M.Tech. Computer Science & Engineering (1st SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

COURSE		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCSE1-101	Advanced Data Structures and Algorithm	3	1	0	40	60	100	4
MCSE1-102	Research Methodologies	3	1	0	40	60	100	4
MCSE1-103	Soft Computing	3	1	0	40	60	100	4
Departmental Elective-I		3	1	0	40	60	100	4
MCSE1-156	Agile Software Development							
MCSE1-157	Software Testing & Validations							
MCSE1-158	Software Engineering Concepts and Methodologies							
MCSE1-159	Business Intelligence and Applications							
Departmental Elective-II		3	1	0	40	60	100	4
MCSE1-160	Cryptography & Network Security							
MCSE1-161	Advanced Operating System							
MCSE1-162	Information Security							
MCSE1-163	Distributed Systems							
MCSE1-104	Practical Lab.-I	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. Courses		15	5	04	260	340	600	22

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M.Tech. Computer Science & Engineering (2nd SEM.)
TOTAL CONTACT HRS. = 24, TOTAL CREDITS = 22

COURSE		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCSE1-205	Advanced Databases	3	1	0	40	60	100	4
MCSE1-206	Advanced Computer Network	3	1	0	40	60	100	4
Departmental Elective-III		3	1	0	40	60	100	4
MCSE1-264	Information Retrieval							
MCSE1-265	Web Mining							
MCSE1-266	Data Warehousing and Data Mining							
MCSE1-267	Enterprise Resource Planning							
Departmental Elective-IV		3	1	0	40	60	100	4
MCSE1-268	Web Technology							
MCSE1-269	Java							
MCSE1-270	Artificial Neural Networks							
MCSE1-271	Open Source Technology							
Open Elective-I		3	1	0	40	60	100	4
MCSE1-207	Practical Lab.-II	0	0	4	60	40	100	2
Total 5 Theory & 1 Lab. Courses		15	5	04	260	340	600	22

M.Tech Computer Science & Engineering (3rd SEM.)
TOTAL CONTACT HRS. = 8, TOTAL CREDITS = 22

COURSE		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
Departmental Elective-V		3	1	0	40	60	100	4
MCSE1-372	Semantic Web and Social Network							
MCSE1-373	Natural Language Processing							
MCSE1-374	Big Data & Cloud Computing							
MCSE1-375	Digital Image Processing							
Open Elective-II		3	1	0	40	60	100	4
MCSE1-308	Project	-	-	-	60	40	100	10
MCSE1-309	Seminar	-	-	-	60	40	100	4
Total 2 Theory Courses		6	2	0	200	200	400	22

M.Tech Computer Science & Engineering (4th SEM.)
TOTAL CREDITS = 24

COURSE		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
MCSE1-410	Dissertation	0	0	0	60	40	100	24
Total		0	0	0	60	40	100	24

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Total Marks = 600 + 600 + 400 + 100 = 1700
Total Credits = 22 + 22 + 22 + 24 = 90

ADVANCED DATA STRUCTURES AND ALGORITHMS

MCSE1-101 **L T P C** **Duration: 45 Hrs.**
MCSE2-101, **3 1 0 4**
MCSE3-101,
MCSE4-101

COURSE OBJECTIVES:
To learn the advanced concepts of data structure and algorithms and its implementation. The COURSE has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms.

COURSE OUTCOMES:
CO1: Ability to apply and implement various data structures to algorithms and to solve problems.
CO2: Basic ability to analyze algorithms and to determine algorithm correctness and time efficiency class.
CO3: Ability to apply various traversing, finding shortest path and text pattern matching algorithm.
CO4: Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems.

UNIT-I (12 Hrs.)

Introduction to Basics: Significance and need of various data structures and algorithms, Arrays, linked lists, Stacks, Queues, Priority queues, Heaps; Strategies for choosing the appropriate data structures.
Advanced Data Structures: Binary Search Tree**,** AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.

UNIT-II (11 Hrs.)

Algorithms Complexity and Analysis: Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.

UNIT-III (11 Hrs.)

Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, bridges, Depth- and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut.
String Matching Algorithms: Suffix arrays, Suffix trees, Brute Force, Rabin-Karp, Knuth-Morris-Pratt, Boyer-Moore algorithm.

UNIT-IV (11 Hrs.)

Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.
Randomized algorithms: Introduction, Type of Randomized Algorithms, 2-SAT; Game Theoretic Techniques, Random Walks.

RECOMMENDED BOOKS:

1. E. Horowitz, S. Sahni and Dinesh Mehta, 'Fundamentals of Data Structures in C++', Galgotia, **1999**.

2. Thomas H. Corman, Charles E. Leiserson, Ronald L. Rivest, 'Introduction to Algorithms', 3rd Edn., PHI, **2009**.
3. Adam Drozdex, 'Data Structures and algorithms in C++', 2nd Edn., Thomson COURSE – Vikas Publishing House, **2001**.
4. G. Brassard and P. Bratley, 'Algorithmics: Theory and Practice', Prentice –Hall, **1988**.

RESEARCH METHODOLOGY

MCSE1-102 **L T P C** **Duration: 45 Hrs.**
MCSE2-102, **3 1 0 4**
MCSE3-102,
MCSE4-102
MREM0-101

COURSE OBJECTIVES:
To define research and describe the research process and research methods.
COURSE OUTCOMES:
CO1: Able to select and define appropriate research problem and Parameters.
CO2: Able to organize and conduct research in a more appropriate manner.
CO3: Able to understand and apply statistical me.

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, OBJECTIVES and Process.
Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental.
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature.
Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.
Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal.

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data.
Data Collection Methods: Questionnaire Designing, Construction.
Sampling Design & Techniques: Probability Sampling and Non Probability Sampling.
Scaling Techniques: Meaning & Types.
Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability.
Validity: Content Validity, Criterion Related Validity and Construct Validity.

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation.
Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number.
Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA.

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling.
Report Writing: Essentials of Report Writing, Report Format.
Statistical Software: Application of Statistical Software like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis.

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**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs.*

RECOMMENDED BOOKS:

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi.
6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

SOFT COMPUTING

MCSE1-103, MCSE2-103, MCSE3-103, MCSE4-103

L T P C
3 1 0 4

Duration: 45 Hrs.

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COURSE OBJECTIVES:

The OBJECTIVES of this COURSE is to teach basic neural networks, fuzzy systems, Genetic Algorithms and optimization algorithms concepts and their relations**.**

COURSE OUTCOMES:

CO1: Able to comprehend techniques and applications of Soft Computing in real world problems.

CO2: Able to follow fuzzy logic methodology and design fuzzy systems for various applications.

CO3: Able to design feed forward Artificial Neural Networks (ANN) and implement various methods of supervised COURSE.

CO4: Able to design feedback Artificial Neural Networks (ANN) and implement various methods of unsupervised COURSE

CO5: Able to appreciate the methodology of GA and its implementation in various applications.

UNIT-I (11 Hrs.)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation.

Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT-II (12 Hrs.)

Structure and Function of a Single Neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. COURSE rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star COURSE rules. Supervised COURSE Network:

Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised COURSE Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map.

UNIT-III (11 Hrs.)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT-IV (11 Hrs.)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems.

RECOMMENDED BOOKS:

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications', 1st Edn., PHI Publication, **2003**.
2. S.N. Sivanandam& S.N. Deepa, 'Principles of Soft Computing', 2nd Edn., Wiley Publications, **2008**.
3. Michael Negnevitsky, 'Artificial Intelligence', 2nd Edn., Pearson Education, New Delhi, **2008.**
4. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', 3rd Edn., Wiley, **2011.**
5. Bose, 'Neural Network fundamental with Graph, Algoithm & Application', TMH, **2004**.
6. Kosko, 'Neural Network & Fuzzy System', 1st Edn., PHI Publication, **2009.**
7. Klir & Yuan, 'Fuzzy sets & Fuzzy Logic: Theory & Application', PHI, **1995**.
8. Hagen, 'Neural Network Design', 2nd Edn., Cengage COURSE, **2008**.

