SCHEME & SYLLABUS

M.Tech Computer Science Engineering

Department of Computer Science Engineering

UIET

Sant Baba Bhag Singh University

2018

INDEX

SEMESTER I

I. Theory Subjects

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE501	Network Technology	4:0:0	4:0:0	4	4
2.	CSE503	Advanced Data Structure and Applications	4:0:0	4:0:0	4	4
3.	CSE505	Software Engineering and Methodologies	4:0:0	4:0:0	4	4
4.	CSE507	Parallel Computing	4:0:0	4:0:0	4	4
5.		Elective-I	4:0:0	4:0:0	4	4

II. Practical Subjects

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE509	Advanced Data Structure and Applications Lab	0:0:4	0:0:2	4	2

Elective-I

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE511	Artificial Intelligence & its Applications	4:0:0	4:0:0	4	4
2.	CSE513	Machine Learning	4:0:0	4:0:0	4	4
3.	CSE515	Network & System Security	4:0:0	4:0:0	4	4

Total Contact Hours = 24
Total Credits Hours = 22

SEMESTER II

I. Theory Subjects

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE502	Advanced Database Design & Management	4:0:0	4:0:0	4	4
2.	MAT524	Research Methodology	4:0:0	4:0:0	4	4
3.	CSE504	Digital Image Analysis	4:0:0	4:0:0	4	4
4.		Elective-II	4:0:0	4:0:0	4	4
5.		Elective-III	4:0:0	4:0:0	4	4

II. Practical Subjects

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE506	Special Problem	0:0:2	0:0:1	2	1
2.	CSE508	Advanced Database Design & Management Lab	0:0:4	0:0:2	4	2
3.		Elective-III Lab	0:0:4	0:0:2	4	2

Elective-II

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE510	Real Time Software and System	4:0:0	4:0:0	4	4
2.	CSE512	Biometric Security	4:0:0	4:0:0	4	4
3.	CSE514	Information Retrieval & its Applications	4:0:0	4:0:0	4	4
4.	CSE516	Principles of Compiler Design	4:0:0	4:0:0	4	4
5.	CSE518	Cryptography and Information Security	4:0:0	4:0:0	4	4
6.	CSE520	Big Data Analytics	4:0:0	4:0:0	4	4
7.	CSE522	Optimization Techniques	4:0:0	4:0:0	4	4

Elective-III

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE524	Ad-hoc Networks	4:0:0	4:0:0	4	4
2.	CSE526	Advanced & Distributed Operating System	4:0:0	4:0:0	4	4
3.	CSE528	Advanced Programming Language	4:0:0	4:0:0	4	4
4.	CSE530	Soft Computing & Intelligent System	4:0:0	4:0:0	4	4
5.	CSE532	Natural Language Processing	4:0:0	4:0:0	4	4
6.	CSE534	Computer Vision and Object Recognition	4:0:0	4:0:0	4	4

Elective-III Lab

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE536	Ad-hoc Networks Lab	0:0:4	0:0:2	4	2
2.	CSE538	Advanced & Distributed Operating System Lab	0:0:4	0:0:2	4	2
3.	CSE540	Advanced Programming Language Lab	0:0:4	0:0:2	4	2
4.	CSE542	Soft Computing & Intelligent System Lab	0:0:4	0:0:2	4	2
5.	CSE544	Natural Language Processing Lab	0:0:4	0:0:2	4	2
6.	CSE546	Computer Vision and Object Recognition Lab	0:0:4	0:0:2	4	2

Total Contact Hours = 30
Total Credits Hours = 25

SEMESTER III

I. Theory Subjects

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE601	Object Oriented Analysis and Design Using UML	3:0:0	3:0:0	3	3
2.		Elective-IV	3:0:0	3:0:0	3	3

II. Practical Subjects

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE603	Object Oriented Analysis and Design Using UML Lab	0:0:2	0:0:1	2	1
2.	CSE605	Seminar	0:0:2	0:0:1	2	1
3.	CSE607	Master's Research	0:0:10	0:0:5	10	5

Elective-IV

S No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE609	Speech Processing	3:0:0	3:0:0	3	3
2.	CSE611	Wireless and Mobile Networks	3:0:0	3:0:0	3	3
3.	CSE613	Software Testing and Quality Management	3:0:0	3:0:0	3	3
4.	CSE615	Distributed Systems	3:0:0	3:0:0	3	3
5.	CSE617	Advanced Software Engineering Methodologies	3:0:0	3:0:0	3	3
6.	CSE619	Data Mining and Data Warehousing	3:0:0	3:0:0	3	3
7.	CSE621	Cloud Computing Architecture	3:0:0	3:0:0	3	3
8.	CSE623	Grid Computing	3:0:0	3:0:0	3	3
9.	CSE625	Indexing and Searching Techniques in Database	3:0:0	3:0:0	3	3
10.	CSE627	Bioinformatics and Algorithms	3:0:0	3:0:0	3	3

Total Contact Hours = 20
Total Credits Hours = 13

SEMESTER IV

I. Practical Subjects

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1.	CSE602	Dissertation				20

Total Credits Hours = 20

COURSE SCHEME SUMMARY

Sem	L	T	P	Contact hrs/wk	Credits	BS	PC	PE	Project/ Trg/Seminar/ Term Paper
1	20	-	2	24	22	-	18	4	-
2	20	-	8	30	25	4	10	10	1Special problem
3	6	-	14	20	13	-	4	3	1 Seminar + 5 Master's Research = 6
4				20	20	-	-	-	Dissertation-20
Total	**46**	**0**	**24**	**94**	**80**	**4**	**32**	**17**	**27**

First Semester

Course Code	**CSE501-19**
Course Title	**Network Technology & Security**
Type of Course	PC
L T P	4 0 0
Credits	4
Course Prerequisites	Basing Knowledge of computer networks
Course Objectives (CO)	The course helps to provide in-depth conceptual understanding and knowledge of the best technology in networking (wired/wireless), security and voice solutions. It also helps to train students on how to design, build, troubleshoot and secure triple play borderless computer networks.

SYLLABUS

UNIT I

Evolution of Internet, WWW undergoing technology, E-mail, Application layer services and protocols (RPC, NFC, SMTP, FTP, TELNET) Network Management Address and domain Management, (SNMP), Internet searching tools, gopher, Archie, Veronica, WWW, Lynx, Mosaic, WAIS, Usenet, Security issues, CGI, PERL, HTML, VRML, JAVA, VB script and other internet development tools.

UNIT II

SLIP/PPP Dedicated lines, BOOTP, DHCP, Domain management (DNS), Transport Layer issues, TCP/IP, Gateway, Dial-up, Internet networking TCP/IP protocols, IP addressing, Network Security.

UNIT III

Review of LAN, Node, LAN Manager, Software of IBASE5 Node, 10BASE5 Ethernet and 10BASE2 (Cheaper net), Twisted pair Ethernet, Serial Communication, Connecting LANs and WANS, FDDI, Serial Communication Circuits, Modems, SDH/SONET, Inter Networking Routing Algorithms, Routing protocols (RIP, BGP, OSPF).

UNIT IV

USART-Processor Interface Data Buffer Block of 8251A, Control logic of USART, PROTOCOLS, Transmitter, Receiver, Synchronous Modems and Asynchronous Modems. SYNDET/BRKDET ion 8251A, Monitoring of 8251A, writing characters to be transmitted to 8251A, Monitoring of 8251A. Read status, ISDN: Technology, devices, Architecture Protocols, Flow Control Error detection and Correction, ATM, Technology.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	TCP/IP	Forouzan	MC Graw Hill.
2	Computer Networks	Tannenbaum	PHI
3	Data Communication and Networking	Forouzan	MC-Graw Hill

Course Code	**CSE503**
Course Title	**Advanced Data Structure and Applications**
Type of Course	PC
L T P	4 0 0
Credits	4
Course Prerequisites	Computer algorithms, C/C++, basics of data structures
Course Objectives (CO)	This course work provides the fundamental design, analysis, and implementation of basic data structures, basic concepts in the specification and analysis of programs, principles for good program design, especially the uses of data abstraction, significance of algorithms in the computer field, various aspects of algorithm development, and qualities of a good solution.

SYLLABUS

UNIT I

Algorithms and Performance analysis: Time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples, Data structures-Linear and non linear data structures, ADT concept, Linear List ADT.

UNIT II

Array & Linked List: Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists, Representation of single, two dimensional arrays, Sparse matrices and their representation.

Stack and Queues: ADTs, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion and deletion, De-queue ADT, array and linked list representations, Priority queue ADT

UNIT III

Trees & Graphs: Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non recursive traversals, threaded binary trees, implementation using Heaps, Insertion into a Max Heap, Deletion from a Max Heap.

Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods-DFS and BFS, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

UNIT IV

Search Trees- Binary search tree-Binary search tree ADT ,insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees – Definition and examples only, B-Trees-definition, insertion and searching operations,

Comparison of Search trees. Text compression-Huffman coding and decoding, Pattern matching-KMP algorithm.

Searching & Sorting: Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hash-Set, Hash-table. Sorting –Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Data structures, Algorithms and Applications in Java	S. Sahni	Universities Press
2	Data structures and Algorithms in Java	Adam Drozdek	Cengage learning
3	Data Structures, Algorithms and Applications in C++	Sartaj Sahni	Tata McGraw Hill
4	Data Structures using C and C++	Tenenbaum, Augenstein, &Langsam	Prentice Hall of India

Course Code	**CSE505**
Course Title	**Software Engineering and Methodologies**
Type of Course	PC
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of Software Engineering principles, methods and work models
Course Objectives (CO)	This Course work will provide, a broad and critical understanding of all the processes for engineering high quality software and the principles, concepts and techniques associated with software development, an ability to analyze and evaluate problems and draw on the theoretical and technical knowledge to develop solutions and systems.

