DEPARTMENT OF COMPUTER SCIENCE
GAUHATI UNIVERSITY
2012

Syllabus for M.Sc (Computer Science) (4 semester course, duration 2 years)

Semester-1	**Semester - II**
CSIT-401 Advanced Concepts in OOP (4-0-2-6)	**CSIT-406** Data Communication and Computer Networks (4-1-1-6)
CSIT-402 Advanced Computer Organization and Architecture (4-2-0-6)	**CSIT-407** Algorithms and Complexity Theory (4-2-0-6)
CSIT-403 Operating System (4-1-1-6)	**CSIT-408** Software Engineering (4-1-1-6)
CSIT-404 Mathematical Foundations of Computer Science (4-2-0-6)	**CSIT-409** Computer Graphics and Multimedia (4-1-1-6)
CSIT-405 Advanced DBMS (4-1-1-6)	**CSIT-410** Advanced Data Structure (4-0-2-6)

Semester – III	**Semester – IV**
CS-501 Theory of Computations (4-2-0-6)	**CSIT505** Programming languages (4-1-1-6)
CSIT-502 Distributed System (4-1-1-6)	**Elective -2**
CSIT-503 Compiler Design (4-1-1-6)	**Elective -3**
Elective -1	**CSIT-506** Project Work (- - - 6)
CSIT-504 Seminar (- - -3)	

Syllabus for M.Sc (Information Technology) (4 semester course, duration 2 years)

Semester-1	**Semester – II**
CSIT-401 Advanced Concepts in OOP (4-0-2-6)	**CSIT-406** Data Communication and Computer Networks (4-1-1-6)
CSIT-402 Advanced Computer Organization and Architecture (4-2-0-6)	**CSIT-407** Algorithms and Complexity Theory (4-2-0-6)
CSIT-403 Operating System (4-1-1-6)	**CSIT-408** Software Engineering (4-1-1-6)
CSIT-404 Mathematical Foundations of Computer Science (4-2-0-6)	**CSIT-409** Computer Graphics and Multimedia (4-1-1-6)
CSIT-405 Advanced DBMS (4-1-1-6)	**CSIT-410** Advanced Data Structure (4-1-1-6)

Semester – III	**Semester – IV**
IT-501 Web Programming Technologies (4-1-1-6)	**CSIT505** Programming languages (4-1-1-6)
CSIT-502 Distributed System (4-1-1-6)	**Elective -2**
CSIT-503 Compiler Design (4-1-1-6)	**Elective -3**
Elective -1	**CSIT-506** Project Work (- - - 6)
CSIT-504 Seminar (- - -3)	

List of Electives

(Papers_numbered as **CSIT** are electives offered to both M.Sc(CS) and M.Sc(IT) course. Papers numbered as **CS** are electives for M.Sc(CS) only and papers numbered as **IT** are electives offered for M.Sc(IT) course only.)

1. **CS-601** Computational Geometry.
2. **CS-603** Functional and Logic programming
3. **CS-604** Queuing theory and Operation Research
4. **CS-605** Parallel and Randomized Algorithms
5. **CS-606** Advanced Computer Architecture
6. **CS-607** Web Programming Technologies
7. **CS-608** Advanced Embedded System
8. **CS-609** Applied Graph Theory and Algorithms
9. **IT-601** Agent Technologies
10. **IT-602** Decision Support System
11. **IT-603** E-commerce Technology
12. **IT-604** E-learning
13. **IT-605** Information Theory and Coding
14. **IT-606** Management Information Systems
15. **IT-607** Software Project Management
16. **IT-608** Software Testing and Quality Assurance
17. **CSIT-601** Artificial Intelligence
18. **CSIT-602** Cryptography and Information Security
19. **CSIT-603** Data Mining and Warehousing
20. **CSIT-604** Embedded System
21. **CSIT-605** Image Processing
22. **CSIT-606** Speech Processing
23. **CSIT-607** Pattern Recognition
24. **CSIT-608** Fuzzy Logic and Neural Networks
25. **CSIT-609** Geographical Information System
26. **CSIT-610** Knowledge Based Systems
27. **CSIT-611** Mobile Computing
28. **CSIT-612** Natural Language Processing
29. **CSIT-613** Pattern Recognition
30. **CSIT-614** Real Time Operating System
31. **CSIT-615** System Administration and Networking
32. **CSIT-616** System Security
33. **CSIT-617** Wireless Communication and Networks
34. **CSIT-618** Digital Signal processing

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CSIT-401

ADVANCED CONCEPTS IN OBJECT ORIENTED PROGRAMMING

Total marks : 100 **LTPC (4-0-2-6)**

Object Oriented Programming

Structured Programming and Object Oriented Programming paradigms.