AGILE SOFTWARE DEVELOPMENT APPROACHES

MCSE1-156, MCSE2-156, MCSE4-156, MCSE3-205 | **L T P C 3 1 0 4** | **Duration: 45 Hrs.**

COURSE OBJECTIVES:

This COURSE makes student learn the fundamental principles and practices associated with each of the agile development methods. To apply the principles and practices of agile software development on a project of interest and relevance to the student.

COURSE OUTCOMES:

CO1: To learn the basics concepts of Agile software and their principles design

CO2: To explain different agile development method, project tools requirement, risk and measurements related with different development methods.

CO3: To understand the overview of Agile methods, strategies, requirements and testing.

CO4: Describe and explain agile measurement, configuration and risk management. Principles of Astern and tools.

UNIT-I (11 Hrs.)

Introduction: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges.

Agile and its Significance: Agile development, Classification of methods, the agile manifesto and principles, Practices of XP, Scrum Practices, working and need of Scrum, advanced Scrum Applications, Scrum and the Organization.

UNIT-II (12 Hrs.)

Agile Project Management: Embrace communication and feedback, Simple practices and project tools, Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. Quality, Risk, Metrics and Measurements, the facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence, Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT-III (11 Hrs.)

Agile Methodology: Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history.

Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature-Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools.

UNIT-IV (11 Hrs.)

Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

Agile Review: Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, the rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools.

RECOMMENDED BOOKS:

1. Elisabeth Hendrickson, 'Agile Testing', Quality Tree Software Inc., **2008**.
2. Craig Larman, 'Agile and Iterative Development – A Manager's Guide', 1st Edn., Pearson Education, **2004**.
3. Robert C. Martin, 'Agile Software Development, Principles, Patterns, and Practices (Alan Apt Series)', 2nd Edn., Pearson Education, **2003**.
4. Alistair Cockburn, 'Agile Software Development series', 1st Edn., Addison-Wesley Professional, **2001**.
5. Mike Cohn, 'Succeeding with Agile: Software Development Using Scrum', 1st Edn., Pearson, **2010**.

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SOFTWARE TESTING & VALIDATION

MCSE1-157,	**L T P C**	**Duration: 45 Hrs.**
MCSE3-206	**3 1 0 4**	

COURSE OBJECTIVES:

This COURSE is designed to enable a clear understanding and knowledge of the foundations, techniques, and tools in the area of software testing and its practice in the industry. The COURSE will prepare students to be leaders in software testing.

COURSE OUTCOMES:

CO1: able to apply software testing knowledge, verification & validation and engineering methods.

CO2: Have an ability to design and conduct a software test process for a quality software test project.

CO3: Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.

CO4: Have an ability to use software testing methods and modern software testing tools for their testing projects.

UNIT-I (11 Hrs.)

Review of Software Engineering: Overview of software evolution, design models, development life cycle, unit and system testing, project management, maintenance, Concept of Software verification, validation and testing.

V & V and their Limitations: Theoretical Foundations: Impracticality of Testing All data; Impracticality of testing All Paths; No Absolute Proof of Correctness.

UNIT-II (12 Hrs.)

The Role of V & V in Software Evolution: Types of Products, Requirements; Specifications, Designs, Implementation, Charges, V & V OBJECTIVESs, Correctness, Consistency, Necessity Sufficiency, Performance.

Software Reliability and Quality Assurance: Software reliability, validation, safety and hazards analysis; features affecting quality of software. Concepts and importance of quality assurance, Software quality assurance strategies, FTR, structured walk through techniques.

UNIT-III (11 Hrs.)

Software V & V Approaches and their Applicability: Software Technical Reviews, Software Testing : Levels of testing, Module, Integration, System, Regression, Testing techniques and their Applicability, Functional testing and Analysis Structural testing and Analysis, Error Oriented testing and Analysis, Hybrid Approaches, Integration Strategies, Transaction Flow Analysis, Stress Analysis, Failure Analysis, Concurrency Analysis, Performance Analysis Proof of Correctness, Simulation and Prototyping, Requirements Tracing.

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UNIT-IV (11 Hrs.)

Software V & V Planning, Identification and Selection Techniques: requirements, Specifications, Designs, Implementations, Changes, Organizations Responsibilities, Development Organization Independent Test Organization, Software Quality Assurance, Independent V &V contractor, V & V Standards, Integrating V & V Approaches, Problem Tracking Test Activities, Assessment.

RECOMMENDED BOOKS:

1. William Perry, 'Effective Methods for Software Testing', John Wiley & Sons, **1995**.
2. Mare Roper, 'Software Testing', McGraw Hill Book Co., **1994**.
3. Cem Kaner, Jack Falk, Nguyen Quoc, 'Testing Computer Software', 2nd Edn., Van Nostrand Reinhold, **1993**.
4. Ron Patton, 'Software Testing', 2nd Edn., **2009.**
5. K.K. & Yogesh Singh, 'Software Engineering; Agricultural', New Age International, **2001**.
6. James Mc Manus I & Gordon Schulmeyer Van Nostrand Reinhold, Handbook of Software Quality Assurance, **1992.**
7. Ronald Owston, Van Nostrand Reinhold, 'Software System Testing and Quality Assurance', **1984**.
8. Michael Deutch Prentice Hall, 'Software Verification and Validation: Realistic Project Approach', **1982**.

SOFTWARE ENGINEERING CONCEPTS AND METHODOLOGIES

MCSE1-158,	**L T P C**	**Duration: 45 Hrs.**
MCSE3-158	**3 1 0 4**	

COURSE OBJECTIVES:

To impart knowledge on software engineering concepts and methodologies. To develop skills that will help the students to construct software using different methodologies and advanced techniques.

COURSE OUTCOMES:

CO1: To study project management concepts.
CO2: To understand the role of formal methods and reengineering.
CO3: To understand the use of advanced techniques to develop the software.
CO4: To study the special requirements and development of different types of systems.

UNIT-I (11 Hrs.)

Project Management: The management spectrum, The People; stakeholders, software team, Agile teams, coordination and communication issues, The product; problem decomposition, The process; modeling the product and process, process decomposition, The W^5 HH principle, RAD model, Metrics for process and projects, software measurements. Agile Methodology- Scrum and XP.

Cleanroom Software Engineering: The cleanroom approach, Functional specification, Cleanroom design and testing.

UNIT-II (12 Hrs.)

Formal Methods: Basic concepts, mathematical preliminaries, Applying mathematical notions for formal specification, Formal specification languages, Z specification Language, Formal methods- the road ahead.

Reengineering: Business process reengineering, Software reengineering, Reverse reengineering, Restructuring, Forward reengineering, economics of reengineering.

UNIT-III (11 Hrs.)

Component-Based Software Engineering: Engineering of component -based systems, CBSE process, Domain engineering, Component-based development, Classifying and retrieving components and economics of CBSE.

Computer-Aided Software Engineering: Building Blocks for CASE, taxonomy of CASE tools, integrated CASE environments, Integration architecture, and CASE repository.

UNIT-IV (11 Hrs.)

Web Engineering: Attributes of web-based applications, the Web E process, a framework for Web E. Formulating, Analyzing Web-based systems, design and testing for web-based applications, Management issues.

Client/Server Software Engineering: Structure of client/server systems, Software engineering for Client/Server systems, Analysis modeling issues, Design for Client/Server systems, Testing issues.