SYLLABUS

UNIT I

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, legacy software, Software myths. A Generic view of process: Software engineering - A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models, Process models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The Unified process.

UNIT II

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management, System models: Context Models, Behavioral models, Data models, Object models, structured methods.

UNIT III

Design Engineering: Design process and Design quality, Design concepts, the design model, pattern based software design, Creating an architectural design: software architecture, Data design, Architectural styles and patterns, Architectural Design, assessing alternative architectural designs, mapping data flow into a software architecture, Modeling component-level design: Designing class-based components, conducting component level design, Object constraint language, designing conventional components. Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

Testing Strategies: A strategic approach to software testing, test strategies for conventional

software, Black-Box and White-Box testing, Validation testing, System testing, Debugging, Product metrics: Software Quality, Frame work for Product metrics, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance, Metrics for Process and Products: Software Measurement, Metrics for software quality.

UNIT IV

Risk management: Reactive vs Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan

Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards, Configuration Management: Configuration Management planning, Change management, Version and release management, System building, CASE tools for configuration management.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Software Engineering: A practitioner's Approach	Roger S Pressman	McGraw Hill International Edition
2	Software Engineering	Ian Sommerville	Pearson education
3	Software Engineering, A Precise Approach	PankajJalote	Wiley India
4	Software Engineering : A Primer,	Waman S Jawadekar	Tata McGraw-Hill
5	Fundamentals of Software Engineering	Rajib Mall	PHI
6	Software Engineering, Principles and Practices	Deepak Jain	Oxford University Press.

Course Code	**CSE507**
Course Title	**Parallel Computing**
Type of Course	PC
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of Computer System Architecture
Course Objectives (CO)	Students become familiar with parallel computer architecture and algorithms.

SYLLABUS

UNIT I

Introduction to Parallel Computing: Basic concepts about program/process/ thread, Concurrent Execution, Parallel Execution, granularity, Potential of Parallelism; Need of Parallel Computation; Levels of parallel processing; Parallel processing Vs. Parallel computing; Dataflow Computing concept; Applications of parallel processing-Scientific Applications / Image processing, Engineering Application, Database query / Answering applications, AI Applications, Mathematical simulations and modeling

Classification of Parallel Computers: Types of Classification; Flynn's/ Handler classification; UMA / NUMA /COMA; Loosely coupled / tightly coupled; Classification based grain size and Instruction level parallelism.

UNIT II

Interconnection Network: Need of Interconnection Network; Concept Bandwidth Nod degree diameter bisection bandwidth, In degree and Out degree; Static and Dynamic Interconnection network; Omega, Parallel Shifter, Bens, permutation, hypercube, butterfly; Shuffle exchange Network

Parallel Computer Architecture: Introduction to various computer architecture; Pipeline processing; Vector / Array processing; VLIW and Super scalar architecture; Associative architecture -Multithreaded architecture.

UNIT III

Parallel Algorithm & Parallel Programming

Parallel Algorithm: Introduction to Parallel Algorithms; Analysis of Parallel Algorithms; Different models of computation- Combinational circuit, Permutation Circuit, Sorting circuit, Matrix computation.

PRAM Algorithms: Message passage programming -Shared memory, Message passing libraries, Data Parallel programming; Data Structures for parallel algorithms-Link list, Arrays pointers, Hypercube network.

Parallel Programming: Introduction to Parallel Programming; Types of parallel programming - Programming based on message passing, data parallelism, Programming for shared memory systems, Example programs for parallel systems.

UNIT IV

Advanced Topics

Operating System for Parallel Computers: Basic issues of Operating Systems for Parallel Computers; Process Management; Resource Management; Memory management; I/O Management; Inter-Processor Communication; Vectorisation Compiler

Performance Evaluation: Introduction to performance evaluation; Metric of Parallel overhead; Law Speedup; Measurement Tools

Recent Trends: Multicompontent CPU; Apex architecture IA 64; Hyperthreading

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Advanced Computer Architecture: Parallelism, Scalability, Programmability	Hwang, K	Tata McGraw Hills
2	Introduction to Parallel Processing	Sasikuma,r M., Shikhare, D., Ravi Prakash	Prentice Hall of India pvt.ltd. New Delhi
3	Computer Architecture and Parallel Processing	Hwang, K., Briggs, F. A.	McGraw Hill

Course Code	**CSE509**
Course Title	**Advanced Data Structures and Applications Lab**
Type of Course	PC
L T P	0 0 4
Credits	2
Course Prerequisites	Any high level programming language, basics of data structure
Course Objectives (CO)	This course helps the students to understand the various advance topics of data structure and its implementation.

SYLLABUS

List of Practicals

1. **Array:** Implement various operations in Arrays
2. **Linked List:** Implement Insertion and Deletion algorithms of single ended and double ended linked list
3. **Stack:** Implement Insertion and Deletion operation in Stack
4. **Queue, Deques & Circular Queues:** Implement Insertion and Deletion algorithm
5. **Min Heap:** Implement Insertion and Deletion algorithms
6. **AVL Tree:** Implement Insertion and Deletion algorithms with appropriate rotations
7. **B-Tree:** Implement Insertion and Deletion algorithms
8. **Quick Sort:** Implement quick sort algorithms
9. **Greedy algorithm:** Implement greedy algorithm
10. Knapsack using Dynamic Programming

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Data structures, Algorithms and Applications in Java	S. Sahni	Universities Press
2	Data structures and Algorithms in Java	Adam Drozdek	Cengage learning
3	Data Structures, Algorithms and Applications in C++	Sartaj Sahni	Tata McGraw Hill
4	Data Structures using C and C++	Tenenbaum, Augenstein, &Langsam	Prentice Hall of India

Course Code	**CSE511**
Course Title	**Artificial Intelligence & its Applications**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of discrete structure, knowledge representation, reasoning, planning etc.
Course Objectives (CO)	The objective of this course is to cover the advance topics in probability theory, uncertain reasoning and machine learning that are commonly used in modern artificial intelligence.

SYLLABUS

UNIT I

Introduction

Basic Knowledge of Artificial Intelligence, Problem solving techniques, Knowledge representation, Planning, Prolog, LISP and Other AI Programming Languages, Learning and Neural Network.

UNIT II

Introduction to Probability Theory

Probability definitions, Bayes rule and its applications, Probabilistic Reasoning: Bayesian networks: representation and inference, Belief Propagation, MCMC algorithm, other methods, sample applications

Probabilistic Reasoning over Time

Hidden Markov Models, Dynamic Bayesian networks, Utility theory, Decision networks

UNIT III

Making Complex Decisions

Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, Partially observable Markov decision problems (POMDPs), sample applications

UNIT IV

Learning from Observations

Inductive learning, decision trees, ensemble learning , Statistical Learning: Complete data, Hidden nodes (EM method), Instance based learning, Neural networks, Reinforcement Learning:

Passive and active, sample applications

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Artificial Intelligence: A Modern Approach	S. Russell and P. Norvig	Prentice-Hall, Third Edition.
2	Introduction to Artificial Intelligence	Eugene Charniak, Drew McDermott	Addison Wesley.
3	AI-Structures and Strategies for Complex Problem Solving	George Lugar	4th edition Pearson Educations
4	Artificial Inteilligence: an Engineering approach	Robert J. Schalkolf	McGraw Hill.
5	Decision Support Systems and Intelligent Systems	Efraim Turban Jay E.Aronson	PHI
6	Artificial Intelligence – Strategies, Applications, and Models through Search	Christopher Thornton and Benedict du Boulay	New Age International Publications

Course Code	**CSE513**
Course Title	**Machine Learning**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Discrete mathematics
Course Objectives (CO)	To understand learning models and learning algorithms

SYLLABUS

UNIT I

Introduction- Basic concepts, machine learning problems, types of learning, designing a learning system, Goals and applications of machine learning

Learning Theory- Bias/variance tradeoff. Union and Chernoff/Hoeffding bounds. VC dimension, Worst case (online) learning, learning algorithms.

UNIT II

Supervised learning- Supervised learning setup, LMS, Logistic regression, Perceptron, Exponential family, Generative learning algorithms, Gaussian discriminant analysis, Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting, Evaluating and debugging learning algorithms.

Unsupervised learning- Clustering. K-means, EM, Mixture of Gaussians, Factor analysis, PCA (Principal components analysis), ICA (Independent components analysis).

UNIT III

Reinforcement learning and control- MDPs, Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR), LQG, Q-learning. Value function approximation, Policy search, Reinforce, POM.

UNIT IV

Decision Tree Learning

Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute: entropy and information gain, Searching for simple trees and computational complexity, Occam's razor, Overfitting, noisy data, and pruning

Rule Learning: Propositional and First-Order

Translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Prolog.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Pattern Recognition and Machine Learning	Bishop, C.	Berlin: Springer-Verlag.
2	Elements of Statistical Learning	Hastie, Tibshirani, and Friedman	Springer
3	Machine Learning	Tom Mitchell	Mc-Graw Hill

Course Code	**CSE515**
Course Title	**Network & System Security**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Computer Networks
Course Objectives (CO)	It aims to introduce students to the fundamental techniques used in implementing secure network communications, and to give them an understanding of common threats and attacks.

SYLLABUS

UNIT I

Introduction: Basic concepts, Control hijacking attacks: exploits and defenses, Principle of least privilege, access control, and operating systems security

UNIT II

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

UNIT III

Simple DES – Differential cryptanalysis, DES - Modes of operation, Triple DES, AES, RC4, RSA, Attacks, Primality test, Factoring.

