network environments. **(9)**

TOTAL: 45

TEXT BOOKS

1. Peter Mika, “Social Networks and the Semantic Web”, Springer, 1st edition, 2007.

2. Borko Furht, “Handbook of Social Network Technologies and Applications, Springer”, 1st edition, 2011.

3. Charu C. Aggarwal, “Social Network Data Analytic”, Springer; 2014.

REFERENCE BOOKS

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2012
2. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010.
3. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking - Techniques and applications”, Springer, 1st edition, 2012
4. Przemyslaw Kazienko, Nitesh Chawla,”Applications of Social Media and Social Network Analysis”, Springer, 2015 CP5007 BIO-INSPIRED CO.

22MDCE54 – NATURAL LANGUAGE PROCESSING

PRE- REQUISITES
Consent of the Instructor

ASSESSMENT: THEORY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO1: *Describe the mathematical and linguistic foundations, underlying approaches to the areas in NLP.*

CO2:: *Apply Hidden Markov Model for Word Processing and Speech Recognition.*

CO3: *Evaluate approaches to syntax, semantic and pragmatic processing in NLP.*

CO4: *Design models using CFG, PCFG, Lexical and Computational concepts for syntax and semantic processing based applications*

CO5: *Design, implement and test algorithms for NLP problems.*

INTRODUCTION

Knowledge in Speech and Language processing - Ambiguity - Models and Algorithms - Language, Thought and Understanding - Brief History.
Words and Transducers : Finite-State Morphological Parsing - Building a Finite-State Lexicon - Finite-State Transducers - Sequential Transducers and Determinism - FSTs for Morphological Parsing -Transducers and Orthographic Rules – Combining FST Lexicon and Rules - Lexicon-Free FSTs -Word and Sentence Tokenization -Detecting and Correcting Spelling Errors - Minimum Edit Distance. **(9)**

WORDS PROCESSING

N-grams : Counting words - Training and test sets - Evaluating N-grams - smoothing. Parts-of speech tagging : English word classes - Tagsets - POS tagging - Rule based POS tagging - HMM POS tagging - Transformation based tagging - Evaluation and error analysis. Hidden Markov Model : Markov chains - HMM - Forward algorithm - Viterbi algorithm - Training HMM. **(9)**

SYNTAX

Formal grammars of English: Context free grammars - Grammar rules - Treebanks - Normal forms - Finite state and CFG - Dependency grammar - spoken language syntax. Parsing with CFG: Parsing as search - Ambiguity - Dynamic programming parsing methods. Statistical Parsing: Probabilistic CFG - Probabilitic CKY parsing - Problems with PCFGs - Improving PCFGs. **(9)**

SPEECH

Phonetics: Articulatory phonetics - Phonological categories. Speech Synthesis: Text normalization - Phonetic analysis – Prosodic analysis. Automatic Speech Recognition: Architecture - HMM to speech - Feature extraction - Lexicon and Language model - Search and Decoding - Embedding training - Evaluation. **(9)**

SEMANTICS, PRAGMATICS AND APPLICATIONS

Representing meaning – Semantic Analysis - Lexical semantics
Applications: Information Retrieval – Statistical Alignment and Machine Translation – Text Categorization. **(9)**

TOTAL : 45

TEXT BOOK

1. *Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice-Hall, Upper Saddle River, NJ, 2000. (Para 1,2,3,4)*
2. *Manning, Christopher D. and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press., Cambridge, MA:, 1999. (Para 5)*

REFERENCE BOOKS

1. *James Allen,"Natural language Understanding", Pearson Education, Second Edition, 1994.*
2. *Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O_Reilly Media, 2009.*
3. *Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.*

Distributed and Network Systems

22MDCE61 BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Explain the basic components of a blockchain, its operations, underlying algorithms, and essentials of trust.

CO2: Explain the working of Bitcoin and Ethereum blockchains.

CO3: Explain the role of cryptography in securing blockchain.

CO4: Apply the learning of solidity and develop smart contracts

CO5: Develop decentralized apps on Ethereum.