RECOMMENDED BOOKS:

1. Roger S. Pressman, 'Software Engineering a Practitioners Approach', 5th Edn., McGraw Hill, **2014**.
2. Sommerville, 'Software Engineering', 7th Edn., Pearson**, 2005**.
3. J. Bowan, 'Formal Specification and Documentation Testing - A Case Study Approach', International Thomson Computer Press, **2003**.
4. James S. Peters, Witold Pedrycz, 'Software Engineering an Engineering Approach', Wiley India, **2011**.

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BUSINESS INTELLIGENCE AND ITS APPLICATIONS

Subject Code: MCSE1-159 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:

The proposed COURSE exposes engineering/management students to Business Intelligence domain. The Core Modules of this COURSE includes introduction to BI terminologies and framework, basics of data integration (Extraction Transformation Loading), introduction to multi-dimensional data modeling, basics of enterprise reporting and application of the concepts using open source/Microsoft tools.

COURSE OUTCOMES:

CO1: Differentiate between Transaction Processing and Analytical applications and describe the need for Business Intelligence.

CO2: Demonstrate understanding of technology, processes associated with Business Intelligence framework, Data Warehouse implementation methodology and project life cycle.

CO3: Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

CO4: Design an enterprise dashboard that depicts the key performance indicators which helps in decision making and demonstrate application of concepts in Microsoft BI suite.

UNIT-I (11 Hrs.)

Introduction: Business Intelligence, OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.

UNIT-II (12 Hrs.)

Basics of Data Integration (Extraction Transformation Loading), Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL using SSIS, Introduction to data quality, data profiling concepts and applications.

UNIT-III (11 Hrs.)

Introduction to Multi-Dimensional Data Modeling, Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.

UNIT-IV (11 Hrs.)

Basics of Enterprise Reporting, Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

RECOMMENDED BOOKS:

1. R.N. Prasad, Seema Acharya, ‘Fundamentals of Business Analytics’, **2011**.
2. David Loshin, ‘Business Intelligence’, **2003.**
3. Mike Biere, ‘Business Intelligence for the Enterprise’, 1st Edn., **2003**.
4. Larissa Terpeluk Moss, Shaku Atre, ‘Business intelligence roadmap’, 1st Edn., **2003**.
5. Cindi Howson, ‘Successful Business Intelligence: Secrets to Making Killer BI Applications’, 2nd Edn., **2013.**
6. Brain, Larson, ‘Delivering business intelligence with Microsoft SQL Server **2008’**.
7. Lynn Langit, ‘Foundations of SQL Server 2005 Business Intelligence’, 1st Edn., **2007.**
8. Stephen Few, ‘Information Dashboard Design’, **2013.**

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CRYPTOGRAPHY & NETWORK SECURITY

MCSE1-160, MCSE4-206, MCSE2-206 | **L T P C** 3 1 0 4 | **Duration: 45 Hrs.**

COURSE OBJECTIVES:

The main OBJECTIVES of this COURSE is to make student able to understand the basic concepts, services, threats and principles in network security, various security services and mechanisms in the network protocol stack.

COURSE OUTCOMES:

CO1: Understand security trends.
CO2: Implement various cryptographic algorithms.
CO3: Explain the hash function.
CO4: Understand the network security and system level security used.

UNIT-I (11 Hrs.)

Security Trends: Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruence, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

UNIT-II (12 Hrs.)

Simple DES: Differential crypto analysis, DES – Modes of operation, Triple DES, AES, RC4, RSA, Attacks – Primality test – factoring.

UNIT-III (11 Hrs.)

Discrete Logarithms: Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal DSA.

UNIT-IV (11 Hrs.)

Authentication Applications: Kerberos, X.509, PKI – Electronic Mail security – PGP, S/MIME – IP security – Web Security – SSL, TLS, SET. Intruders, Malicious software, viruses and related threats, Firewalls, Security Standards.

RECOMMENDED BOOKS:

1. Wade Trappe, Lawrence C Washington, 'Introduction to Cryptography with Coding Theory', 2nd Edn., Pearson, **2007**.
2. William Stallings, 'Cryptography and Network Security Principles and Practices', 4th Edn., Pearson/PHI, **2006**.
3. W. Mao, 'Modern Cryptography – Theory and Practice', 2nd Edn., Pearson Education, **2007**.
4. Charles P. Pfleeger, Shari Lawrence Pfleeger, 'Security in Computing', 3rd Edn., Prentice Hall of India, **2006**.
5. Behrouz Forouzan, 'Cryptography & Network Security', 2nd Edn., McGraw Hill, **2011.**

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ADVANCED OPERATING SYSTEM

MCSE1-161, MCSE4-162, MCSE2-161, MCSE3-161 | **L T P C** 3 1 0 4 | **Duration: 45 Hrs.**

COURSE OBJECTIVES:

To learn the fundamentals of Operating Systems and gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.

COURSE OUTCOMES:

CO1**:** Discuss the various synchronization, scheduling and memory management issues.
CO2**:** Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
CO3**:** Discuss the various resource management techniques for distributed systems.
CO4**:** Identify the different features of real time and mobile operating systems.

UNIT-I (11 Hrs.)

Fundamentals of Operating Systems: Strategies of operating system, Structures of operating system, overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling –Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

Distributed Operating Systems: Issues in Distributed Operating System – Architecture – Communication Primitives –Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

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UNIT-II (12 Hrs.)

Distributed Resource Management: Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

UNIT-III (11 Hrs.)

Real Time and Mobile Operating Systems: Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems –Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads – Memory Management – File system, Networked file system.

UNIT-IV (11 Hrs.)

CASE STUDIES: Linux System: Design Principles - Kernel Modules - Process Management Scheduling –Memory Management - Input-Output Management - File System – Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer -Services Layer - Core OS Layer – File System.

RECOMMENDED BOOKS:

1. Andrew S. Tanenbaum and Maarten van Steen, 'Distributed Systems: Principles and Paradigms', 2nd Edn., Prentice Hall, **2007**.
2. Mukesh Singhal and Niranjan G. Shivaratri, 'Advanced Concepts in Operating Systems – Distributed Database, and Multiprocessor Operating Systems', Tata McGraw Hill, **2001**.

3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', 7th Edn., John Wiley & Sons, **2004**.
4. Daniel P. Bovet and Marco Cesati, 'Understanding the Linux kernel', 3rd Edn., O'Reilly, **2005**.
5. Rajib Mall, 'Real-Time Systems: Theory and Practice', Pearson Education India, **2006**.
6. Neil Smyth, 'iPhone iOS 4 Development Essentials – Xcode', 4th Edn., Payload Media, **2011**.

INFORMATION SECURITY

MCSE1-162, MCSE4-157, MCSE2-157 | **L T P C** 3 1 0 4 | **Duration: 45 Hrs.**

COURSE OBJECTIVES:

It will help the students to understand the various concepts related to network security. The students will learn various techniques/algorithms that can be used to achieve security. They will also learn the security basics for wireless networks.

COURSE OUTCOMES:

CO1: To understand the concepts of network security.
CO2: To learn the techniques for authentication and authorization.
CO3: To be able to understand the confidentiality requirement and the ways to achieve it.
CO4: To know about wireless network security.

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UNIT-I (11 Hrs.)

Overview: Computer Security Concepts, Challenges, Requirements, OSI security Architecture: services, mechanism and attacks, network security model, Classical encryption techniques, latest security trends, need of security strategy.

UNIT-II (12 Hrs.)

Authentication: Message authentication, message authentication techniques: Hash, MAC, digital Signatures, User Authentication: one-way authentication, mutual authentication, Password-based authentication, token based authentication, Biometric authentication, Remote User authentication.

Authorization: Identification, authorization, Access Control: Principles, Access Rights, Discretionary Access Control, Role Based Access Control, Unix File Access Control, Role Based Access Control Internet Authentication Applications: Kerberos, X.509, PKI, Federated Identity Management.