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, Unwanted traffic: denial of service attacks.

UNIT IV

Authentication applications – Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME, IP security, Web Security, SSL, TLS, SET.

System Security – Intruders, Malicious software, viruses, Firewalls and filters, Security Standards.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Cryptography And Network Security - Principles and Practices	William Stallings	Prentice Hall of India pvt.ltd. New Delhi
2	Cryptography and Network Security	AtulKahate	Tata Mc-Graw Hill
3	Computer Networks	A.S Tanenbaum	Pearson

Second Semester

Course Code	**CSE502**
Course Title	**Advanced Database Design & Management**
Type of Course	PC
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of Database and relational database management system
Course Objectives (CO)	This course is intended to provide an understanding of the current theory and practice of database management systems, a solid technical overview of database management systems. In addition to technical concerns, more general issues are emphasized. These include data independence, integrity, security, recovery, performance, database design principles and database administration.

SYLLABUS

UNIT I

Introduction : Introduction to DBMS, RDBMS, Types of DBMS and their advantages and disadvantages, Types of relational query language, E-R Diagram, Keys, Normalization, Query optimization

Transaction Processing and Concurrency Control: Transaction Management, Concurrency Control and Serializability; Recoverability and Strictness; Two-phase locking, Multiple Granularity, Timestamp based Protocol.

Database protection in RDBMS –Integrity, Availability

UNITII

Distributed Databases: Basic concepts, structure, trade-offs Methods of data distribution – fragmentation, replication, design & advance concepts of DDBMS like Two-phase commit protocol, distributed transaction, distributed concurrency control, distributed deadlock handling.

Introduction to object oriented databases: Object Oriented Data model, Object Oriented Database Management System, Object Query Language, Object Oriented Relational Database Management System and its concepts.

UNIT III

Data warehousing Concepts: Architecture, Dataflows, Tools & Technologies, Data Marts, Data Mining & Online Analytical Processing.

UNIT IV

Emerging Database Technologies: Spatial & Multimedia databases, Mobile Computing & Mobile Databases

New Topics and Applications: (a) Information Retrieval (b) Bioinformatics (c) Incomplete and Uncertain Databases (d) Non-relational Databases, (e) Data Stream Management

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Advanced database management system	RiniChakrabarti, ShilbhadraDasgupta	Wiley India Pvt. Ltd.
2	Distributed Databases	Ozsu and Valduriez	Pearson Education
3	Advanced Database Management System	VaishaliP.Yadav	Pearson Education India
4	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	Tata McGraw-Hill
5	Database Management Systems	Raghu Ramakrishnan	Mc-Graw Hill

Course Code	**MAT524**
Course Title	**Research Methodology**
Type of Course	BS
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of mathematical concepts
Course Objectives (CO)	The course aims at equipping students with an understanding of the research process, tools and techniques in order to facilitate managerial decision making.

SYLLABUS

Unit –I

An Introduction to Research: Meaning, Definition, Objectives and Process; Research Problem: Selection of Problem, Understanding Problem, Necessity of Defined Problem; Review of Literature in Research. Research Design: Meaning, Types –Descriptive, Diagnostic, Exploratory and Experimental.

Unit –II

Sources Of Data: Primary And Secondary; Data Collection Methods; Questionnaire Designing: Construction, Types And Developing A Good Questionnaire. Sampling Design and Techniques, Scaling Techniques, Meaning, Types, Data Processing Operations, Editing, Coding, Classification, Tabulation. Research Proposal/Synopsis Writing.

Unit –III

Statistics - Descriptive Statistics: Central Tendency and Dispersion, Correlation: Linear, Partial and Multiple, Simple and Multiple Regression, Discriminant Analysis, Conjoint Analysis, Time Series and Business Forecasting. Applications of Index Numbers; Sampling Distribution; Tests Of Significance: Z-Test, T-Test, Chi-Square Test, F -Test, And ANOVA; Use Of SPSS For T-Test, Chi-Square Test and ANOVA.

Unit –IV

Multi Dimensional Scaling: Factor Analysis, Cluster Analysis, Interpretation of Data, Report Preparation and Presentation.

Each Student has to prepare Mini Research Project on Topic / Area of their Choice and Make Presentation. The report should consist of application of tests and techniques mentioned in above units. Relevant Case Studies should be discussed in class.
Note: Practical-Use of SPSS / Systat and Excel.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Business Research Methods	D R. Cooper, &P.S,Schindler	Tata McGraw Hill
2	An Applied Orientation	N. Malhotra, and S.,Dash, Marketing	Pearson Education

		Research	
3	Research Methodology: Methods & Techniques	C.R,Kothari	New Age International Publishers
4	SPSS Explained	Hiolton, Brownlow McMurray,Cozens	Tata McGraw Hill
5	Business Research Methods	Willian G.Zikmund	Thomson South-Western Learning
6	SPSS for Windows Step by Step	Darren George & Paul Mallery	Pearson Education
7	Marketing Research	Churchill & Israel	Cengage Learning
8	Marketing Research: Text & Cases	RajendraNargundka	Tata McGraw Hill
9	Business Research Methodology	Srivastava and Rego	Tata Mc Graw Hill
10	Essentials of Marketing Research	Zikmund	Cengage Learning

Course Code	**CSE504**
Course Title	**Digital Image Analysis**
Type of Course	PC
L T P	4 0 0
Credits	4
Course Prerequisites	Sufficient background in Probability and knowledge of computer algorithms
Course Objectives (CO)	This course will explore the algorithms and techniques involved in Digital Image Processing using computational tools. The course will comprise of comprehensive understanding of digital imagery and digital image processing

SYLLABUS

UNIT I

Introduction to Image Processing: Definition, Examples of Fields that use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals: Image Sensing, and Acquisition, Image Sampling and Quantization, Basic Relationship between Pixels, Distance Measures, Linear and Non-linear Operations.

UNIT II

Image Enhancement in Spatial Domain: Basic Gray Level Transformations, Histogram Processing, Enhancements using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing, Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Fourier Series Transformation: Fourier series, Impulses and their sifting Property, Discrete Fourier Transform (DFT) of one variable and Its Inverse, 2-D Discrete Fourier Transform and Its inverse, Properties of 2-D DFT, Im1age Smoothing using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters, Laplacian in Frequency Domain, Homo-morphic Filtering, Band reject and Band pass Filters, Notch Filters, The Fast Fourier Transform in 1-D

Image Restoration : Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations.

UNIT III

Color Image Processing: Color Models, Pseudo color Image Processing, Basics of Full Color

Image Processing. Color Transformations, Smoothing and Sharpening. Color Segmentation.

Wavelets and Multi Resolution Processing: Image pyramids, subband coding, The Haar Transform, series expansion, scaling functions, wavelet functions, wavelet transform in 1-D, Inverse Discrete wavelet Transform in 1-D, Fast wavelet Transform in 1-D, Discrete wavelet Transform in 2-D, wavelet Packets

UNIT IV

Image Compression: Image Compression Models, Huffman coding, Golomb Coding, Arithmetic coding, LZW coding, Run Length coding, Bit-Plane coding, Block Transform coding, wavelet coding.

Image Segmentation: Point Detection, Line Detection and Edge Detection, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Image Processing	Gonzalez and Woods	Addison Wesley
2	Digital Image Processing and Pattern	Pakhera Malay K	PHI
3	Digital Image Processing	Jayaraman and Veerakumara	Mc-Graw Hill
4	Computer Vision A Modern Approach	Forsyth and Ponce	Pearson Education

Course Code	**CSE508**
Course Title	**Advanced Database Design & Management Lab**
Type of Course	PC
L T P	0 0 4
Credits	2
Course Prerequisites	Database management system
Course Objectives (CO)	This course offers a good understanding of emerging database technologies and prepares students to be in a position to design databases in variety of technologies.

SYLLABUS

Students are required to develop a project using concepts of database using following concepts:

- Basic SQL
- ER Modeling
- Database Design and Normalization

The students are also required to submit the synopsis during semester and final report at the end of semester. The evaluation will be done on the basis of project submitted.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Advanced database management system	RiniChakrabarti, Shilbhadra Das Gupta	Wiley India Pvt. Ltd.
2	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	Tata McGraw-Hill
3	Database Management Systems	Raghu Ramakrishnan	Mc-Graw Hill

Course Code	**CSE510**
Course Title	**Real Time Software and System**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Database
Course Objectives (CO)	This subject provides the basis difference between hard real time and soft real time system.

SYLLABUS

UNIT I

Introduction: Hard Versus Soft Real time Systems: Jobs and Processors , Real times, Deadlines and Timing constraints , Hard and Soft timing constraints, Hard Real time systems, Soft Real time systems, A reference model of Real time systems: Processors and resources, Temporal parameters of Real time workload, Periodic task model, Precedence constraints and data dependency, Other types of dependencies, Functional Parameters, Resource Parameters of Jobs and Parameters of resources, Scheduling hierarchy.

UNIT II

Commonly used approaches to Real time scheduling: Clock driven approach, Weighted round robin approach, Priority Driven approach, Dynamic versus Static systems, Effective Release times and Deadlines, Optimality of EDF and LST, Challenges in validating timing constraints in Priority driven systems, Offline versus Online scheduling, Clock driven scheduling: Notations and assumptions, Static Timer driven scheduler, General structure of Cyclic schedules, Cyclic executives, Improving average response time of Aperiodic jobs, Scheduling Sporadic jobs .