Data abstraction: Object, class, member and friend functions, memory allocation for objects, constructors and destructors, templates.
Inheritance: Extending a class, casting up the hierarchy, single and multiple inheritances, virtual base class.
Polymorphism: Compile time polymorphism, operator overloading, function overloading, static binding, run-time polymorphism, virtual functions, pure virtual functions, abstract class, dynamic binding.
Exception handling.

Object Oriented Design

Object Oriented Design Approaches, Object Modeling Techniques (OMT) tools : Object Model, Dynamic Model, and Functional Model. (Object Diagram, State Diagram, and DFD).
Phases of Object-Oriented Development: Object Analysis, System Design, Object Design.

Recommended Readings:

- B. Stroustrup, The C++ Programming Language, Addison Wesley Publishing Company, 1995.
- Herbert Schild : The Complete Reference to C++, Osborne McGrawHill.
- Rambaugh et al. : Object Oriented Modeling and Design, PHI(EEE).

CSIT-402
ADVANCED COMPUTER ORGANIZATION AND ARCHITECTURE

Total Marks- 100 **LTPC (4-2-0-6)**

Instruction Set Architecture: - 15
Instruction set design, addressing modes, representation of data (character, integral, floating point)
Computer Arithmetic: -
Serial adder, parallel adder, ripple carry adder, carry look-ahead adder, multiplication of signed and unsigned numbers, Booth's algorithm, division of integer, floating point arithmetic.

Processor Design: - 20
Register transfer language, one, two and three bus data path, ALU Design, control unit, hardwired control unit, micro programmed control unit.

Memory: - Classification and types. Cache memory, direct mapped, associative mapped and set associative mapped cache. cache replacement policies, write policy, unified, split and multilevel cache, virtual memory, paging, segmentation.

Input Output System: 15
I/O buses, device controller, Interrupt and DMA. Interrupt driven I/O, Program controlled I/O and DMA transfer.

Parallel Architectures: 25
Classification, SISD, SIMD, MISD, MIMD, Scalar, vector, superscalar and pipelined processor, Pipelining, Instruction pipeline, pipeline bubbles, Hazards: -resource conflicts, data dependency, branch difficulty. Vector computing, arithmetic pipeline, vector and scalar register, chaining, scatter gather operations, vector-register processor, memory- memory vector processor. Array processor.

Advanced concepts: 25
Branch prediction, super pipelining, Branch delay slot, Register file, superscalar architecture, superscalar pipelines, superscalar branch prediction, out of order execution, register renaming, Pipeline scheduling, dynamic scheduling and static scheduling algorithms, reorder buffer and register renaming, Thronton technique and scoreboard. Tomasulo algorithm and reservation stations. VLIW architecture: - EPIC architecture, Multiprocessor systems: - Interconnection types. Cache coherence problem

Recommended Readings*:*

- Computer Architecture and Organization by B. Govindarajalu.; TMH publication.
- Advanced Computer Architecture A systems Design Approach by Richard Y. Kain; PHI Publication
- Computer Organization and Architecture Designing for Performance by William Stallings; Pearson Education
- Computer System Architecture by M. Morris Mano, PHI Publication

CSIT-403
OPERATING SYSTEM

Total Marks: 100 **LTPC (4-1-1-6)**

Review of computer organization: Major subsystems, instruction sets, I/O organization.

Memory architecture: Address protection, segmentation, virtual memory, paging, page replacement algorithms, cache memory, hierarchy of memory types, associative memory.

Support for concurrent process: Mutual exclusion, shared data, critical sections, busy form of waiting, lock and unlock primitives, synchronization block and wakeup.

Scheduling: Process states, virtual processors, interrupt mechanism, scheduling algorithms, implementation of concurrency primitive.