UNIT-III (11 Hrs.)

Confidentiality: Encryption, attacks, Symmetric Encryption: DES, AES, Asymmetric Encryption: RSA, Key Distribution scenario, Email security: S/ MIME, PGP.

Wireless network security: IEEE 802.11 wireless LAN, 802.11i wireless LAN security, Wireless Application Protocol, Wireless transport layer security, WAP End to End security.

UNIT IV-(11 Hrs.)

Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.

RECOMMENDED BOOKS:

1. William Stalling, Lawrie Brown, 'Computer Security: Principles and Practice', Indian Edition, Pearson, **2010**
2. Chuck Easttom, 'Computer Security Fundamentals', Pearson, **2011**
3. M. Stamp, 'Information Security: Principles and Practice', 2nd Edn., Wiley, **2011**.

4. M. E. Whitman and H. J. Mattord, 'Principles of Information Security', 4th Edn., Course Technology, **2011**.
5. M. Bishop, 'Computer Security: Art and Science', Addison Wesley.

DISTRIBUTED SYSTEMS

MCSE1-163, MCSE2-266 | **L T P C: 3 1 0 4** | **Duration: 45 Hrs.**

COURSE OBJECTIVES:

To study the various types of distributed systems, Models and various its various features.

COURSE OUTCOMES:

CO1: To give the students an introduction about the basic Distributed systems, Models and some features of operating systems.

CO2: To give the introduction of Interprocess communication and other features. Also, the details of distributed file systems.

CO3: To give the students an introduction of various services like name services, name system etc., and distributed transaction features.

CO4: To understand the Distributed multi-media and its applications.

UNIT-I (11 Hrs.)

Characterization of Distributed Systems: Introduction, System models –Architectural and fundamental models with examples.

Operating System Support: Operating System layer, Protection, processes and threads, operating system architecture.

UNIT-II (12 Hrs.)

Interprocess Communication: API for internet protocol, Marshalling, Client server communication and group communication.

Distributed Objects and Remote Invocation: communication between Distributed objects, RPC and characteristics.

Distributed File System: File service architecture, network file system, Sun network file system, Andrew file system Case Study: Unix.

UNIT-III (11 Hrs.)

Name Services: Name services and domain name system, directory and discovery services Case Study: Global Name service.

Transaction and Concurrency Control: transactions, nested transactions, Locks, optimistic concurrency control, time stamp ordering, Comparison of methods for concurrency control.

Distributed Transaction: Flat and nested distributed transactions. Atomic Commit protocol, Distributed dead locks.

UNIT-IV (11 Hrs.)

Distributed Multimedia Systems: Characteristics of multimedia, multimedia data. Quality of service management, resource management, stream adaptation. Case study; Tiger video file server.

RECOMMENDED BOOKS:

1. G. Coulouis, et al., 'Distributed Systems: Concepts and design', 5th Edn., Pearson Education Asia, Pearson, **2011**.
2. A.S. Tanenbaum, 'Modern operating Systems', 3rd Edn., Prentince Hall, **2015**.
3. Seema Shah and Sunita Mahajan, 'Distributed Computing', 1st Edn., Oxford University Press, **2010**.

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PRACTICAL LAB.-I

Subject Code: MCSE1-104 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

ADAVANCED DATABASES

MCSE1-205 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
The OBJECTIVES of this COURSE is to study principal of database management system, distributed databases, parallel databases and emerging database technologies. To understand the basic principles, concepts and applications of data warehousing and data mining.

COURSE OUTCOMES:
CO1: Be able to acquire the essential concept of ER Model and object oriented Databases and Schema Designs.
CO2: Be able to understand essential concept of parallel, distributed systems with concurrency control and their recovery.
CO3: Be able to cope up with XML databases and related advance topics.
CO4: Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment and Data Mining.

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UNIT-I (12 Hrs.)

Extended Entity Relationship Model and Object Model: Introduction to ER model, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization. Relationship Types.
Object−Oriented Databases: Weakness of RDBMS, Overview of Object−Oriented Concepts. Object Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods, and Persistence, Type Hierarchies and Inheritance; Database Schema Design for OODBMS; Overview of OQL, Persistent Programming Languages; OODBMS Architecture and Storage Issues.
Object Relational and Extended Relational Databases: Database Design for an ORDBMS, Nested Relations and Collections; Storage and Access methods, Query processing and Optimization; An Overview of SQL3; Comparison of RDBMS, OODBMS, ORDBMS.

UNIT-II (11 Hrs.)

Parallel and Distributed Databases and Client−Server Architecture: Introduction to Parallel Databases, architecture for Parallel Databases, I/O Parallelism, Inter and Intra Query Parallelism. Distributed Database Concepts, Data Fragmentation, Replication, and Allocation techniques for Distributed Database Design; Query Processing in Distributed Databases; Concurrency Control and Recovery in Distributed Databases. An Overview of Client−Server Architecture.

UNIT-III (11 Hrs.)

Databases on the Web and Semi Structured Data: Web Interfaces to the Web, Overview of XML; Structure of XML Data, Document Schema, Querying XML Data; Storage of XML Data, XML Applications; The Semi Structured Data Model, Implementation Issues. Indexes for Text Data.

Enhanced Data Models for Advanced Applications: Active Database Concepts. Temporal Database Concepts; Spatial Databases, Concepts and architecture; Deductive Databases, Mobile Databases, Geographic Information Systems.

UNIT-IV (11 Hrs.)

Introduction to Data Warehousing: Introduction to Data warehouse and OLAP, Multidimensional data model, Data Warehouse architecture, data cubes, Operations on cubes, Data preprocessing- Need for preprocessing, Analysis of Data preprocessing. Introduction to data mining, Data mining functionalities, clustering, classification - decision tree, Bayesian classifiers, association rules - apriori algorithm, Introduction to text mining.

RECOMMENDED BOOKS:

1. R. Elmasri, S.B. Navathe, 'Fundamentals of Database Systems', 6th Edn., Pearson Education, **2010**.
2. Abraham Silberschatz, Henry. F. Korth and S. Sudharsan, 'Database System Concepts', 4th Edn., Tata McGraw Hill, **2004**.
3. Raghu Ramakrishna and Johannes Gehrke, Database Management Systems, 3rd Edn., Tata McGraw Hill, **2003**.
4. Arihant Khitcha, Neeti Kapoor, 'Advance Database Management System', 4th Edn., Genius Publications, **2014**.
5. S.S. Khandare, S. Chand, 'Database Management and Oracle Programming', 2nd Edn., **2010**.

ADVANCED COMPUTER NETWORKS

Subject Code: MCSE1-206 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

MRSPTU

COURSE OBJECTIVES:

This COURSE provides knowledge about computer network related hardware and software using a layered architecture. It is also offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.

COURSE OUTCOMES:

CO1: Able to explain the Fundamentals of Computer Networks and their layered architecture. Also acquire knowledge about ATM Layered model and LAN Emulation.

CO2: Able to explain about various Transport and Application Layer Protocols. Also acquire knowledge about various congestion control mechanisms and network management.

CO3: Able to explain Features, advantages and applications of Adhoc Networks, Adhoc versus Cellular networks, Network architecture and Technologies. Evolution with the examples of wireless communication systems other techniques of Cellular Networks like 2G, 2.5G and 3G Technologies. Also able to explain wireless local loop (WLL), Wireless and local Area Networks (WLANs).

CO4: Able to define the Fundamentals of network security, various authentication protocols and E-mail Security.

UNIT-I (11 Hrs.)

Computer Networks: Layered architecture, Asynchronous Transfer Mode- ATM layered model, switching and switching fabrics, network layer in ATM, QOS, LAN emulation.

UNIT-II (11 Hrs.)