INTRODUCTION

Basics of Distributed Computing - Consensus Mechanisms - Decentralization - Applications of Blockchain - Scalability and Challenges. **(7)**

BITCOIN BLOCKCHAIN

Introduction - working of bitcoin - Reference Implementation - Keys and Addresses - Wallets. **(10)**

BITCOIN BLOCKCHAIN MINING

Transactions - Scripting - Bitcoin Network - Mining and Consensus. **(9)**

ETHEREUM BLOCKCHAIN

Basics - Ethereum Clients - Ethereum Networks - Ethereum Addresses - Wallets - Transactions - Smart Contract Security. **(9)**

SMART CONTRACTS

Basics - Life Cycle of a Smart Contract - Building a Smart Contract with Solidity - programming with Solidity - Gas Considerations. **(10)**

TOTAL : 45

TEXT BOOKS

1. Imran Bashir, "*Mastering Blockchain*", Packt Publishing, First Edition, 2017. (Para 1).

2. Andreas M. Antonopoulos, "*Mastering Bitcoin - Programming the open Blockchain*", O'Reilly, 2017.(Para 2,3).

3. Andreas M. Antonopoulos Dr. Gavin Wood, "*Mastering Ethereum - Building Smart Contracts and DApp*", O'Reilly, 2019. Para (4,5).

REFERENCE BOOKS

1. Saifedean Ammous, "The Bitcoin Standard: The Decentralized Alternative to Central Banking", Wiley, 2018.

2. Lorne Lantz, Daniel Cawrey, "*Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications"*, O'Reilly, 2020.

3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "B*itcoin and Cryptocurrency Technologies*", Princeton University Press, 2016.

22MDCE62 - DISTRIBUTED COMPUTING

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Describe the hardware and software concepts needed for distributed system model
CO2: Compare Remote Procedure Call and Remote Method Invocation from the perspective of developing distributed applications
CO3: Describe the role of the components of distributed Operating System
CO4: Explain the concurrency control mechanism for distributed transactions

INTRODUCTION

Definition, Goals, Hardware Concepts, Software Concepts, The Client-Server Model. **(4)**

COMMUNICATION

Layered Protocols, Remote Procedure Call, Remote Object Invocation - Java RMI - Distributed Objects - The Roles of Client and Server, Remote Method Calls, The RMI Programming Model, Parameters and Return Values in Remote Methods, Remote Method Activation. Message-Oriented Communication, Stream-Oriented Communication **(12)**

PROCESSES

Threads, Clients, Servers, Code Migration, Software Agents, Naming - Naming Entities, locating Mobile Entities, Removing Unreferenced Entities **(10)**

SYNCHRONIZATION

Clock Synchronization, Logical Clocks- Distributed Transactions- Consistency and Replication - Introduction, Distributed Protocols **(12)**

EXAMPLES OF DISTRIBUTED SYSTEMS

CORBA, Sun Network File System, Jini **(9)**

Total 45 Hours

TEXT BOOKS

1. Andrew S. Tanenbaum, Maarten van Steen, “Distributed Systems - Principles and Paradigms”, Prentice Hall of India, 3rd edition 2017. Para(1,3,4,5)

2. Cay S.Horstmann, Gary Cornell, “*Core Java - Volume II - Advanced Features*”, Eighth Edition, Prentice Hall, 2008. Para (2)

22MDCE91 - EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Assess the 8051-microcontroller architecture and the instruction set.

CO2: Demonstrate knowledge of inter-process communication developed for multi-processor systems.

CO3: Design simple embedded systems comprising CPU, Memory, Timer, Interrupt and I/O ports.

CO4: Demonstrate knowledge of Real-time operating system and paradigms for Embedded systems.

CO5: Recognize the development tools and debugging techniques.

INTRODUCTION TO EMBEDDED SYSTEMS

Microprocessors vs Microcontrollers – RISC vs CISC - Embedded System: Definition – Software and Hardware Units of Embedded System – Examples – Introduction to INTEL 8051 Microcontroller – 8051 Architecture: CPU, Oscillator, On Chip RAM and ROM, Timers, Interrupts, IO and Serial ports, Registers and SFRs **(9)**

MICROCONTROLLER PROGRAMMING TECHNIQUES

8051 Addressing Modes – Instruction Set: Arithmetic, Logical and Branching Instructions - 8051 Programming techniques: Timer, IO, Interrupt and Serial port programming models **(10)**

INTER PROCESS COMMUNICATION

Device Drivers and Interrupt Servicing Mechanism – Program Modeling Concepts in Single and Multiprocessor Systems – IPC and Synchronization of Processes, Tasks and Threads **(9)**