System deadlock: Prevention, detection and avoidance.

Multiprogramming system: Queue management, I/O supervisors, memory management. File system, disk and drum scheduling.

Case Study: Some real operating system– semaphores, messages, shared memory.

Advanced Topics: Secondary storage management, Security, Distributed operating system.

Recommended Readings:

- A. S. Tanenbaum and A. S. Woodhull, 'Operating Systems Design and Implementation ', PHI
- Stallings, Unix Network programming, PHI.
- Kerninghan and Pike, The Unix programming Environment, PHI.
- M. Bach, 'The Design of the Unix Operating System', PHI
- A. S. Tanenbaum, 'Design of Operating System', Addison Wesley
- J. L. Peterson and A. Silberschatz, 'Operating System concepts ', Addison – Wesley
- Milenkovic, 'Operating System concept and design', McGraw Hill
- W. Stallings, 'Operating Systems', PHI
- A. Silberschatz and P. Galvin, 'Operating System Concepts', Addison-Wesley

CSIT-404
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Total marks: 100 **LTPC (4-2-0-6)**

Discrete mathematical structures: Basic concepts of sets, relations, binary relations, functions; Algebraic structures- groups, free groups, congruence, homomorphism and isomorphism, poset, permutation and combination; Lattices and Boolean algebra; Vector Spaces and properties; Linear transformations and linear operators.

Mathematical logic: Connectives- statement formulae and truth tables, tautologies and tautological implications, two-state devices and statement logic; Theory of inference- rules, consistency of premises and indirect method of proof, automatic theorem proving; Propositional calculus, predicate calculus- predicates, quantifiers, predicate formulas, free and bound variables, inference theory of predicate calculus; validity, soundness, completeness, compactness,(definitions only); resolution principles; Skolemization and Herbrand domain; Introduction to axiomatic theory.

Graph theory: Basic concepts- finite and infinite graphs, incidence and degree, isolated and pendant vertices, null graph; Paths and Circuits- isomorphism, subgraphs, walks, connected and disconnected graphs and components, Euler graphs, Bi-partite graphs, Hamiltonian paths and circuits; Trees- properties of trees, distance and centers, rooted and binary trees, on counting trees, spanning trees, fundamental circuits, spanning trees in weighted graphs; Cut-sets- properties, connectivity and separability, network flows; Matrix representation of graphs- incidence matrix, submatrices, circuit matrix, cut-set matrix, path matrix, adjacency matrix; Coloring, Covering and Partitioning- basic concepts; Directed graphs- definition, types, directed paths and connectedness, Euler digraph, tress with directed edges.

Automata theory: Concept of language and grammar. Review of DFA, NFA, NFA with empty moves and their equivalence. Minimization of FA. Regular sets and regular expressions. Pumping lemma for regular sets, closure properties and decision algorithms for regular sets. Context free language – definition, removal of useless symbols, removal of null productions and unit productions. Normal forms of CFLs- CNF and GNF.

Recommended readings:

- J. P. Tremblay and R. Manohar, “Discrete Mathematical Structures With Applications To Computer Science”, Mcgraw Hill.
- C. L. Liu, “Elements of Discrete Mathematics”, Mcgraw Hill.
- J. H. Gallier, “Logic For Computer Science”, J. Willey & Sons.
- H. R. Lewis and C. H. Papadimitriou, “Elements of The Theory of Computation”, PHI.
- N. Deo, “Graph Theory With Applications To Engineering And Computer Science”, PHI

CSIT-405
ADVANCED DATABASE MANAGEMENT SYSTEMS

Total Marks : 100 **LTPC (4-1-1-6)**

Relational model, relational algebra, and relational calculus (review): Relational model concepts, relational databases and schemas; Relational algebra operations, queries in relational algebra; overview of relational calculus; Commercial query language SQL- data definition, constraints, SQL queries, insertion, deletion, updation.