Transport Layer: Elements of transport protocols; Internet transport protocols: TCP and UDP, TCP connection management, congestion control. Application Layer-Network application architectures: Client-server, P2P and hybrid; Application layer protocols: DNS,

FTP, TFTP, TELNET, HTTP and WWW, SMTP and electronic mail; Network management and SNMP.

UNIT-III (13 Hrs.)

Adhoc and Cellular networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. Wireless Communication Systems- Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. Wireless and Mobile Networks-Wireless links and network characteristics, wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks.

UNIT-IV (10 Hrs.)

Introduction to Network Security: Cryptography, symmetric and public-key algorithms, digital signatures, communication security, and authentication protocols, E-mail security, PGP and PEM.

RECOMMENDED BOOKS:

1. B.A. Forouzan, 'Data Communication and Networking', 5th Edn., Tata McGraw-Hill, **2013**.
2. A.S. Tanenbaum, 'Computer Networks', 4th Edn., Pearson Education, **2002.**
3. William Stallings, 'Network Security and Cryptography', 6th Edn., Prentice Hall of India, **2013**.
4. Theodore S. Rappaport, 'Wireless Communication: Principles and Practices', 2nd Edn., Pearson Education, **2001**.
5. D.E. Comer and R.E. Droms, 'Computer Networks and Internets', Prentice Hall, 4th Edn., **1998**.
6. Sunil Kumar S. Manvi, Mahabaleshwar S. Kakkasageri, 'Wireless and Mobile Networks: Concepts and Protocols', 2nd Edn., Wiley India, **2016**.

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INFORMATION RETRIEVAL

Subject Code: MCSE1-264 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

COURSE OBJECTIVES:

To learn the underlying technologies of modern information retrieval system.

COURSE OUTCOMES:

CO1: Able to understand the basic concepts of modern information retrieval system.
CO2: Able to understand the search engine architecture.
CO3: Able to learn the retrieval models and apply the algorithms of retrieval algorithms.
CO4: Able to evaluate the quality of retrieval system.

UNIT-I (11 Hrs.)

Introduction: The nature of unstructured and semi-structured text, Boolean queries, World Wide Web, History of Hypertext, Hypertext systems, Problems due to Uniform accessibility, types of Hypertext data, Text and multimedia data indexing, PageRank, HITS, XML and Semantic web.

UNIT-II (12 Hrs.)

Search Engine Architecture: The basic building blocks of a modern search engine system, including web crawler, basic text analysis techniques, inverted index, query processing, search result interface.

UNIT-III (11 Hrs.)

Retrieval Models: Boolean, vector space, probabilistic and language models, latent semantic indexing, ranking algorithm, Introduction to the most recent development of COURSE-based ranking algorithms, i.e., COURSE-to-rank, Relevance feedback, query expansion, link analysis and search applications.

UNIT-IV (11 Hrs.)

Performance Evaluation: Evaluating search engines, User happiness, precision, recall, F-measure.

RECOMMENDED BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval, 1st Edn., Cambridge University Press, **2008**.
2. Bruce Croft, Donald Metzler and Trevor Strohman, 'Search Engines: Information Retrieval in Practice', 1st Edn., Pearson Education, **2009**.
3. Yates Ricardo and Berthier Ribeiro-Neto, 'Modern Information Retrieval', 2nd Edn., Addison-Wesley, **2011**.
4. Soumen Chakrabarti, 'Mining the Web', 1st Edn., Morgan-Kaufmann, **2002.**

WEB MINING

Subject Code: MCSE1-265 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

MRSPTU

COURSE OBJECTIVES:

To strengthen real network concept while crawling web and real large scale data structure. It develops the knowledge of web search engines, and related technologies and develops the skill to apply the learned knowledge in real problems.

COURSE OUTCOMES:

CO1: Able to explain the basics of Search Engines and their architecture. Also acquire knowledge about Crawls and feeds.

CO2: Able to explain about Ranking with indexes, inverted indexes. Also acquire knowledge about Entropy and Ambiguity, Delta Encoding, Bit-aligned codes, Byte-aligned codes.

CO3: Able to explain about evaluating Search Engines, The Evaluation Corpus, Logging, Effectiveness Metrics, Recall and Precision, Averaging and Interpolation, Efficiency Metrics, Training, Significance Tests, Setting Parameter Values.

CO4: Able to explain various Classification and Clustering Methods. Also acquire knowledge about Social Search, indexing and mechanisms.

UNIT-I (11 Hrs.)

Basic Search Engines and information Retrieval: Architecture of a Search Engine, Basic Building Blocks (Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking Evaluation). Crawls and Feeds, deciding what to search, Crawling the Web, Directory Crawling, Document Feeds, Storing the Documents, Detecting Duplicates, Removing Noise.

UNIT-II (11 Hrs.)

Ranking with Indexes: Abstract Model of Ranking, Inverted indexes, Documents, Counts, Positions, Fields and Extents, Scores, Ordering, Compression, Entropy and Ambiguity, Delta Encoding, Bit-aligned codes, Byte-aligned codes, Looking ahead.

UNIT-III (11 Hrs.)

Evaluating Search Engines: Why Evaluate? The Evaluation Corpus, Logging, Effectiveness Metrics, Recall and Precision, Averaging and Interpolation, Focusing On the Top

Documents, Using Preferences, Efficiency Metrics, Training, Testing, and Statistics, Significance Tests, Setting Parameter Values, Bottom Line.

UNIT-IV (12 Hrs.)

Classification and Clustering: Classification and Categorization, Naïve Bayes, Support Vector Machines, Evaluation, Classifier and Feature Selection, Spam, Sentiment, and Online Advertising, Clustering, Hierarchical and *K*-Means Clustering, *K* Nearest Neighbour Clustering, Social Search, What is Social Search?, User Tags and Manual Indexing, Searching With Communities, Filtering and, Recommending, Document Filtering, Collaborative Filtering, Personalization, Peer-to-Peer and Meta search, Distributed search, P2P Networks.

RECOMMENDED BOOKS:

1. Soumen Chakrabarti, Mining the Web, 1st Edn., Morgan-Kaufmann, **2002**.
2. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schutze, 'Introduction to Information Retrieval', 1st Edn., Cambridge University Press, **2008.**

DATA WAREHOUSING AND DATA MINING

Subject Code: MCSE1-266 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:

Concept of Data mining and warehousing, applications to real life examples. The study of data warehousing and various data mining tools.

COURSE OUTCOMES:

CO1: To introduce the basic concepts of Data Warehouse and Data Mining techniques.
CO2: To process raw data to make it suitable for various data mining algorithms.
CO3: To discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
CO4: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.

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UNIT-I (11 Hrs.)

Data Warehousing: Introduction, ETL, Data warehouses– design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view and data cube, Data cube operations, data cube computation.

Review of the Basic Data Analytic Methods using R: Introduction to R –look at the data, Analyzing and Exploring the Data, Statistics for Model Building and Evaluation.

UNIT-II (11 Hrs.)

Data Mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms.

UNIT-III (11 Hrs.)

Classification: Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method.

UNIT-IV (12 Hrs.)

Cluster Analysis: Introduction, partitional methods, hierarchical methods, density based methods, dealing with large databases, cluster software; Search engines: Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

Web Data Mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.

RECOMMENDED BOOKS:

1. Carlo Vercellis, 'Business Intelligence: Data mining and Optimization for Decision Making', Wiley, **2013**.
2. J. Han, M. Kamber and J. Pei, 'Data Mining Concepts and Techniques', Morgan Kaufmann Publishers, 3rd Edn., **2011**.
3. V. Pudi, P.R. Krishana, 'Data Mining', Oxford University Press, 1st Edn., **2009**.
4. P. Adriaans, D. Zantinge, 'Data Mining', Pearson Education Press, 1st Edn.., **1996**.
5. P. Pooniah, 'Data Warehousing Fundamentals', 1st Edn., Willey interscience Publication, **2001**.