REAL TIME OPERATING SYSTEM

Operating System Vs Real Time Operating System – RTOS: Definition – Services – Process Management – Memory Management – Device Management – Interrupt Routines in RTOS Environment – RTOS Task Scheduling Models – Interrupt Latency and Response Time of Tasks. **(9)**

SOFTWARE AND HARDWARE TOOLS

Embedded Software Development Tools – Debugging Techniques – Real Time Examples **(8)**

TOTAL : 45 HOURS

TEXT BOOKS

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First re print Oct. 2003

2. Muhammad Ali Mazidi, Rolin McKinlay, Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems Using Assembly and C 2 Edition, Pearson, 2007

REFERENCE BOOKS

1. David E Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint, 2000

2. Kenneth J Ayala, The 8051 Microcontroller Architecture, Programming and Applications, Second Edition, Thomson Delmar Learning, 2006

22MDCE92 SENSING AND SENSORS

L	T	P	C
3	0	0	3

PRE-REQUISITES
Consent of the Instructor

ASSESMENT: THEORY

COURSE OUTCOMES

- Assess the characteristics of the analog and digital sensors.
- List the sensing requirements of proposed applications of robotics
- Gain knowledge on the dynamic characteristics of the industrial sensors.
- Analyse and realize the sensor specifications in real-time applications.

Sensor Characteristics: Introduction - Transfer Function – Calibration - Computation of Stimulus – Static and Dynamic characteristics and errors. **(7)**

Physical Principles of Sensing: Electric Charges, Fields, and Potentials – Magnetism – Induction – Resistance - Piezoelectric Effect - Pyroelectric Effect - Hall Effect - Sound Waves - Temperature and Thermal Properties of Materials - Heat Transfer – Light - Dynamic Models of Sensor Elements **(11)**

Interfacing sensors to the System: Optical Components of Sensors -Interface Electronic Circuits **(8)**

Dynamic characteristics Measurement: Occupancy and Motion Detectors – Position, Displacement and Level Detectors – Force, Strain and Tactile sensors **(8)**

Radiation and Chemical Sensors: Radiation Detectors: Scintillating Detectors - Ionization Detectors - Cloud and Bubble Chambers - Chemical Sensors: Characteristics – classes – Biochemical sensors – Multi-sensor arrays – Difficulties – Participatory Sensing, Industrial IoT and Automotive IoT - Actuator **(11)**

TOTAL HOURS:45

TEXT BOOK

1. Jacob Fraden, “Handbook of Modern Sensors: Physics, Designs, and Applications”, 4th Edition, Springer, 2010.
2. Raj Kamal, “Internet of Things - Architecture and Design Principles”, McGraw Hill,2017

REFERENCE BOOKS

1. John Vetelino, AravindReghu, "Introduction to Sensors", CRC press,2011.
2. D. Patranabi, "Sensors and Transducers", PHI,2003.

22MDCE93 INTERNET OF THINGS

L	T	P	C
3	0	0	3

PRE-REQUISITES
22MDC53, 22MDCE91, 22MDCE92

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: *Recognize the challenges for smart object*

CO2:: *Given an application, assess the different IoT technologies that suits the application*

CO3: *Demonstrate knowledge of MAC and routing protocols developed for Low Power and Lossy networks*

CO4: *Design simple IoT systems comprising sensors, edge devices, wireless network connections and data analytics capabilities*

CO5: *Demonstrate knowledge of main architectures and paradigms for the Internet of Things*

INTRODUCTION
Smart Objects - Challenges for Smart Objects - IP for Smart Objects: motivation and main challenges - Security for Smart objects - Web services for Smart Objects - Connectivity models for Smart Object Networks - Introduction to the Internet of Things: application scenarios, current solutions. **(9)**

SMART OBJECTS AND LLNS
Hardware and Software - Energy Management - Communication for Smart Objects: IEEE 802.15.4: main features, topologies, addressing and MAC frame format - Low Power and Lossy Networks (LLN): Introduction to 6LoWPAN - 6LoWPAN architecture: simple, extended and ad-hoc networks - 6LoWPAN adaptation layer -Issues in determining IPv6 links in LLNs - IPv6 addressing in 6LoWPAN- 6LoWPAN forwarding: route-over and mesh under approaches - Neighbor Discovery optimizations and extensions to the ND protocol for 6LoWPAN networks. **(11)**