Semantic modeling (review): introduction, The E-R model, E-R diagrams, design of database with E-R model, Transformation of ER model to relational schema

Normalization and functional dependencies (review): design guidelines, functional dependencies – equivalence of sets of functional dependencies, cover, minimal cover; normal forms- 1NF, 2NF, 3NF, BCNF , 4 NF , dependency-preserving property , lossless join property , algorithms to ensure dependency -preserving property and lossless join property

System implementation techniques: Query processing and optimization- translation between SQL queries and relational algebra ; Transaction processing- transaction and system concepts, desirable properties, schedules and recoverability; Concurrency control- locking techniques, concurrency control based on timestamp ordering, multiversion concurrency control techniques; Database recovery- concepts and techniques, recovery in multidatabase systems; Security and authentication- issues, access control techniques, introduction to multilevel security.

Object oriented database systems: Concepts of object-oriented databases; Standards, languages and design; Object relational database systems.

Distributed databases: Concepts; Data fragmentation, replication, and allocation techniques; Types of distributed database systems; Query processing in distributed databases; Overview of concurrency control and recovery in distributed databases.

Image, multimedia, and spatial databases: Concepts of Image, multimedia, and spatial databases; Content-based indexing and retrieval, Indexing techniques- R trees, R+ trees, KD trees.

Recommended Readings:

- R. Elmasri and S. B. Navathe, ‘Fundamentals of Database Systems’, Pearson Education.
- C. J. Date, ‘An Introduction To Database Systems’, Pearson Education.
- D. Stamper and W. Price, ‘Database Design And Management- An Applied Approach’, Mcgraw Hill.
- C. S. R. Prabhu, ‘Object-Oriented Database Systems- Approaches And Architectures’, PHI.
- J. D. Ullman, ‘Principles of Database Systems’, Galgotia.

CSIT-406
DATA COMMUNICATION AND COMPUTER NETWORKS

Total Marks : 100 **LTPC (4-1-1-6)**

UNIT I: Data Communication concepts and terminologies: Data representation, Data transmission, Transmission channels, Signal encoding, Transmission impairments, Transmission media: Guided transmission media (*Twisted pair, Coaxial and Optical fiber);* Wireless transmission (*Terrestrial microwave, satellite microwave, Broadcast Radio and Infrared)*

UNIT II: Asynchronous and Synchronous transmission, Baseband and Broadband transmission, Modulation methods, Modems, Multiplexing.

UNIT III: Evolution of computer networks: Circuit switching, Development of packet switching: 1961-1972, Proprietary networks and internetworking: 1972-1980, Proliferation of networks: 1980-1990. The internet explosion: 1990s.

UNIT IV: Network standards and protocols: The IEEE standards, OSI 7 layer model, TCP/IP protocol suit. Data Link Layer: Frame design, Flow control, Error handling, HDLC, PPP, Sliding window protocol.

UNIT V: Network Layer: IP, X.25, Frame Relay, ATM, Routing, Queuing theory. Transport Layer: TCP, UDP, Congestion control, Flow control, Socket interface. Application Layer: SNMP, Authentication, Encryption, Web and HTTP, FTP, Email, DNS, Network File System (NFS) and File sharing, Remote Procedure Calling (RPC).

UNIT VI: Local Area Network (LAN): Needs, Architecture and Technology, Ethernet: CSMA/CD operation, parameters and specifications, Cabling: 10Base5, 10Base2, 10BaseT, 10BaseF, Hubs, patch panels and wiring closets. Bridges, Switches, 100BaseT, 100BaseVGANY,Gigabit Ethernet. FDDI, Token Ring, Wireless, ISDN, B-ISDN

UNIT VII: VSAT technology, Wireless LAN: Technologies, IEEE standards and protocols. Basics of Network management and Security, Infrastructure for network management and security.

Recommended Readings:

- Stallings, W.; Data and Computer Communications; Prentice Hall of India.
- Tanenbaum A.S.; Computer Networks; Prentice Hall of India.
- Kurose and Ross; Computer Networking; Addison Wesley
- Prakash C. Gupta; Data Communication; Prentice Hall of India

CSIT-407
ALGORITHMS AND COMPLEXITY THEORY

Total Marks: 100 **LTPC (4-1-1-6)**

Analysis of Algorithms: Concepts in algorithm analysis, time and space complexity**, r**eview of asymptotic notations used for time complexity. Standard notations and common functions-monotonicity, floors and ceilings, polynomials, exponentials, logarithms, factorials, iterated logarithmic functions, Fibonacci numbers. Asymptotic behaviors of polynomials, relative asymptotic growth, ordering by asymptotic growth rates. Recurrences - substitution method, iteration method (using recursion tree), using Master theorem (proof of the theorem is not included). Amortized analysis.