ENTERPRISE RESOURSE PLANNING

Subject Code: MCSE1-267 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:

It gives knowledge about the various functions performed in the organizations to accomplish their targets. This COURSE teaches the various business modules of an organization.

COURSE OUTCOMES:

CO1: To understand the meaning of an enterprise and its related technologies.
CO2: To understand the various strategies used for ERP Implementation.
CO3: To give overview about various business modules used in an organization.
CO4: To understand the applications of an ERP system and study various ERP packages.

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UNIT-I (11 Hrs.)

ERP AND Technology: Introduction, Related Technologies, Business Intelligence, E-Commerce and E-Business, Business Process Reengineering, Data Warehousing, Data Mining, OLAP, Product life Cycle management, SCM, CRM.

UNIT-II (12 Hrs.)

ERP Implementation: Implementation Challenges, Strategies, Life Cycle, Methodologies, Package selection, Project Teams, Process Definitions, Vendors and Consultants, Data Migration, Project management.

UNIT-III (11 Hrs.)

ERP in Action & Business Modules: Operation and Maintenance, Performance, Maximizing the ERP System, Business Modules, Finance, Manufacturing, Human Resources, Plant maintenance, Materials Management, Quality management, Marketing, Sales, Distribution and service.

UNIT-IV (11 Hrs.)

ERP Application and Market: Enterprise Application Integration, ERP II, Total quality management, Future Directions, SAP AG, Oracle, PeopleSoft, JD Edwards, QAD Inc, SSA Global, Lawson Software, Epicor, Intuitive.

RECOMMENDED BOOKS:

1. Alexis Leon, 'ERP DEMYSTIFIED', 2nd Edn., Tata McGraw Hill, **2008**.
2. Mary Sumner, 'Enterprise Resource Planning', Pearson Education, **2007**.
3. Jim Mazzullo, 'SAP R/3 for Everyone', Pearson, **2007**.
4. Jose Antonio Fernandz, 'The SAP R /3 Handbook', Tata McGraw Hill, **1998**.
5. Biao Fu, 'SAP BW: A Step-by-Step Guide', 1st Edn., Pearson Education, **2003**.

WEB TECHNOLOGY

Subject Code: MCSE1-268 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
To study various web technologies used today.
COURSE OUTCOMES:
CO1: To understand the meaning of internet and World Wide Web.
CO2: To understand HTML5 and various graphics used in HTML5.
CO3: To understand the various concepts used in JavaScript.
CO4: To understand the concept of AJAX and Java, Standard Controls, techniques to design website pages.

UNIT-I (11 Hrs.)

Internet and World Wide Web: Introduction, Internet Addressing, ISP, types of Internet Connections, Introduction to WWW, WEB Browsers, WEB Servers, URLS, http, WEB applications, Tools for WEB site creation.
HTML5: Introduction to HTML5, Lists, adding graphics to HTML5 page, creating tables, linking documents, forms, frames, Cascading Style sheets.

UNIT-II (12 Hrs.)

JavaScript: Introduction to JavaScript, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies. Introduction, HTTP request, XMHttpRequest, AJAX Server Script, AJAX Database.
PHP: Introduction, syntax, statements, operators, sessions, E-mail, PHP and MySQL.

UNIT-III (11 Hrs.)

JAVA: Introduction to java objects and classes, control statements, arrays, inheritance, polymorphism, Exception handling.
Standard Controls: Display information, accepting user input, submitting form data, displaying images, using the panel control, using the hyperlink control.

UNIT-IV (11 Hrs.)

Designing Website with Master Pages: Creating master pages, Modifying master page content, and Loading master page dynamically.
List Controls: Dropdown list control, Radio button list controls, list box controls, bulleted list controls, custom list controls.
Grid View Controls: Grid view control fundamentals, using field with the grid view control, working with grid view control events extending the grid view control.

RECOMMENDED BOOKS:

1. Harvey Deitel, Paul Deitel, Tem Nieto, and Praveen Sandhu, 'XML How to Program', Pearson Education, **2001**.
2. Herbert Schildt, Fatrick nanghton, 'The complete reference Java 2.0', 3rd Edn., McGraw Hill Professional, **1999**.
3. Ivan Bayross, 'Web Enabled Commercial Application', 4th Edn., BPB Publications, **2016**.
4. Steven M. Schafer, ' HTML, CSS, JavaScript, Perl, Python and PHP', Wiley India Textbooks, **2005**.

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JAVA

Subject Code: MCSE1-269 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
The students should be able to create Java programs that leverage the object-oriented features of the Java language, such as encapsulation, inheritance and polymorphism; use data types, arrays and other data collections; implement error-handling techniques using exception handling**.** Understand and acquire knowledge of Servlets and JSP.

COURSE OUTCOMES:
CO1: Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
CO2: Create Java application programs that is interfaces and APIs and learn proper program structuring.
CO3: Be able to use the Java SDK environment to create, debug and run simple Java programs.
CO4: Understand Servlets, JSP to make use of it and address a particular software problem.

UNIT-I (11 Hrs.)

Introduction to Java programming: The Java Virtual Machine, Variables and data type, Conditional and looping constructs, Arrays. Object-oriented programming with Java Classes and Objects-Fields and Methods, Constructors, Overloading methods, Garbage collection, Nested classes. Inheritance- Overriding methods, Polymorphism, Making methods and classes final, Abstract classes and methods, Interfaces.

UNIT-II (12 Hrs.)

Exception Handling: With try-throw-catch-finally constructs, The Exception class. The Object class- Cloning objects, The JDK Linked List class, Strings, String conversions. Working with types- Wrapper classes, Enumeration interface, Packages- Package access, Documentation comments. Applets- Configuring applets, Applet capabilities and restrictions, Basics of AWT and Swing- Layout Managers, Event Handling, The Action Listener interface, Panels, Classes for various controls, such as label, choice, list, Checkbox, etc., Dialogs and frames, using menus, Using the adapter classes, Graphics.

UNIT-III (11 Hrs.)

Threads: Synchronization. The I/O Package-InputStream and OutputStream classes, Reader and Writer classes.Database connectivity with JDBC-Java security, Types of Drivers, Two-Tier Client/Server Model, Three-Tier Client/Server Model, Basic Steps of JDBC, Creating and Executing SQL Statement, The Result Set Object, Working with Database MetaData, Interface.

UNIT-IV (11 Hrs.)

Servlets: Servlet Interaction & Advanced Servlets, Life cycle of Servlet, Java Servlet Development Kit, Javax.servlet package, Reading Servlet Parameters, Reading Initialization Parameters, The javax.servlet.http Package, Handling HTTP. JavaServer Pages-JSP Technologies, Understanding the Client-Server Model, Understanding Web server software, Configuring the JSP Server, Handling JSP Errors.

RECOMMENDED BOOKS:

1. Bruce Eckel, 'Thinking in Java', 4th Edn., Prentice Hall, **2006**.
2. Herbert Schildt, Fatrick Nanghton, 'The Complete Reference Java 2.0', 3rd Edn., McGraw Hill Professional, **1999**.
3. Iver Harton, 'Beginning in Java 2.0', 7th Edn., Wrax Publications, **2011**.

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4. Paul Dietal, Harvey Dietal, 'Java How to Program', 9th Edn., Prentice Hall, **2011**.
5. Hortsmann, C.S. Cornell, 'Core Java Vol.-1 Fundamentals', 10th Edn., Pearson, **2016.**
6. Marty Hall, Larry Brown, 'Core Servlets & Java Server Pages Volume-1', 2nd Edn., Prentice, **2003**.

ARTIFICIAL NEURAL NETWORKS

Subject Code: MCSE1-270 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
To understand the basics, architecture and applications of neural networks.