UNIT III

Priority driven scheduling of Periodic jobs: Static assumptions, Fixed priority versus Dynamic priority algorithms, Maximum schedulable utilization, Optimality of RM and DM algorithms, Schedulability test for Fixed priority tasks with Short response times, Schedulability Test for Fixed priority tasks with arbitrary response times, Sufficient Schedulability conditions for RM and DM algorithms.

Unit IV

Scheduling Aperiodic and Sporadic Jobs in Priority Driven Systems: Assumptions and Approaches, Deferrable servers, Sporadic servers, Constant Utilization, Resources and Resource Access Control: Assumptions on resources and their usage, Effects of resource contention and resource access control, Non preemptive Critical Sections, Basic Priority Inheritance Protocol, Basic Priority Ceiling Protocol, Stack Based Priority ceiling Protocol, Preemption Ceiling Protocol

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Real-Time Systems	Jane W.S. Liu	Pearson Education
2	Real-Time Systems Design and Analysis	Phillip A. Laplante	Prentice Hall of India, Second Edition

3	Real-Time Systems	Krishna C. M., Kang G. Shin	McGraw- Hill International Edition.

Course Code	**CSE512**
Course Title	**Biometric Security**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Image Processing
Course Objectives (CO)	To understand basic biometric concepts

SYLLABUS

UNIT I

Introduction: Introduction of Biometric traits and its aim, image processing basics, basic image operations, filtering, enhancement, sharpening, edge detection, smoothening, enhancement, thresholding, localization. Fourier Series, DFT, inverse of DFT.

UNIT II

Biometric system, identification and verification. FAR/FRR, system design issues.
Positive/negative identification. Biometric system security, authentication protocols, matching score distribution, ROC curve, DET curve, FAR/FRR curve. Expected overall error, EER, biometric myths and misrepresentations.

UNIT III

Selection of suitable biometric. Biometric attributes, Zephyr charts, types of multi biometrics. Verification on multimodel system, normalization strategy, Fusion methods, Multimodel identification

UNIT IV

Biometric system security, Biometric system vulnerabilities, circumvention, covert acquisition, quality control, template generation, interoperability, data storage. Recognition systems: Face, Signature, Fingerprint, Ear, Iris etc.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Implementing Biometric Security	John Chirillo, Scott Blaul	Pearson
2	Handbook of Biometrics	Jain, Anil, Flynn Patrick, Ross, Arun A.	Springer
3	Advances in Biometrics for Secure Human Authentication and Recognition	Dakshina Ranjan Kisku, Phalguni Gupta, Jamuna Kanta Sing	CRC Press

Course Code	**CSE514**
Course Title	**Information Retrieval & its Applications**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	SQL, Multimedia
Course Objectives (CO)	This subject provides various techniques of information retrieval.

SYLLABUS

UNIT I

Introduction: Basic Concepts, Retrieval Process, Modeling, Classic Information Retrieval, Set Theoretic, Algebraic and Probabilistic Model, Structured Text Retrieval Models, Retrieval Evaluation, Word Sense Disambiguation

UNIT II

Querying: Languages, Key Word based Querying, Pattern Matching, Structural Queries, Query Operations, User Relevance Feedback, Local and Global Analysis, Text and Multimedia languages

Text Operations And User Interface: Document Preprocessing, Clustering, Text Compression, Indexing and Searching, Inverted files, Boolean Queries, Sequential searching, Pattern matching, User Interface and Visualization, Human Computer Interaction, Access Process, Starting Points, Query Specification , Context, User relevance Judgment , Interface for Search

UNIT III

Multimedia Information Retrieval: Data Models, Query Languages, Spatial Access Models, Generic Approach, One Dimensional Time Series, Two Dimensional Color Images, Feature Extraction

UNIT IV

Applications: Searching the Web, Challenges, Characterizing the Web, Search Engines, Browsing, Meta-searchers, Online IR systems, Online Public Access Catalogs, Digital Libraries, Architectural Issues, Document Models, Representations and Access , Prototypes and Standards

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Modern Information Retrieval	Ricardo Baeza-Yate, Berthier Ribeiro-Neto	Pearson Education Asia
2	Information Retrieval: Algorithms, and Heuristics	David A. Grossman, Ophir Frieder	Academic Press
3	Speech and Language Processing	Daniel Jurafsky and James H. Martin	Pearson Education
4	Introduction to Modern Information Retrieval	G.G. Chowdhury	Neal- Schuman Publishers

Course Code	**CSE516**
Course Title	**Principles of Compiler Design**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	High level language, general programming concepts, data structures
Course Objectives (CO)	This course aims to teach students the principles involved in compiler design. It will cover all the basic components of a compiler.

SYLLABUS

UNIT I

Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

UNIT II

Top down Parsing: Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

Bottom up parsing: Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing, handling ambiguous grammar, YACC – automatic parser generator.

UNIT III

Semantic analysis: Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes. Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Symbol Tables: Symbol table format, organization for block structures languages, hashing, and tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

UNIT IV

Code optimization: Consideration for Optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

Data Flow Analysis: Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation.

Code Generation: Object code forms, machine dependent code optimization, register allocation and assignment generic code generation algorithms, DAG for register allocation.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Principles of Compiler Design	A.V. Aho, J.D. Ullman	Pearson Education
2	Modern Compiler Implementationin C	Andrew N. Appel	Cambridge University Press
3	The Art of Compiler Design: Theory and Practice	Thomas Pittman,James Peters	Pearson
4	Compiler Design Using FLEX and YACC	Vinu V. Das	PHI

Course Code	**CSE518**
Course Title	**Cryptography and Information Security**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of computer networks, error correction and detection.
Course Objectives (CO)	To make students familiar with information security, critical concepts of information security, Enumerate the phases of the security systems development life cycle. Describe the information security roles of professionals within an organization

SYLLABUS

UNIT I

Introduction: Information Security: Introduction, History of Information security, What is Security, CNSS Security Model, Components of Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Security Systems Development Life Cycle.

UNIT II

Symmetric Key/Asymmetric Key Cryptography: Concepts and Techniques, symmetric and asymmetric key cryptography, steganography, Symmetric key Ciphers: DES structure, DES Analysis, Security of DES, variants of DES, Block cipher modes of operation, AES structure, Analysis of AES, Key distribution. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange.

UNIT III

Message Authentication and Hash Functions: Authentication requirements and functions, MAC and Hash Funtions, MAC Algorithms: Secure Hash Algorithm, Whirlpool, HMAC, Digital signatures, X.509, Kerberos.

UNIT IV

Security at layers(Network, Transport, Application):IPSec, Secure Socket Layer(SSL), Transport Layer Security(TLS), Secure Electronic Transaction(SET), Pretty Good Privacy(PGP), S/MIME .

Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Principles of Information Security	Michel. E Wittman, Herbert J.Mattord	CENGAGE Learning

2	Cryptography and Network Security- Principles and Practices	Williams Stallings	PHI
3	Cryptography and Network Security	B.A Forouzan	Mc-Graw Hill
4	Computer Networks	Tanenbaum	Pearson Education

Course Code	**CSE520**
Course Title	**Big Data Analytics**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Knowledge of Database Management System.
Course Objectives (CO)	To understand big data analytics as the next wave for businesses looking for competitive advantage, To understand the financial value of big data analytics, To explore tools and practices for working with big data, To understand how big data analytics can leverage into a key component, To understand how to mine the data, To learn about stream computing, To know about the research that requires the integration of large amounts of data.

SYLLABUS

UNIT I

Introduction to Big Data

Analytics, Nuances of big data, Value, Issues, Case for Big data, Big data options Team challenge, Big data sources, Acquisition, Nuts and Bolts of Big data. Features of Big Data, Security, Compliance, auditing and protection, Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics, Volume, Veracity, Velocity, and Variety, Data Appliance and Integration tools, Greenplum, Informatica.

UNIT II

Data Analysis

Evolution of analytic scalability, Convergence, parallel processing systems, Cloud computing, grid computing, map reduce, enterprise analytic sand box, analytic data sets, Analytic methods, analytic tools, Cognos, Microstrategy, Pentaho. Analysis approaches, Statistical significance, business approaches, Analytic innovation, Traditional approaches

UNIT III

Stream Computing

Introduction to Streams Concepts, Stream data model and architecture, Stream Computing, Sampling data in a stream, Filtering streams, Counting distinct elements in a stream, Estimating moments, Counting oneness in a window, Decaying window, Realtime Analytics Platform(RTAP) applications IBM Infosphere, Big data at rest, Infosphere streams, Data stage, Statistical analysis, Intelligent scheduler, Infosphere Streams.

UNIT IV

Predictive Analytics And Visualization

Predictive Analytics, Supervised, Unsupervised learning, Neural networks, Kohonen models, Normal, Deviations from normal patterns, Normal behaviours, Expert options, Variable entry, Mining Frequent itemsets, Market based model, Apriori Algorithm, Handling large data sets in Main memory, Limited Pass algorithm, Counting frequent itemsets in a stream, Clustering Techniques, Hierarchical, K- Means, Clustering high dimensional data Visualizations, Visual data analysis techniques, interaction techniques; Systems and applications:

Frameworks And Applications

IBM for Big Data, Map Reduce Framework, Hadoop, Hive, Sharding, NoSQL Databases, S3 - Hadoop Distributed file systems, Hbase, Impala, Analyzing big data with twitter, Big data for Ecommerce, Big data for blogs.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Big Data Analytics: Turning Big Data into Big Money	Frank J Ohlhorst	Wiley and SAS Business Series
2	Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis	Colleen Mccue	Elsevier
3	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics	Bill Franks	Wiley and SAS Business Series
4	Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data	Paul Zikopoulos, Chris Eaton, Paul Zikopoulos	McGraw Hill
5	Data Mining Concepts and Techniques	Jiawei Han, MichelineKamber	Elsevier

Course Code	**CSE522**
Course Title	**Optimization Techniques**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Soft Computing, Artificial intelligence
Course Objectives (CO)	This subject will provide knowledge about different optimization techniques & the ways to get optimized results.