ROUTING IN LOW POWER AND LOSSY NETWORKS
Mesh-under and route-over solutions - Routing Requirements - Routing metrics - The IPv6 Routing Protocol for LLNs (RPL)- Protocol operation - use of destination oriented directed acyclic graphs - DODAG formation - RPL Messages **(9)**

CoAP
Interaction model - Messages and Request/Response Model - Resource observing - Service discovery - Resource discovery - CORE Link Format **(9)**

APPLICATIONS
Smart Cities and Urban automation - Home Automation -Building Automation -Structural Health Monitoring **(7)**

TOTAL: 45 HOURS

TEXT BOOKS

1. *J.-P. Vasseur, A. Dunkels, "Interconnecting Smart Objects with IP: The Next Internet", Morgan Kaufmann, 2010.*

REFERENCE BOOKS

1. Z. Shelby, C, "Bormann. 6LoWPAN: The Wireless Embedded Internet", Wiley, 2009
2. Z. Sahelby, K. Hartke, K. Hartke, "The Constrained Application Protocol (CoAP)", RFC 7252, 2014.

Software Engineering

22MDCE71 - SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Analyze different approaches to identify software defects and develop testing plans based on v-model.
CO2: Describe and distinguish among the different types and levels of testing.
CO3: Design and develop black box and white box testing techniques, test cases, test data and conduct test operation at various testing levels for given testing requirements.
CO4: Apply different approaches of quality management and quality assurance.
CO5: Implement various test processes for quality improvement.

INTRODUCTION

The Role of Process in Software Quality - Testing as a Process - Overview of the Testing Maturity Model (TMM)-Basic Definitions-Software Testing Principles-Origin of Defects-Defect Classes, the Defect Repository and Test Design - Defect examples: the coin problem **(8)**

TESTING STRATEGIES

Test case design strategies - Black Box Approach-Random Testing - Equivalence Class Partitioning-Boundary Value Analysis-Cause and Effect Graphing-State Transition Testing - Error Guessing - White Box Approach-Test Adequacy Criteria-Coverage and Control Flow Graphs-Covering Code Logic-Data Flow and White Box Test Design-Loop Testing-Mutation Testing. **(10)**

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 - The Test Harness - Integration Test: Goal - Integration Strategies for Procedures and Functions - Integration Strategies for Classes - Designing Integration Test. **(10)**

SYSTEM TEST AND TESTING ARTIFACTS

System Test- The Different Types-Regression Testing -Alpha, Beta and AcceptanceTests-Test Planning - Test Plan Components-Test Plan Attachments- Reporting Test Results. **(9)**

SOFTWARE QUALITY

Defining Quality-Importance of Quality- Quality Assurance at each Phase of SDLC-Managing Software - Quality in an Organization-Quality Management System-Product Quality and Process Quality. **(8)**

TOTAL : 45

TEXT BOOKS

1. Ilene Burnstein, "Practical Software Testing", Springer International Edition, First Indian reprint, 2004. (para 1, para 2, para 3 and pará 4).
2. Nina S Godbole "Software quality Assurance, Principles and Practice", Narosa Publishing House,2004 (para 5).

REFERENCE BOOKS

1. C.Jorgensen, "Software Testing-A Craftman'sApproach", CRC press,1995.
2. Boris Beizer, VanNostrandReinhold. "Software Testing Techniques", 2ndEdition, 1990.
3. GlenfordJ.Myers, "The Art of Software Testing", Wiley, 3rd edition, 2011.

22MDCE72 HUMAN COMPUTER INTERACTION AND INTERFACE

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Ability to develop user interfaces for interactive systems.
CO2: Apply the knowledge to develop high-quality user interfaces for interactive systems.
CO3: Apply the basics of Virtual reality and 3D interactions
CO4: Analyze the design rules involved in the HCI patterns
CO5: the guidelines for Interaction Devices
CO6: Develop an understanding with Documentation Search and Visualization

INTRODUCTION USABILITY OF INTERACTIVE SYSTEMS

Usability Requirements - Usability Measures - Usability Motivations - Universal Usability. Guidelines, Principles, and Theories for Designers. **(5)**