COURSE OUTCOMES:

CO1: To give students an introduction to the basics and architecture of artificial Neural Network.
CO2: To understand the single layer ANN and its various COURSE algorithms.
CO3: To study in detail the concept of multi-Layer ANN and the various backpropagation algorithms.
CO4: To survey the applications of ANN in various fields such as pattern recognition.

UNIT-I (11 Hrs.)

Introduction and ANN Structure: Biological neurons and artificial neurons, Model of an ANN, Activation functions used in ANNs, Typical classes of network architectures.
Mathematical Foundations and COURSE mechanisms: Re-visiting vector and matrix algebra, State-space concepts, Concepts of optimization, Error-correction COURSE, Memory-based COURSE, Hebbian COURSE, Competitive COURSE.

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UNIT-II (12 Hrs.)

Single layer perceptrons: Structure and COURSE of perceptrons, Pattern classifier - introduction and Bayes' classifiers, Perceptron as a pattern classifier, Perceptron convergence, Limitations of a perceptrons.
Feedforward ANN: Structures of Multi-layer feedforward networks, Back propagation algorithm, Back propagation - training and convergence, Functional approximation with back propagation, Practical and design issues of back propagation COURSE.

UNIT-III (11 Hrs.)

Radial Basis Function Networks: Pattern separability and interpolation, Regularization Theory, Regularization and RBF networks, RBF network design and training, Approximation properties of RBF.
Support Vector machines: Linear separability and optimal hyperplane, Determination of optimal hyperplane, Optimal hyperplane for non-separable patterns, Design of an SVM, Examples of SVM.

UNIT-IV (11 Hrs.)

Competitive COURSE and Self organizing ANN: General clustering procedures, COURSE Vector Quantization (LVQ), Competitive COURSE algorithms and architectures, Self-organizing feature maps, Properties of feature maps.
Fuzzy Neural Networks: Neuro-fuzzy systems, Background of fuzzy sets and logic, Design of fuzzy stems, Design of fuzzy ANNs.

RECOMMENDED BOOKS:

1. Simon Haykin, 'Neural Networks: A comprehensive foundation', 2nd Edn., Pearson Education Asia.
2. Satish Kumar, 'Neural Networks: A Classroom Approach', Tata McGraw Hill, **2004**.

3. Robert J. Schalkoff, 'Artificial Neural Networks', McGraw Hill International Editions, **1997**.

OPEN SOURCE TECHNOLOGIES

Subject Code: MCSE1-271 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:
To give a brief introduction to the open source technology. Through interactive sessions enabling students to enhance their skills in contributing and implementing their technical knowledge.

COURSE OUTCOMES:
CO1: Open source software history, initiatives and principles. Open standards, Licenses and FOSS.
CO2: Learn about the Open Source Operating system and its distributions like Fedora, Google chrome OS, Ubuntu.
CO3: Study of Web technologies based on open Software's LAMP (Linux Apache MySqland PHP/Python).
CO4: To Learn HTML, XHTML, PHP and JavaScript.

UNIT-I (11 Hrs.)

Introduction: Open Source Definition, Free Software vs. Open Source Software, Public Domain Software, Open Source History, Initiatives, Principle and Methodologies. Open Standards.
Open Source Development Model Licenses and Patents: What Is a License, Important FOSS Licenses (Apache, BSD, GPL, LGPL), copyrights and copy lefts, Patents Economics of FOSS: Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization.

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UNIT-II (12 Hrs.)

Open Source Operating Systems: Different open source operating systems. Google Chrome OS, BSD, Linux Distributions – Fedora and Ubuntu, Installation, Disk Partitioning, Boot loader. Using Linux – Shell, File system familiarity, Linux Administration – Managing users, services and software, Network Connectivity, Configurations and Security.
Open Source Web Technologies: Two Tier and Three Tier Web based Application Architecture. LAMP Terminologies, Advantages. Apache, Web server conceptual working, Web browser, HTTP, Installation and Configuration, httpd.conf file, Logging, Security, Running a website, MySQL, Database management system, ER diagram, Relational database, Installation, Configuration, Administration, Common SQL queries.

UNIT-III (11 Hrs.)

Programming on XHTML and XML: Editing XHTML, W3C XHTML validation services, designing XHTML by using XHTML tables, frames, forms and other elements. CSS and its types. XML, XML namespaces, DTD, XML schema, XML vocabularies, DOM and its methods, SOAP.

UNIT-IV (11 Hrs.)

Programming on PHP and Java Script: JavaScript: JavaScript variables, control structures, functions, arrays and objects. Cascading Style Sheets, Client Side Scripting - Java Script, PHP: Form processing and business logic, stream processing and regular expressions, viewing client/server environment variables, connecting to database and handling of cookies. SQL, Accessing databases with PHP.

Open Source Ethics: Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, shared software, Shared source.

Case Studies: Mozilla (Firefox), Wikipedia, Joomla, Open Office, GCC.

RECOMMENDED BOOKS:

1. B. Ware, B. Lee J., 'Open Source Development with Lamp: Using Linux, Apache, MySQL, Perl, and PHP', Addison-Wesley Professional.
2. Deitel, 'Internet and World Wide Web, How to Program', 4th Edn., Prentice Hall, **2008.**
3. P. DuBois, MySQL, 4th Edn., Addison-Wesley Professional.
4. M. Zandstra, 'Teach Yourself PHP in 24 Hours', 2nd Edn., Sams Publishing.

PRACTICAL LAB.-II

Subject Code: MCSE1-207 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

- Practical's should be related to the core subjects of the same semester.

SEMANTICS WEB AND SOCIAL NETWORKING

Subject Code: MCSE1-372 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

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COURSE OBJECTIVES:

The OBJECTIVES of this COURSE is to understand the need of semantic web in web services and advances the knowledge about Semantic Web Applications, Services and Social Networking.

COURSE OUTCOMES:

CO1: Able to understand semantic web basics, architecture and technologies.

CO2: Able to understand the Knowledge Representation for the Semantic Web and Ontology Engineering.

CO3: Able to design and implement a web services application that "discovers" the data and/or other web services via the semantic web.

CO4: Able to discover the capabilities and limitations of semantic web technology for social networks.

UNIT-I (11 Hrs.)

Introduction: Introduction to the Syntactic web and Semantic Web, Evolution of the Web, the visual and syntactic web, Levels of Semantics, Metadata for web information, The semantic web architecture and technologies, Contrasting Semantic with Conventional Technologies, Semantic Modeling, Potential of semantic web solutions and challenges of adoption.

UNIT-II (12 Hrs.)

Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web Resource Description Framework (RDF) / RDF Schema, fundamental concepts of Ontology Web Language (OWL), UML, XML/XML Schema.

Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-III (11Hrs.)

Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-COURSE, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT-IV (11 Hrs.)

Social Network Analysis and Semantic Web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.

RECOMMENDED BOOKS:

1. Peter Mika, 'Social Networks and the Semantic Web', 1st Edn., Springer, **2007**.
2. Berners Lee, Godel and Turing, 'Thinking on the Web', Wiley Inter Science, **2009**.
3. Liyang Yu, 'A Developer's Guide to the Semantic Web', 1st Edn., Springer, **2011**.
4. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, 'Semantic Web Programming', 1st Edn., Wiley, **2009**.

NATURAL LANGUAGE PROCESSING

Subject Code: MCSE1-373 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

COURSE OBJECTIVES:

To describe the techniques and algorithms used in processing natural languages.

COURSE OUTCOMES:

CO1: To understand the concept of Natural Language Processing (NLP), Challenges of NLP, NLP Applications, Understanding different levels of language analysis.

CO2: To understand concepts related to morphology and parsing in detail.

CO3: To study Need of Machine translation, Problems of Machine Translation, MT Approaches.