SYLLABUS

UNIT I

Introduction to optimization, functions of single variable, functions of several variables, Formulation of optimization problems. Review of classical methods, linear programming, and non-linear programming.

UNIT II

Constraint optimality criteria, constrained optimization, constraint direct search method, linearization methods for constrained problems, transformation method. Nonlinear programming: problem formulation, Quadratic Approximation Methods for Constrained Problems Unconstrained minimization techniques.

UNIT III

Dynamic programming: sub-optimization, multistage optimization problem. Multi-objective and goal programming: problem formulation, solution of a multi-objective problem. Case studies **Introduction to Stochastic Optimization Techniques**, types: Local Search, Population Based, Introduction to Genetic Algorithms, Motivation from Nature, Genetic Algorithms: Working Principle: Representation, Fitness Assignment, Reproduction, Crossover, Mutation, Constraint Handling, Real Parameter Genetic Algorithms, Combined Genetic Algorithm, Advanced Genetic Algorithms, Applications.

UNIT IV

Ant Colony Optimization: Introduction, Ant System, Ant Colony System, ANTS, Significant Problems, Convergence Proofs. Discrete Particle Swarm Optimization (PSO): introduction, PSO Elements: Position and State Space, Objective Function, Velocity, PSO Algorithm, Examples and Results, Applications.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Optimization Techniques	Singiresu S. Rao	New Age International Publishers
2	Power System Optimization	D. P. Kothari and J. S. Dhillon,	Tata McGraw Hill
3	New Optimization Techniques in Engineering	Godfrey C. Onwubolu, B. V.	Springer-Verlag

		Babu	
4	Optimization Techniques	C. Mohan and Kusum Deep	New Age International Publishers

Course Code	**CSE524**
Course Title	**Ad-Hoc Networks**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Computer networks
Course Objectives (CO)	This subject provides the knowledge of Adhoc and sensor networks.

SYLLABUS

UNIT I

Ad-Hoc MAC

Introduction, Issues in Ad-Hoc Wireless Networks. MAC Protocols, Issues, Classifications of MAC protocols, Multi channel MAC& Power control MAC protocol.

UNIT II

Ad-Hoc Network Routing & TCP

Issue, Classifications of routing protocols, Hierarchical and Power aware. Multicast routing, Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc, Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.

UNIT III

WSN -MAC

Introduction, Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols, self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

WSN Routing, Localization & QOS

Issues in WSN routing , OLSR, AODV. Localization, Indoor and Sensor Network Localization. QoS in WSN.

UNIT IV

Mesh Networks

Necessity for Mesh Networks, MAC enhancements, IEEE 802.11s Architecture, Opportunistic routing, Self configuration and Autoconfiguration, Capacity Models, Fairness, Heterogeneous Mesh Networks, Vehicular Mesh Networks

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Ad Hoc Wireless Networks – Architectures and Protocols	C.Siva Ram Murthy and B.Smanoj	Pearson Education.
2	Wireless Sensor Networks	Feng Zhao and Leonidas Guibas,	Morgan Kaufman Publishers.

3	Ad Hoc Mobile Wireless Networks	C.K.Toh	Pearson Education.
4	Wireless Mesh Networking	Thomas Krag and SebastinBuettrich	O'Reilly Publishers.

Course Code	**CSE526**
Course Title	**Advanced & Distributed Operating System**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Basics of Operating system and knowledge of networking
Course Objectives (CO)	This course work helps to learn the fundamentals of Operating Systems, to gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols and to gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.

SYLLABUS

UNIT I

Overview of 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.

UNIT II

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

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.

UNIT IV

Case Studies: Linux System: Design Principles, Kernel Modules, Process Management scheduling, Memory Management, Input-Output Management, File system, Inter process Communication. iOS and Android: Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Advanced Concepts in Operating Systems –Distributed, Database, and Multiprocessor Operating Systems	MukeshSinghal and Niranjan G. Shivaratri	Tata McGraw-Hill
2	Operating System Concepts	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne	John Wiley & Sons
3	Understanding the Linux kernel	Daniel P Bovet and Marco Cesati	O'Reilly
4	Real-Time Systems: Theory and Practice	Rajib Mall	Pearson Education India
5	iPhone iOS 4 Development Essentials –Xcode	Neil Smyth	Payload media

Course Code	**CSE528**
Course Title	**Advanced Programming Languages**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Basic knowledge of computer programming language constructs
Course Objectives (CO)	Allows students to be familiar with the programming language work execution flow.

SYLLABUS

UNIT I

Introduction: Brief history of Programming Language, Characteristics of programming language.

Programming Language Processors: The structure and operation of a computer, Hardware and firmware computers, Translator and simulator computers, Syntax, semantics and virtual computers, hierarchies of computers, binding and binding time.

UNIT II

Elementary Data Types: Data object, variable and constants, data types, specification of elementary data types, declarations, type checking and type conversion, assignment and initialization, numeric data types, enumerations, Boolean, characters

Structured Data Types: Structured data object and data types, specification of data structure types, implementation of data structure types, declarations and type checking for data structures, vector and arrays, record, character strings, variable sized data structures, pointers and programmer-constructed data objects, sets, file and input/output.

UNIT III

Subprogram And Programmer-Defined Data Types: Evolution of the data type concept, Abstraction, encapsulation, and information hiding, subprogram, type definitions, abstract data types.

Sequence Control: Implicit and explicit sequence control, sequence control within expression, sequence control between statements, subprogram sequence control, recursive subprogram, exceptions and exception handlers, Co-routines, scheduled subprograms, tasks and concurrent execution, data structures and sequence control.

Data Control: names and referencing environments, static and dynamic scope, block structure, local data and local referencing environments, shared data, task and shared data.

UNIT IV

Storage Management: Major Runtime elements requiring storage, programmer and system controlled storage management, storage management phases, static storage management, stack based storage management, heap storage management.

Syntax And Translation: General syntactic criteria, syntactic elements of language, stages in translation, formal definition of syntax.

Operating And Programming Environment: Batch processing environment, interactive environments, embedded system environments, programming environments, Theoretical Models: Problem in syntax and translation, problem in semantic.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Programming Languages, design and implementation	Terrence W. Pratt	Prentice Hall of India pvt.ltd. New Delhi
2	Advanced Programming Language Design	Raphael A. Finkel	Addison-Wesley

Course Code	**CSE530**
Course Title	**Soft Computing & Intelligent System**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Artificial intelligence
Course Objectives (CO)	This subject provides the knowledge of artificial intelligence techniques and natural behavior of insects.

SYLLABUS

UNIT I

Introduction To Soft Computing And Neural Networks

Evolution of Computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics

UNIT II

Genetic Algorithms

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning, Machine Learning Approach to Knowledge Acquisition.

UNIT II

Neural Networks

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks, Reinforcement Learning, Unsupervised Learning Neural Networks' Adaptive Resonance architectures, Advances in Neural networks.

UNIT IV

Fuzzy Logic

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Neuro-Fuzzy Modeling

Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rulebase Structure Identification, Neuro-Fuzzy Control, Case studies

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	An Introduction to Genetic Algorithm	Mitchell Melanie	Prentice Hall.
2	Optimization and Machine Learning	David E. Goldberg	Addison Wesley
3	Introduction to Fuzzy Logic using MATLAB	S. N. Sivanandam, S. Sumathi and S. N. Deepa	Springer.
4	Introduction to Genetic Algorithms	S.N.Sivanandam · S.N.Deepa	Springer.

Course Code	**CSE532**
Course Title	**Natural Language Processing**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	To be a knowledge of Grammar Rules and Artificial Intelligence concepts
Course Objectives (CO)	NLP attempts to interact with humans and human texts via language. Problems in the domain include analyzing texts to discover structures and to make decisions. Translating from one language to another. Interacting with humans in dialogue systems or cooperative tasks.

SYLLABUS

UNIT I

Introduction and Overview: concepts of Natural Language Processing, Ambiguity and uncertainty in language. The Turing test.

Regular Expressions: Chomsky hierarchy, regular languages, and their limitations. Finite-state automata. Practical regular expressions for finding and counting language phenomena. A little morphology.

Programming in Python: An introduction to programming in Python, Variables, numbers, strings, arrays, dictionaries, conditionals, and iteration. The NLTK (Natural Language Toolkit)

String Edit Distance and Alignment: Key algorithmic tool: dynamic programming, first a simple example, then its use in optimal alignment of sequences. String edit operations, edit distance, and examples of use in spelling correction, and machine translation

UNIT II

Context Free Grammars: Constituency, CFG definition, use and limitations. Chomsky Normal Form. Top-down parsing, bottom-up parsing, and the problems with each

Non-probabilistic Parsing: Efficient CFG parsing with CYK, another dynamic programming algorithm. Also, perhaps, the Earley parser. Designing a little grammar, and parsing

Probability: Introduction to probability theory--the backbone of modern natural language processing. Events, and counting. Joint and conditional probability, marginals, independence, Bayes rule, combining evidence. Examples of applications in natural language

UNIT III

Information Theory: meaning, Measuring it in bits. The "noisy channel model." The "Shannon game"--motivated by language! Entropy, cross-entropy, information gain, applications

Language modeling and Naive Bayes: Probabilistic language modeling and its applications. Markov models. N-grams. Estimating the probability of a word, and smoothing. Generative models of language.