DEVELOPMENT PROCESSES

Managing Design Processes: Organizational Design to Support Usability - The Four Pillars of Design- Development Methodologies- Ethnographic Observation - Participatory Design- Scenario Development- Social Impact Statement for Early Design Review - Legal Issues. Evaluating Interface Designs: Expert Reviews - Usability Testing and Laboratories-Survey Instruments- Acceptance Tests- Evaluation During Active Use-Controlled Psychologically Oriented Experiments **(8)**

INTERACTION STYLES

Direct Manipulation and Virtual Environments: Introduction - 3D Interfaces-Teleoperation- Virtual and Augmented Reality. Menu Selection, Form Filling, and Dialog Boxes: Task-Related Menu Organization- Single Menus-Combinations of Multiple Menus - Content Organization- Fast Movement through Menus- Data Entry with Menus: Form Filling, Dialog Boxes and Alternatives-Audio Menus and Menus for Small Displays. **(8)**

INTERACTION DEVICES

Keyboards and Keypads- Pointing Devices- Speech and Auditory Interfaces- Displays - Small and Large. Collaboration and Social Media Participation -Goals -Asynchronous Distributed Interfaces- Synchronous Distributed Interfaces-Different Place, Same Time -Face-to-Face Interfaces. **(8)**

DESIGN ISSUES

Quality of Service - Models of Response Time Impacts- Expectations and Attitudes- User Productivity- Variability in Response Time- Frustrating Experiences- Balancing Function and Fashion: Error Messages- Nonanthropomorphic Design- Display Design- Web Page Design-Window Design-Colour **(8)**

DOCUMENTATION SEARCH AND VISUALIZATION

User Documentation and Online Help- Information Search: Searching in Textual Documents and Database Querying - Multimedia Document Searches-Advanced Filtering and Search Interface. Information Visualization: Data Type by Task Taxonomy - Challenges for Information Visualization. **(8)**

TOTAL: 45 HOURS

TEXT BOOK

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs," Designing the User Interface: Strategies for Effective Human-Computer Interaction ", 5th Edition Pearson, Education 2010

REFERENCE BOOK

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 5th Edition, Pearson, Education 2004.

22MDCE73 - SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Describe the various types of software patterns and their needs in software development.

CO2:: Apply design patterns to solve the issues in designing the objects

CO3: Design the software architectures using appropriate architectural patterns based on the quality attributes and documenting them

INTRODUCTION TO PATTERNS

Definition - Making a pattern - Pattern categories - Relationship between patterns - Patterns and software architecture. **(8)**

DESIGN PATTERNS

Introduction - Creational patterns - Structural patterns - Behavioral patterns - Case study. **(10)**

INTRODUCTION TO SOFTWARE ARCHITECTURE

Software architecture definition and needs. Introduction: Architectural patterns - Reference models - Reference architecture - Architectural structures and views. **(8)**

ARCHITECTURAL STYLES

Pipes and filters - Data abstraction and object oriented organization - Event based, Implicit invocation - Layered style - Repository - Interpreter - Process control - Distributed - Case study. **(9)**

THE ARCHITECTURAL BUSINESS CYCLE

Creating an architecture: Understanding quality attributes - Achieving qualities - Designing the architecture - Documenting the architecture - Case study. **(10)**

TOTAL : 45 HOURS

TEXT BOOKS

1. Frank Buschmann, Regine Meunier, Hans Rohnex, Peter Sommerland & Michael, "Pattern - Oriented Software Architecture - A Systems of Patterns Volume - I", 1996 (Reprint 2001) (Para - I).
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns - Elements of reusable Object Oriented Software", Pearson Education, 1999. (Para II).
3. Mary Shaw, David Garlan, "Software Architecture - Perspectives on an Emerging Discipline", PHI,1996 (Para IV).
4. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", 2nd Edition, Pearson Education, First Indian Reprint, 2003. (Para III & V).