CO4: To study about lexical knowledge network and speech recognition.

UNIT –I (11 Hrs.)

Introduction: Natural Languages, Origin of Natural Language Processing (NLP), Challenges of NLP, Application of Natural Language, Understanding Different levels of language analysis.

Regular Expressions, Finite state automata, Morphological analysis: Inflectional and derivational morphology, Finite state morphological parsing.

UNIT-II (12 Hrs.)

Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology COURSE; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution.

Structures: Theories of Parsing, Parsing Algorithms: Top down parsing, bottom up parsing, Problems with top down and bottom up parsing, Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

UNIT-III (11 Hrs.)

Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT

System, Statistical Machine Translation, UNL Based Machine Translation, Translation involving Indian Languages.

UNIT-IV (11 Hrs.)

Meaning: Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors.

Speech Recognition: Issues in Speech Recognition, The Sound Structure of Language, Speech Recognition, Signal processing and analysis method, Articulation and acoustics, Phonology and phonetic transcription, Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.

RECOMMENDED BOOKS:

1. J. Allen, 'Natural Language Understanding', 2nd Edn., Benjamin/Cunnings, **1987**.
2. Siddiqui and Tiwary U.S., 'Natural Language Processing and Information Retrieval', 1st Edn., Oxford University Press, **2008**.
3. K. Jensen, G.E. Heidorn, S.D. Richardson, 'Natural Language Processing: The PLNLP Approach', Springer, **2013**.
4. P. Roach, 'Phonetics', Oxford University Press, **2012**.

BIG DATA & CLOUD COMPUTING

Subject Code: MCSE1-374 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

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COURSE OBJECTIVES:

This COURSE will help you in COURSE Big data with Cloud technology to understand what is cloud storage, Big data in the cloud, characteristics of cloud computing, cloud computing services and cloud hosting, cloud data storage and deployment models, cloud computing companies and cloud service providers, cloud infrastructure, advantages of cloud computing and issues with cloud computing.

COURSE OUTCOMES:

CO1: Ability to learn basics of Big data, Hadoop and Map Reduce.

CO2: Able to learn the basics of Hive, HQL, HBase schema design, PIG and NoSQL.

CO3: Understand various basic concepts related to cloud computing technologies, architecture and concept of different cloud models: IaaS, PaaS, SaaS. Cloud virtualization, cloud storage, data management and data visualization.

CO4: Understand different cloud programming platforms & tools and familiar with application development and deployment using cloud platforms.

UNIT I (11 Hrs.)

Introduction – Introduction to Big Data and its importance, 5v's of Big Data, Security Challenges, Need for Big data analytics, Big data applications. Apache Hadoop Architecture, Hadoop YARN, Comparison of Traditional system & Hadoop Ecosystem, Installation steps of Hadoop (1.x), Moving Data in and out of Hadoop, need for Record Reader and Record writer, understanding inputs and outputs file format of Map Reduce.

UNIT-II (12 Hrs.)

Introduction to Hive, Hive Architecture and Installation, HQL vs. SQL, HBase concepts-Schema Design, Table Design, Introduction to PIG, NoSQL.

UNIT-III (11 Hrs.)

Cloud Computing Fundamental: Cloud Computing definition, Deployment models. Cloud as a Service. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Benefits and challenges to Cloud architecture.

UNIT-IV (11 Hrs.)

Cloud Applications, Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment, computing infrastructures available for implementing cloud based services. Case Study of EC2.

RECOMMENDED BOOKS:

1. Chris Eaton, Dirk deroos et al., 'Understanding Big Data', 1st Edn., McGraw Hill, **2015**.
2. Tom White, 'HADOOP: The definitive Guide', 4th Edn., O Reilly, **2015**.
3. Gautam Shroff, 'Enterprise Cloud Computing Technology Architecture Applications', 1st Edn., Cambridge University Press, **2010**.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, 'Cloud Computing, A Practical Approach', 1st Edn., Mcgraw Hill Education, **2009**.

DIGITAL IMAGE PROCESSING

Subject Code: MCSE1-375 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

COURSE OBJECTIVES:

Visual information plays an important role in many aspects of our life. Much of this information is represented by digital images. Digital image processing is ubiquitous, with applications including television, tomography, photography, printing, robot perception, and remote sensing. This is an introductory COURSE to the fundamentals of digital image processing. It emphasizes general principles of image processing, rather than specific applications.

COURSE OUTCOMES:

CO1: To introduce the digital images, processing with digital images, application areas of the field, fundamentals step to process images, image acquisition and digitization and understand image processing system.

CO2: To learn basic image transforms, image enhancement in spatial as well as frequency domain, to make them aware about various filters used for enhancement. Aim is to introduce histograms in image processing.

CO3: To study the image restoration of degraded images and processing of colour images and Introduction to wavelets.

CO4: To understand the image compression in order to save bandwidth and storage, image segmentation techniques, representation of image and basics of morphological processing operations.

UNIT-I (11 Hrs.)

Introduction: Digital Images and their Representation, Digital image processing, Application areas of digital image processing. Fundamental Steps in Image Processing, Elements of a Digital Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, A Simple Image Model, Image acquisition, Sampling and Quantization, Some Basic Relationships between Pixels, Mathematical Preliminaries, 2D Linear Space Invariant Systems,2D Convolution and Correlation.

UNIT-II (12 Hrs.)

Image Enhancement: Some Simple Intensity Transformations, Image Subtraction, Image Averaging, Spatial Domain Methods, Smoothing Filters, Sharpening Filters, Frequency Domain Methods, Lowpass Filtering, Highpass Filtering, Generation of Spatial Masks from Frequency Domain Specifications, Histogram Processing: Streaching, Equalization and Specification.

Image Transforms: 2D Orthogonal and Unitary Transforms, Properties and Examples. Introduction to the Fourier Transform, The Discrete Fourier Transform, 2D DFT, FFT, DCT, Hadamard Transform, Haar Transform, KL Transform.

UNIT-III (11 Hrs.)

Image Restoration: Degradations Model, Degradation Model for continuous and discrete functions, Algebraic Approach to Restoration: Unconstrained Restoration, Constrained Restoration, Inverse Filtering, weiner filters, Restoration in the Spatial Domain, Geometric Transformation.

Color Image processing and wavelets: Color Image Processing Fundamentals, Color Models: RGB, CMY, CMYK, HSI, Relationship between different Models.

UNIT-IV (11 Hrs.)

Image Compression: Fundamentals: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. Image Compression Models, Loss Less Variable Length, Huffman, Arithmetic Coding, Bit Plane Coding, Loss Less Predictive Coding, Lossy Transform (DCT) Based Coding, Sub Band Coding.

Image Segmentation: Edge Detection, Line Detection, Curve Detection, Edge Linking and Boundary Extraction, Image Representation: Boundary Representation, Region Representation and Segmentation, Morphological Processing: Dilation, Erosion, Opening and Closing, Hit and Miss Algorithms.

RECOMMENDED BOOKS:

1. Rafael. C. Gonzalez & Richard E. Woods. 'Digital Image Processing', 2nd Edn., Pearson Education, **2006.**
2. W.K. Pratt. 'Digital Image Processing',3rd Edn., John Wiley & Sons, Inc., **2006.**
3. M. Sonka et.al, 'Image Processing, Analysis and Machine Vision', 2nd Edn., Thomson, COURSE, India Edition, **2007**.
4. Kenneth R. Castleman, 'Digital Image Processing', 2nd Edn., Pearson Education, **1996**.
5. S. Jayaraman, S. Esakkirajan, T. Veerakumar, 'Digital Image Processing', 1st Edn., McGraw Hill Education, **2009**.
6. Anil Jain. K., 'Fundamentals of Digital Image Processing', 4th Edn., Prentice Hall of India, **1989**.

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