UNIT IV

Part of Speech Tagging and Hidden Markov Models: The concept of parts-of-speech, examples, usage. The Penn Treebank and Brown Corpus. Probabilistic (weighted) finite state automata. Hidden Markov models (HMMs), definition and use

Viterbi Algorithm for Finding Most Likely HMM Path: Dynamic programming with Hidden Markov Models, and its use for part-of-speech tagging

Parsing with PCFGs: Treebank, The probabilistic version of CYK., humans parsing process, Experiments with eye-tracking. Modern parsers.

Machine Learning Tool: Machine Translation and MT Tools - GIZA++ and Moses

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Natural Language Understanding	Allen, James	Second Edition, Benjamin/Cumming
2	Statistical Language Learning	Charniack, Eugene	MIT Press
3	Speech and Language Processing	Jurafsky, Dan and Martin, James	Second Edition, Prentice Hall
4	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	MIT Press.

Course Code	**CSE534**
Course Title	**Computer Vision And Object Recognition**
Type of Course	PE
L T P	4 0 0
Credits	4
Course Prerequisites	Computer graphics
Course Objectives (CO)	To understand concepts of object recognition

SYLLABUS

UNIT I

Digital Image Formation and low-level processing - Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

Depth estimation and Multi-camera views - Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

UNIT II

Feature Extraction - Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Image Segmentation - Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

UNIT III

Pattern Analysis Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Motion Analysis - Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

UNIT IV

Shape from X - Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion

and edges.

Miscellaneous - Applications: CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing; Modern trends, super-resolution; GPU, Augmented Reality; cognitive models, fusion and SR&CS.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Computer Vision: A Modern Approach	D. A. Forsyth, J. Ponce	Pearson Education

Course Code	**CSE536**
Course Title	**Ad-hoc Networks Lab**
Type of Course	PE
L T P	0 0 4
Credits	2
Course Prerequisites	Basic concepts of Computer Networks, Wireless Networks
Course Objectives (CO)	This course enables students to design and implement a network using available tools.

SYLLABUS

List of Practicals

1) Study of Devices and Equipments for The installation of a Network

2) To know how to install a Server Operating system. How to configure it. Installing Active Directory.

3) Dynamic IP addressing and Static

4) Testing the LAN by pinging. The use of the PING command

5) Making a peer to peer Adhoc Wireless Network

6) Exposure to Network simulator2(NS2) : Simulation Commands ,Drawing a Network Topology, Simulate the transmission of ping messages over a network topology

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Course Code	**CSE538**
Course Title	**Advanced & Distributed Operating System Lab**
Type of Course	PE
L T P	0 0 4
Credits	2
Course Prerequisites	Operating System
Course Objectives (CO)	This course focuses on concepts of relevant to operating system design and implementation. Major concepts of interprocess communication, environment variables and command history.

SYLLABUS

Programs to be implemented :

1) Write programs using the I/O System calls of UNIX operating system (open, read, write, etc.).

2) Develop application using Inter-Process Communication (using shared memory, pipes or message queues)

3) Write program for Multiprocessor OS implementing Semaphores

4)Implement the Producer-Consumer problem using semaphores (using UNIX system calls)

5) Write program for Multiprocessor OS implementing Multithreading

6) Develop a program for controlling accessing pool of programs and resources.

7)Implement Memory management schemes like paging and segmentation.

8) Implement Memory management schemes like First fit, Best fit and Worst fit.

9) Implement any file allocation techniques (Contiguous, Linked or Indexed).

Course Code	**CSE540**
Course Title	**Advanced Programming Languages Lab**
Type of Course	PE
L T P	0 0 4
Credits	2
Course Prerequisites	OOPS concepts
Course Objectives (CO)	To understand some advance programming concepts and deal with complex data objects as whole.

SYLLABUS

Programs to be implemented :

1)Program for Longest Palindromic Subsequence

2) Program for Partition problem

3) Program for Count all possible paths from top left to bottom right of a m x n matrix

4) Program to print all permutations of a given string

5) Program for Count Inversions in an array

6) Program for Median of two sorted arrays of different sizes

7)Program for Print all possible combinations of r elements in a given array of size n

8) Program for Finite Automata

9) Program for Maximum Bipartite Matching

10)Program for Hamiltonian Cycle Detection

11)Program for Shortest Path in Directed Acyclic Graph

12) Program for Topological Sorting

Instructor can chose other different programs that fit best according to the syllabus.

Course Code	**CSE542**
Course Title	**Soft Computing Lab**
Type of Course	PE
L T P	0 0 4
Credits	2
Course Prerequisites	Basic knowledge of Artificial intelligence and Machine Learning
Course Objectives (CO)	This course focuses on implementation of various artificial intelligence concepts by using available tools.

SYLLABUS

Programs to be implemented in MATLAB :

1) Write a program in MATLAB to perform Union, Intersection and Complement operations.

2) Implement program in MATLAB to plot various membership functions.

3) Implement De-Morgan's Law

4)) Find the fuzzy relation between two vectors R and Using max–product and max-min method by a Matlab program

5) Illustrate different types of generalized bell membership functions using Matlab program

6) Generate ANDNOT function using McCulloch-Pitts neural net.

7)Write a MATLAB program for Hebb net to classify two dimensional input patterns bipolar with their targets

8) To calculate the weights for given patterns using hetero associative neural net.

9) Program for Maximum Bipartite Matching

10) To store vector in an auto-associative net. Find weight matrix & test the net with input

Course Code	**CSE544**
Course Title	**Natural Language Processing Lab**
Type of Course	PE
L T P	0 0 4
Credits	2
Course Prerequisites	Basic concepts of Theory of Computation and Data mining
Course Objectives (CO)	This course objective is to introduce students with basics of NLP which will empower them for developing advanced NLP tools and solve practical problems in field.

SYLLABUS

Analyzing Text with the Natural Language Toolkit

1)Processing Raw Text

2) Categorizing and Tagging words.

3) Reduce noise from the text

4)) Learn to classify text

5) Analyze sentence structure

6) Extractinformation from text

7)Building Feature based grammar

8) Import and visualize data

9) Analyze Structured data

Instructors can use Data mining tools for this course.

Course Code	**CSE546**
Course Title	**Computer vision and Object recognition Lab**
Type of Course	PE
L T P	0 0 4
Credits	2
Course Prerequisites	Basic concepts of Computer graphics, Digital image processing and Data mining
Course Objectives (CO)	This course focuses on deep understanding of visual tasks its processing perspectives and image transformations.

SYLLABUS

MATLAB Exercises :

1)Linear Image Restortion

2) Edge Detection

3) Morphological Image Processing : Classification , Region Filling

4)) Contrast enhancement,

5) Feature-based object detection

6) SVM classification with histograms of oriented gradients (HOG) features

7)Image segmentation and blob analysis

8) Count Objects in an image

9) Change Lightining in Phong Model

Third Semester

Course Code	**CSE601**
Course Title	**Object Oriented Analysis and Design Using UML**
Type of Course	PC
L T P	3 0 0
Credits	3
Course Prerequisites	Basic knowledge of Software Analysis and Design and Software Engineering
Course Objectives (CO)	Students are made familiar with the tools to Create analysis and design diagrams, Describe how design patterns facilitate development and list several of the most popular patterns.

SYLLABUS

UNIT I

Object Oriented Design and Modeling: Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modeling, principles of modeling, object oriented modeling.

Introduction to UML: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, software development life cycle.

UNIT II

Basic Structural Modeling: Classes, relationships, common mechanisms, class and object diagrams.

Advanced structural Modeling: Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

UNIT III

Collaboration Diagrams and Sequence Diagrams: Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence diagram. Depicting synchronous messages with/without priority call back mechanism.

UNIT IV

Basic Behavioral Modeling: Interactions use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams.

Advanced Behavioral Modeling: Events and signals, state machines, process and threads, time and space, state chart diagrams.

Architectural Modeling: Terms, Concepts, examples, Modeling techniques for component diagrams and deployment diagrams.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**

1	The Unified Modelling Language User Guide	GrandyBooch, James Rumbough, Ivar Jacobson	Pearson Education
2	Object-oriented Software Engineering: Using UmL, Patterns and Java	Bernd Bruegge , Allen H. Dutoit	Pearson
3	Object Oriented Analysis and Design Using UML	D. Jeya Mala & S. Geetha	Tata Mc-Graw Hill

Course Code	**CSE603**
Course Title	**Object Oriented Analysis and Design Using UML Lab**
Type of Course	PC
L T P	0 0 2
Credits	1
Course Prerequisites	Basic knowledge of Software Analysis and Design and Software Engineering
Course Objectives (CO)	Students are made familiar with the tools to Create analysis and design diagrams, Describe how design patterns facilitate development and list several of the most popular patterns.

SYLLABUS

To develop a mini-project following the 12 exercises listed below:

- To develop a problem statement
- Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).
- Identify Use Cases and develop the Use Case model.
- Identify the business activities and develop an UML Activity diagram.
- Identity the conceptual classes and develop a domain model with UML Class diagram.
- Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
- Draw the State Chart diagram
- Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	The Unified Modelling Language User Guide	GrandyBooch, James Rumbough, Ivar Jacobson	Pearson Education

Course Code	**CSE609**
Course Title	**Speech Processing**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	This course has no prerequisite other than knowledge of probability and statistics, and programming skills.
Course Objectives (CO)	The objective of this course is to teach students the key algorithms in speech processing. By taking this course, the students are expected to understand the basic algorithms, and be able to apply these techniques to various speech applications.