Cyber Security

22MDCE81 - CYBER SECURITY ANALYTICS

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

INTRODUCTION - Cybersecurity -Data Mining- Machine Learning - Review on Cybersecurity Solutions - Proactive Security Solutions - Reactive Security Solutions - Successful ML applications in Cyber security **(3)**

SUPERVISED LEARNING FOR MISUSE/SIGNATURE DETECTION -Misuse/Signature Detection -Machine Learning in Misuse/Signature Detection -Machine-Learning Applications in Misuse Detection – Malware Analysis - Static – Dynamic – Smartphone security. **(9)**

MACHINE LEARNING FOR ANOMALY DETECTION –Introduction -Anomaly Detection -Machine learning in Anomaly Detection Systems -Machine-Learning Applications in Anomaly Detection Supervised Anomaly detection - Spam detection - Unsupervised Anomaly Detection. **(8)**

MACHINE LEARNING FOR PROFILING NETWORK TRAFFIC – Introduction - Network Traffic Profiling and Related Network Traffic Knowledge -Machine Learning and Network Traffic Profiling -Data-Mining and Machine-Learning Applications in Network Profiling - Network IDS – DDOS -Emerging Challenges in Intrusion Detection – Log Analysis. **(9)**

BOTNETS AND INSIDER THREATS - Botnet topologies, botnet detection using NetFlow analysis - Botnet detection using DNS analysis, introduction to insider threats, Insider threat profiles -masquerader detection strategies - Using honey tokens for insider threat. **(8)**

W**EB SECURITY, EMAIL, SOCIAL NETWORK SECURITY**: **Web threat detection via web server log analysis - Alert aggregation for web security** - Spam detection, Phishing detection -: Detecting compromised accounts, detecting social network spam. **(8)**

Total : 45

TEXT BOOK

1. Dua, Sumeet, and Xian Du. “Data Mining and Machine Learning in Cyber Security”, CRC press, 2016.

REFERENCES

1. Jacobs Jay and Bob Rudis, “Data Driven Security Analysis, Visualization, and Dashboards”, John Wiley & Sons, 2014.

2. Stolfo, Salvatore J., Bellovin S M, Hershkop S., Keromytis, A.D., Sinclair S, Smith.S, “ Insider Attack and Cyber Security: Beyond The Hacker”, Springer, 2008.

3. Bhattacharyya, Dhruba Kumar, and Jugal Kumar Kalita. “Network Anomaly Detection: A Machine Learning Perspective”, CRC Press, 2013.

22MDCE82 DIGITAL FORENSICS

L	T	P	C
3	0	0	3

PREREQUISITES: Consent of the Instructor

ASSESSMENT: THEORY

COURSE OUTCOME

CO1: Understand the cyber-crime investigation procedures and interpret the cyber pieces of evidence, digital forensic process model and their legal perspective

CO2:: Understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.

CO3: Know how to examine digital evidences such as the data acquisition, identification analysis.

CO4: Analyze the digital evidence used to commit cyber offences.

CO5: To be well-trained as next-generation computer crime investigators.

Introduction to Digital Forensics: Computer forensics fundamentals - Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues. (8)

Computing Investigations: Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations. (8)

Collecting Digital Evidence: Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools. (10)

Analysing Digital Evidence: Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case. (9)

Current Computer Forensics Tools: Software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool. (10)

TOTAL: 45 HOURS

TEXT BOOKS

1. Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”, Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

REFERENCE BOOKS

1. The basics of digital Forensics (Latest Edition) – The primer for getting started in digital forensics by John Sammons – Elsevier Syngress Imprint 2.
2. Cybersecurity – Understanding of cybercrimes, computer forensics and Legal perspectives by Nina Godbole and Sunit Belapure – Wiley India Publication 3.
3. Practical Digital Forensics – Richard Boddington [PACKT] Publication, Open source community
4. Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

PROFESSIONAL ELECTIVES - LABORATORY COURSES
22MDCEL1 - BUSINESS INTELLIGENCE LABORATORY

PRE- REQUISITES: Consent of the Instructor

L	T	P	C
0	0	4	2

ASSESSMENT: PRACTICAL

COURSE OUTCOME:

CO1: Design appropriate data warehouse model for a given decision making problem. Generate the different views of analyzed data.

CO2: Develop a dashboard to present the analyzed data in a format that help the decision makers to do the prediction.

CONCEPTS TO BE COVERED

1. Create highly formatted templates, reports, and documents such as flash reports, checks, KPI and Score cards
2. Create BI dashboards and reports to turn insights into actions by providing the ability to invoke business processes
3. Design the analysis template to enable the business analyst to create new analyses from scratch or modify existing analyses
4. Present the analyzed data using maps and spatial visualizations format
5. Generate a powerful, multi-step alert engine that can trigger workflows based on business events and notify stakeholders via their preferred medium and channel

22MDCEL2 - NATURAL LANGUAGE PROCESSING LABORATORY

PRE- REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSEOUTCOMES

CO1: Acquire knowledge in Fundamentals of Natural Language Processing.