Advanced Algorithm Design and Analysis Techniques: Algorithm design techniques – Divide and Conquer, Dynamic programming, Greedy Algorithm, Back-tracking, Branch and Bound. Illustration of design techniques by application to some specific problems such as: sorting and searching, matrix manipulation problems, knapsack problem, internal and external sorting problem, job sequencing problem, set manipulation problem. Dynamic storage allocation, garbage collection.

Graph Algorithms: Representation of graphs, depth-first search and breadth-first search, topological sort. Minimum spanning tree – Kruskal and Prim's algorithm, Single source shortest path problem and algorithm due to Dijkstra.

Theory of NP-Completeness: Formal language framework, complexity classes – P, NP. co-NP Reducibility and NP-Complete, NP-Hard.

Lower Bound Theory.

Basic ideas about neural network, genetic algorithms.

Recommended readings:

- T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Tata-Mcgraw Hill Publishers.
- Horowitz and Sahani, Fundamentals of Computer Algorithms, Galgotia.
- A. Aho, J. E. Hopcroft and J. D. Ullman, Design and Analysis of Computer Algorithms, Addison-Wesley.
- S. Baase and Allen Van Gelder, Computer Algorithms-Introduction to Design and Analysis, Pearson Education, LPE.

CSIT-408
SOFTWARE ENGINEERING

Total Marks: 100 **LTPC (4-2-0-6)**

UNIT I: Problem domain, SE challenges, SE approach. Software process, Characteristics of SW process, SW development process model.

UNIT II: SW requirement, problem analysis, requirement specification, functional specification, validation, matrices.

UNIT III: Role of SW architecture, architecture view, component and connector view, style for C&C view. Process planning, Effort estimation, Software Cost Estimation based on COCOMO II cost model, Scheduling and staffing, SW configuration management plan, quality plan, risk management, project monitoring plan.

UNIT IV: Design principle, module level concept, design notation and specification, structured design methodology, verification. OO Analysis and OO Design. OO Design concept, UML, OO Design methodology.

UNIT V: Detail design and PDL, Verification, Metrices. Programming principles and guidelines, Coding process, refactoring, verification. Testing fundamentals.

Recommended Readings:

- An integrated Approach to Software Engineering: Pankaj Jalote: Narosa Publishing House
- Software Engineering: Ron Patton: Pearson Education.
- Software Engineering: K K Agarwal, Yogesh Singh: New Age International Publisher.
- Software Engineering: Ian Sommerville: Pearson Education (Addison Wesley)
- Software Engineering: A practitioner's Approach: Roger S. Pressman: McGraw Hill.

CSIT-409
COMPUTER GRAPHICS AND MULTIMEDIA

Total Marks:100 **LTPC (4-1-1-6)**

Introduction: Computer graphics and its applications; Input devices; Output devices- display devices; Display techniques- Raster-scan display and Random-scan display; color display techniques; Direct view storage tubes; emissive & non-emissive flat-panel displays-Plasma panels, Thin-film electrostatic displays, LED, LCD; Three-dimensional viewing devices; display systems architecture.

Graphics software: classifications, graphics functions for various operations, software standards- PHIGS, PHIGS+, GKS.

Output primitives: line-drawing algorithms- DDA algorithm and Bresenham's algorithm; Midpoint algorithms for circle & ellipse generation; area-filling algorithms-scan-line polygon-fill, nonzero-winding number rule; scan-line curve filling, boundary-fill algorithm, flood-fill algorithm; Character generation techniques- generation of bitmap and outlined font.

2-D geometric transformations: Basic transformations- translation, rotation and scaling; matrix representations and Homogeneous co-ordinate representations; Composite transformations among translation, rotation and scaling; General pivot-point rotation; General fixed-point scaling; General scaling directions; Other transformations- reflection and shear; Transformation between co-ordinate systems; Definition of Affine transformations.

2-D viewing: definition; viewing transformation pipeline; window-to-viewport co-ordinate transformation.

2-D Clipping operations: definition; point clipping; line clipping algorithms; polygon clipping algorithms; curve clipping, text clipping.