SYLLABUS

UNIT I

Speech Processing Basic Concepts

Speech Fundamentals: Articulatory Phonetics, Production and Classification of Speech Sounds; Acoustic Phonetics, acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Speech Analysis

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures, mathematical and perceptual, Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization, Dynamic Time Warping, Multiple Time, Alignment Paths.

UNIT II

Speech Modeling

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence, Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.

Speech Recognition

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system, acoustics and language models, ngrams, context dependent sub, word units; Applications and present status.

UNIT III

Speech Synthesis:

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword units for TTS, intelligibility and naturalness, role of prosody, Basic Speech Generation Techniques:

Formant synthesis, basic diphone synthesis; signal processing for synthesis. Intonation and F0 control, Applications and present status.

UNIT IV

Advanced Techniques for Speech Recognition Systems

Introduction and review of speech recognition components, Large vocabulary speech recognition search & generation of multiple hypotheses, Lattices, confusion networks & confidence estimation, Discriminative training, Feature Selection and Extraction: PCA, LDA, Audio segmentation and speaker clustering, Adaptation & Robustness: MAP, linear transforms, MLLR, noise robustness, Speech Recognition system examples and applications.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Fundamentals of Speech Recognition	Lawrence RabinerandBiing-Hwang Juang	Pearson Education.
2	Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition	Daniel Jurafsky and James H Martin	Pearson Education
3	The Scientist and Engineer's Guide to Digital Signal Processing	Steven W. Smith	California Technical Publishing
4	Discrete-Time Speech Signal Processing – Principles and Practice	Thomas F Quatieri	Pearson Education
5	Speech Recognition	Claudio Becchetti and LucioPrinaRicotti	John Wiley and Sons.
6	Speech and audio signal processing", processing and perception of speech and music	Ben gold and Nelson Morgan	Wiley- India Edition.

Course Code	**CSE611**
Course Title	**Wireless and Mobile network**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Computer Network
Course Objectives (CO)	To present the wireless and mobile network architectures, technologies and protocols

SYLLABUS

UNIT I

Introduction

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity, Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring .

UNIT II

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley- Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT III

Mobile Radio Propagation: Small –Scale Fading and Multipath: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT IV

Equalization and Diversity: Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non linear

Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration- Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

Wireless Networks: Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11,IEEE 802.11 Medium Access Control, Comparision of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, HiperLan, WLL.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Wireless Communications, Principles, Practice	Theodore, S. Rappaport	PHI
2	Wireless Communications	Andrea Goldsmith	Cambridge University Press
3	Mobile Cellular Communication	Gottapu Sasibhushana Rao	Pearson Education
4	Principles of Wireless Networks	Kaveh Pah Laven and P. Krishna Murthy	Pearson Education

Course Code	**CSE613**
Course Title	**Software Testing and Quality Management**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Software Engineering
Course Objectives (CO)	The objective of Software Quality Management (SQM) is to manage the quality of software and of its development process. A quality product is one which meets its requirements and satisfies the user.

SYLLABUS

UNIT I

Introduction: The Software Quality Challenge, Software Quality Factors, Components of the Software Quality Assurance System. Pre-Project Software Quality Components, Contract Review, Development and Quality Plans.

Software Quality Assurance Components In The Project Life Cycle: Integrating Quality Activities in the Project Life Cycle – Reviews, Software Testing, Strategies, Software Testing – Implementation, Assuring the Quality of Software Maintenance, Assuring The Quality of External Participants' Parts, Case Tools and their Affect on Software Quality.

UNIT II

Software Quality Infrastructure Components: Procedures and Work Instructions, Supporting Quality Devices, Staff Training, Instructing and Certification, Preventive and Corrective Actions, Configuration Management, Documentation and Quality Records Controls.

Software Quality Management Components: Project Progress Control, Components, Internal & External Participants, Progress control regimes, Computerized tools, Software Quality Metrics – Objective, Classification, Process & Product Metrics, Implementation & Limitation of Software Metrics, Software Quality Costs, Objective, Classification Model of cost, Extended Model and Applications.

UNIT III

Standards, Certification And Assessment: SQA Standards, ISO9001 Certification, Software Process Assessment. Organizing for Quality Assurance, Management and its Role in Quality Assurance, The Software Quality Assurance Unit, SQA Trustees and Committees

UNIT IV

Testing: Black Box Testing, White Box Testing, Test Case Selection And Adequacy, Test Execution: Overview; Test specification and cases; Adequacy criteria; Comparing criteria; Overview of test execution; From test case specification to test cases; Scaffolding; Generic versus specific scaffolding; Test oracles; Self-checks as oracles; Capture and replay.

PROCESS: Test and analysis activities within a software process: The quality process; Planning and monitoring; Quality goals; Dependability properties; Analysis; Testing; Improving the process; Organizational factors. Acceptance and Regression Testing.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Foundations of Software Testing	Aditya P Mathur	Pearson Education
2	Software Testing and Analysis Process Principles and Techniques	Mauro Pezze	Wiley India

Course Code	**CSE615**
Course Title	**Distributed Systems**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Students are expected to know and understand the fundamentals of operating systems, to be able to program in both Java and C/C++ in a Unix environment.
Course Objectives (CO)	To list the principles underlying the functioning of distributed systems, describe the problems and challenges associated with these principles, To recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems; To build distributed system software using basic OS mechanisms as well as higher-level middleware and languages.

SYLLABUS

UNIT I

Characterization of Distributed Systems: Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models-Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication, Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

UNIT II

Operating System Support: Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture, case study- SUN network file systems. Name Services-Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.

UNIT III

Peer to Peer Systems: Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies- Pastry, Tapestry, Application case studies- Squirrel, Ocean Store.Time and Global States - Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement - Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

UNIT IV

Transactions and Concurrency control: Introduction, Transactions, Nested Transactions,

Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control, Distributed Transactions- Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery, Replication- Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

Security: Introduction, Overview of Security techniques, Cryptographic algorithms, Digital signatures, Case studies- Kerberos,TLS,802.11 Wi-Fi. Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, Other consistency models, CORBA case study - Introduction, CORBA RMI, CORBA Services.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Distributed Systems Concepts and Design	G Coulouris, J Dollimore and T Kindberg	Pearson Education: New Delhi
2	Distributed Sytems :An algorithmic approach	Sukumar Ghosh	CRC press
3	Distributed Systems: Principles and Paradigms	Andrew S.Tanenbaum	Pearson
4	Modeling Distributed Systems	Fokkink, Wan	Springer

Course Code	**CSE617**
Course Title	**Advanced Software Engineering Methodologies**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Basics of software principles and software engineering
Course Objectives (CO)	The advanced software engineering curriculum prepares students for a career in reliable, economical software development.

SYLLABUS

UNIT I

Introduction: Life cycle models, Requirement Analysis and specification, Formal requirements specification.

UNIT II

Fundamental issues in software design: Goodness of design, cohesions, coupling. Function-oriented design: structured analysis and design. Overview of object –oriented concepts.

Unified Modeling Language (UML), Unified design process. User interface design. Coding standards and guidelines. Code walkthrough and reviews.

UNIT III

Unit testing, Black box and white box testing. Integration and system testing. Software quality and reliability.

SEI CMM and ISO 9001. PSP and Six Sigma. Clean room technique.

UNIT IV

Software maintenance issues and techniques, Software Reengineering, Software reuse. Client-Server software development.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Software Engineering	I. Sommerville	Addison-Wesley P
2	The Mythical Man-Month	F. Brooks	Addison-Wesley
3	Schaum's Outline of Software Engineering	D. Gustafson	McGraw-Hill

Course Code	**CSE619**
Course Title	**Data Warehouse and Data Mining**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Database Management System
Course Objectives (CO)	Students will be enabled to understand and implement classical models and algorithms in data warehousing and data mining. They will learn how to analyze the data, identify the problems, and choose the relevant models and algorithms to apply. They will further be able to assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

SYLLABUS

UNIT I

Data Warehousing: Need for Data Warehousing, Paradigm Shift, Operational and Informational Data Stores, Data Warehouse Characteristics, Architecture for a Data Warehouse Data Warehouse Sourcing, Acquisition, Cleanup and Transformation tools, Metadata, Access Tools, Data Marts. OLAP Tools: Need for OLAP, Multidimensional Versus Multi relational OLAP, Categorization of OLAP tools, OLAP operations, Identifying Facts and Dimensions, Designing Fact Tables, Designing Dimension Tables

Building a Data Warehouse: Data Warehouse Schemas. Steps for the Design and Construction of Data Warehouses. Business consideration, Design consideration, Technical consideration, Integrated Solutions.

UNIT II

Data Mining: Introduction: Motivation, Knowledge Discovery Process, Kind of Data, Data Mining Functionalities, Interesting Patterns, Classification of Data Mining Systems, Major issues. Data Preparation: Preprocess, Data Cleaning, Data Integration and Transformation, Data Reduction. Data Mining Primitives, Languages, and System Architectures. Concept Description and Data Generalization by Attribute-Oriented Induction.

Mining Frequent patterns, Associations and Correlations: Market Basket Analysis, Frequent Itemsets, Closed Itemsets and Association Rules, Frequent Itemset Mining Methods, Pattern Evaluation Methods.

Decision Tree: Basics, Building a Decision Tree, Classifying

UNIT II

Clustering: Clustering in Grouping, Agglomerative Hierarchical Clustering, K-means Clustering, Multilayer Neural Nets: Neurodes, Modeling an AND Gate, Or Gate and XOR Gate. Commonly used Neunet Architecture, Nearest Neighbor Classification: Performance of Nearest Neighbor classifier, Modification of Nearest Neighbor Classifier.

UNIT IV

Web Mining: Introduction to web mining techniques, web basics and HTTP, data Sources on the web, personalization, working with logs, forms and cookies, user identification and path

analysis. E-Metrics.