CO2: Apply various techniques to access and process text from the Web.

CO3: Gain experience in categorizing and tagging words.

CO4: Develop models for text classification using Supervised Learning Algorithms

CO5: Apply and analyze sentence structure using context free grammar.

CONCEPTS TO BE COVERED

1. Access Text Corpora and Lexical Resources
(i) Conditional Frequency Distribution
(ii) WordNet
2. Processing Raw Text
(i) Accessing Text from the Web
(ii) Regular Expression for Detecting Word Patterns
(iii) Normalizing the Text
(iv) Re
gular Expression for Tokenizing text
3. Categorizing and Tagging Words
(i) Automatic Tagging
(ii) N-Gram Tagging
(iii) Transformation-Based tagging
4. Text Classification using Supervised Learning Algorithm
5. Extracting Information from Text
(i) Chunking
(ii) Named Entity Recognition
(iii) Relation Extraction
6. Analyzing Sentence Structure using Context Free Grammars
7. Analyzing the Synonym of Sentences.

22MDCEL3 - COMPUTATIONAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

PRE- REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSEOUTCOMES

CO1: Apply intelligent systems technologies in a variety of engineering applications

CO2: Employ Evolutionary programming techniques to solve any real-world scenarios

CO3: To solve a given application, can apply swarm intelligence techniques

CO4: Develop and implement a basic trainable neural network for a computing application

CO5: Develop and implement a basic fuzzy logic system for a typical computing application

CONCEPTS TO BE COVERED

1. Implement Artificial Neural Network Algorithms to simulate logical gates.

2. Implement ANN techniques to solve simple classification problems.

3. Implement Genetic Algorithm to solve optimization problem.

4. Implement PSO to solve optimization problem.

5. Implement Artificial Immune System to solve optimization problem.

6. Implement the different Fuzzy Membership functions, Fuzzy set operations and its properties and composition of Fuzzy and Crisp Relations.

22MDCEL4 - SOFTWARE ENGINEERING LABORATORY

PRE- REQUISITES: Consent of the Instructor

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: Develop a plan for appropriate selection of process models for the given scenario.

CO2: Create Software Requirements System from the description of user/customer to provide solutions for commercial/scientific problems using open-source tools.

CO3: Construct Use Case model, which includes Actors (primary and secondary), Use Cases (Precondition, Post Condition, Successful and Alternative Scenario) to describe the requirements of a given problem using open source tools.

CO4: Design the Analysis Class model that consists of classes/objects and their basic attributes, methods and relationships among them by realizing the use cases.

CO5: Produce the design models both static and dynamic for the SRS, use case model and Analysis Class generated and Build prototype of user interface for the systems

Students should be able to:

1. Determine the scope of the problem and identify appropriate process models. 2. Create software requirements specification from the communication phase of the life cycle model. 3. Requirement Analysis and generating use case model - Identifying actors, Identifying use

cases, Writing use case description (detailed use case)

4. Analysis class/object identification and generating analysis model

a. using noun phrase analysis

5. Use case realization (using sequence or collaboration diagram for use cases)

a. Finding attributes

6. Performing classification(generalization/specialization) 7. Relating classes/objects (links, association)

a. Design class model creation

b. Finding methods

c. Refining attributes and associations d. Generating behavioral model

8. Build prototype of user interface

22MDCEL5 INTERNET OF THINGS LABORATORY

PRE-REQUISITES

22MDC53, 22MDCE91, 22MDCE92

ASSESSMENT: PRACTICAL

COURSE OUTCOME

CO1: For a given requirement, choose the required sensor and calibrate.

CO2: Devise interface circuit for connecting a chosen sensor to Galileo board.

CO3: Develop software for Galileo board to interact with the sensor to meet the requirements

CO4: Develop software to interact (send/receive data) with Web/Application server located in the Internet

CO5: Use a data analytics tool to analyze the data collected and present the report to the end user.

THE STUDENTS MUST BE TRAINED FOR

1.Gaining knowledge on working of smart sensors for IoT applications.

2.Developing applications using open-source microcontroller boards, exploiting all the features of the board.

3.Developing an end-to-end IoT project covering – collect, transport, store, analyses and archive phases.