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Data Warehousing, Data Mining & OLAP	A. Berson, S.J. Smith	Tata McGraw-Hill
2	Data Mining Concepts and Techniques	J Han, M. Kamber and J. Pei	Elsevier India
3	Data mining Applications with R	Zhao Y., Cen Y.	Elsevier India
4	Data Mining – Concepts and Techniques	Jiawei Han &MichelineKamber	Elsevier India

Course Code	**CSE621**
Course Title	**Cloud Computing Architecture**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Knowledge of networking, server technology etc.
Course Objectives (CO)	This course work provides the complete understanding of Cloud System architecture, its implementation techniques and its various applications in the field of computer science.

SYLLABUS

UNIT I

Cloud Computing Fundamental

Cloud Computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications.

UNIT II

Cloud Applications

Technologies and the processes required when deploying web services; deploying a web service from inside and outside a cloud architecture, advantages and disadvantages.

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.

UNIT III

Cloud Economics

Cloud computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat).

UNIT IV

Application Development

Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

Best Practice Cloud IT Model

Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if

the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO).

RECOMMENDED BOOKS			
Sr. no.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1	Cloud Computing Bible	Sosinsky B	Wiley India
2	Cloud Computing : Principles and Paradigm	Buyya R., Broberg J., Goscinski A.	John Wiley & Sons
3	Cloud Computing – A practical Approach	Velte T., Velte A., Elsenpeter R.	Tata McGrawHill.
4	Cloud Computing and SOA Convergence in Enterprise	Linthicium D.	Pearson Education India.
5	Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online	Miller Michael	Pearson Education India.

Course Code	**CSE623**
Course Title	**Grid Computing**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Knowledge of database management and networking
Course Objectives (CO)	To get an overview about system infrastructure of grid. Also to learn about the current architecture, services and instantiations of the Grid.

SYLLABUS

UNIT I

Concepts and Architecture: Introduction, Parallel and Distributed Computing, Cluster Computing, Grid Computing, Anatomy and Physiology of Grid, Review of Web Services, OGSA, WSRF

UNIT II

Grid Monitoring: Grid Monitoring Architecture (GMA), An Overview of Grid Monitoring Systems- Grid ICE, JAMM, MDS, Network Weather Service, R-GMA, Other Monitoring Systems, Ganglia and GridMon

UNIT III

Grid security and resource management: Grid Security, Brief Security Primer, PKI, X509 Certificates, Grid Security, Grid Scheduling and Resource Management, Scheduling Paradigms, Working principles of Scheduling, A Review of Condor, SGE, PBS and LSF - Grid Scheduling with QoS.

UNIT IV

Data Management and Grid portals: Data Management, Categories and Origins of Structured Data, Data Management Challenges, Architectural Approaches, Collective Data Management Services, Federation Services, Grid Portals, First-Generation Grid Portals, Second-Generation Grid Portals

Grid middleware: List of globally available Middle wares, Case Studies, Recent version of Globus Toolkit and gLite - Architecture, Components and Features.

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	The Grid Core Technologies	Maozhen Li, Mark Baker	John Wiley & Sons
2	The Grid 2 – Blueprint for a New Computing Infrastructure	Ian Foster & Carl Kesselman	Morgan Kaufman

3	Grid Computing	Joshy Joseph & Craig Fellenstein	Pearson Education
4	Grid Computing: Making the Global Infrastructure a reality	Fran Berman,Geoffrey Fox, Anthony J.G.Hey	John Wiley and sons

Course Code	**CSE625**
Course Title	**Indexing & Searching Techniques in databases**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Knowledge of databases and data warehouse
Course Objectives (CO)	This course helps to understand the database index which is a data structure that improves the speed of data retrieval operations on a database table at the cost of additional writes and storage space to maintain the index data structure. It also helps to understand the searching techniques in databases.

SYLLABUS

UNIT I

Basics and background: Database queries and errors in query retrieval algorithms, Memory and disk accesses, Vector and metric spaces

UNIT II

Distances: Introduction of Distance functions, types of Distance functions, algorithms and its applications

Hashing techniques, One-dimensional orderings, Binary search trees, B-trees and B+-trees, Low-dimensional memory-based index structures, Disk-based index structures, Analysis of high-dimensional index structures, File-based techniques

UNIT III

Dimensionality reduction: Introduction of Dimensionality reduction techniques, methods, Feature selection, Feature extraction, Dimension reduction

UNIT IV

Miscellaneous topics: Data representation techniques, Multi-attribute retrieval techniques, Joins, skyline queries, XML queries, spatial-temporal queries, Case studies

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Advances in Knowledge Discovery and Data Mining	Usama M. Fayyad	InTech
2	Data Mining and Knowledge Discovery with Evolutionary Algorithms	Alex A. Freitas	Springer

Course Code	**CSE627**
Course Title	**Bioinformatics and Algorithms**
Type of Course	PE
L T P	3 0 0
Credits	3
Course Prerequisites	Biological Sciences
Course Objectives (CO)	This course will emphasis on the introduction and historical perspective to the field of bioinformatics, it helps to learn the key methods and tools used in bioinformatics, it builds a solid foundation and acquire the vocabulary need to supervise or to communicate with others who use these tools.

SYLLABUS

UNIT I

Biology Background: Chemistry and structure of DNA and RNA, Proteins, DNA replication, Transcription and translation

UNIT II

Overview of Algorithms: Algorithm complexity, Divide and conquer algorithms, Greedy algorithms, Backtracking algorithms, Dynamic programming

Pair-wise Sequence Alignment: Homology and Similarity, Global alignment algorithm, Local alignment algorithm, Scoring matrices for protein alignment

UNIT III

Multiple Sequence Alignment: Heuristic algorithms, ClustalW, Star alignments, Tree alignments, Hidden Markov Models

Database Search: Protein databases, GenBank, FASTA, BLAST

UNIT IV

DNA Fragment Assembly: Shotgun sequencing, Shortest common superstring problem, Multicontigs

Phylogenetic Trees: Distance and character methods, UPGMA algorithm, Fitch and Margoliash algorithm

RECOMMENDED BOOKS

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Bioinformatics Methods and Applications, Genomics, Proteomics and Drug Discovery	S C Rastogi, N Mdndiratta, P Rastogi	PHI
2	Bioinformatics Computing	Bryan Bergeron	Pearson Education

GENERAL GUIDELINES FOR SPECIAL PROBLEM, SEMINAR, MASTER'S RESEARCH AND DISSERTATION

SPECIAL PROBLEM: Each student will choose a special problem of interest related to the course and submit a term paper. Supervisor will be allotted to each student for guidance. Student will submit their paper during semester. Each term paper should be based on research papers/technical reports/articles etc. This term paper should be of 8-10 pages. Paper format should be IEEE/UGC format. Supervisor will guide them in report writing. Evaluation of the term paper will be done by the research committee. It is mandatory to give a presentation of paper before a panel constituted for the purpose.

SEMINAR :Seminar is a course requirement wherein under the guidance of a faculty member a student is expected to do an in depth study in a specialized area by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. It should provide insights into research methodology in the field, as well as an introduction to the meaning of research. While doing a seminar, the student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a seminar report. It is mandatory to give a seminar presentation before a panel constituted for the purpose. The grading is done on the basis of the depth of the work done, understanding of the problem, report and presentation by the student concerned. Students will submit their report for seminar. Report which is to about 10-20 pages which should be based work done.

MASTER'S RESEARCH: Students are expected to have expertise in your selected area including a solid understanding of the literature in your field before you delve into solving a specific research problem within that field. In the master's research you present an idea along with a preliminary plan for your research and convince the faculty that the proposed research is worthy of a dissertation. This document can't be a static one. It has to be updated regularly to track the dissertation .This Paper should be of 20-30 pages. It includes the following elements:

1) Abstract
2) Introduction
3) Brief overview of Literature
4) Problem Statement
5) Dissertation Goal
6) Research Questions
7) References
8) Appendix (if needed)

Guidelines for Master's Research

- Give a survey of the basic facts and theories in the field of research.
- Give an account of the recent work done by other researchers, and what important questions still remain unanswered.
- Show what ideas you have for new research to find the answers to some of these questions.
- Give details of
    - the new information you will seek,
    - the materials to be used,
    - the equipment needed,
    - the observations and measurements to be made,
    - how the data will be analysed.

DISSERTATION: In Dissertation, the students are required to do the research work related to their field. It involves two steps pre-submission & Final Submission of dissertation. In Pre-submission, every student will submit the synopsis on the selected topic and give the synopsis presentation also. In Final submission, every student will submit the detailed report on the selected topics and will present the findings of the report in front of the examination board.

(i) Each M.Tech candidate shall be allotted a dissertation supervisor.

(ii) Topic should be allotted to the student in third semester.

(iii) Report may be divided into the number of chapters as required. Format of the report is as follows:

- **Introduction**
- **Review of Literature**
- **Methodology**
- **Results**
- **Conclusion**

The First Chapter should give:

- the general background of your work,
- a review of the work done by other people,
- the objective of your own work,
- the reasons why your work is interesting and useful.

The Middle Chapters should give detailed information about your work so that other people could repeat what you have done, or could do further work starting where your work finished. In these chapters you should

- explain the theory,
- describe exactly how you did the work,
- give the results you obtained.

The Last Chapter should:

- state the conclusions you have drawn from your work,
- compare your conclusions with the opinions of other people (Are your conclusions the same or different?),
- suggest what new work should be done to answer questions raised by your work and extend our knowledge further.

Evaluation of the dissertation will be done by the Supervisor, Nominee and External expert.