3-D concepts: display methods- Parallel projection, perspective projection, depth visible line & surface identification, surface rendering, exploded & cutaway views, 3-D & stereoscopic views.

3-D geometric transformations: Translation; Rotation- rotations about co-ordinate axes, general 3-D rotation; Scaling; Reflection; Shear.

3-D viewing: viewing transformation pipeline; world co-ordinate to viewing co-ordinate transformation.

Projections: Parallel projection techniques- orthographic & oblique projections and their transformation equations; Perspective projection and transformation equations.

Visible surface detection: definition; classification of algorithms- object-space methods & Image-space methods; algorithms for visible surface detection; curved-surface detection; wireframe displays;

Illumination and Surface rendering: definition and importance; light sources; Definition of basic illumination models.

Color models and applications: properties of light; standard preliminaries- XYZ model, CIE chromaticity diagram; color models- RGB, YIQ, CMY, HSV, HLS; conversion between color models.

Multimedia Systems: Review of typical interactive multimedia systems; Aspects of multimedia systems; Multimedia design techniques, Multimedia technology; Network-based multimedia systems.

Computer Animation: Traditional animation techniques, 2D animation, 3D animation.

Case Study: Graphics API with GD or OpenGL or DirectX/3D.

Recommended Readings:

- Donald Hearn, M. Pauline Baker; "Computer Graphics C Version"; PHI.
- Foly, Van Dam, Feiner, Hughes; "Computer Graphics principles and practice"; Pearson Education.
- Z. Xiang, R. A. Plastock; "Computer Graphics", second edition, McGraw Hill, 2006.
- N. Sinha, A. D. Udai; "Computer Graphics", 1st edition, McGraw Hill, 2008.

CSIT-410

ADVANCED DATA STRUCTURE

Total Marks: 100 **LTPC (4-0-2-6)**

Review of basic concepts in Data Structure: A quick review of array versus linked list structure; binary tree, binary search tree; traversal, insertion and deletion in binary search trees.

Dictionary ADT: Search trees, balancing of search trees – AVL trees, Red-Black trees, multi way search trees, 2-3 trees, splay trees. Insertion and Deletion in each of the above data structures. Hashing.

Sorting and Selection Techniques: Quick sort, Heap sort, Shell sort, sorting in linear time – Counting sort, Radix sort. Medians and order Statistics. Selection and Adversary arguments. Lower bound on sorting.

Priority Queue ADT: Heaps-extended priority queue, min(max) heaps, binomial heap, fibonacci heap and its amortized analysis.

Partition ADT: Union-find algorithms through weighted merge and path compression.

Data Structure for external storage operations: B-tree, insertion and deletion in B-trees, external sorting. B^+ tree.

Recommended Readings:

- T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Tata-Mcgraw Hill Publishers.
- A. Aho, J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Addison-Wesley.
- Horowitz and Sahani, Fundamentals of Data Structures in C/C++, Computer Science Press.
- A. Aho, J. E. Hopcroft and J. D. Ullman, Design and Analysis of Computer Algorithms, Addison-Wesley.

CS-501
THEORY OF COMPUTATIONS

Total Marks: 100 **LTPC (4-2-0-6)**

Extending Finite-State Automata: The Pushdown Automaton (PDA), Pushdown Automaton as language acceptor – acceptance with final state and empty stack. PDA and Context free languages. Ambiguity and properties of CFLs. Properties of Pushdown Automaton and relation with Finite State Automata. Pumping lemma for CFLs, Closure and decision properties of CFLs. Left and Right linear grammar and relation with Regular sets.

Turing Machines: Techniques for construction. Turing machines as function evaluators. Turing machines with two way infinite tape, Multi-tape Turing machines, Multi-dimensional Turing machines, non-deterministic Turing machines, Universal Turing machine. Recursive and recursively enumerable languages, unrestricted grammar. Church Turing hypothesis. Undecidability, Context-sensitive languages and linear bounded automata.

Computability Theory: Primitive recursive function, partial recursive function. Arithmetization: Encoding of Turing machines, recursive and recursively enumerable sets, Rice's theorem, degree of unsolvability.

Recommended Readings:

- Hopcroft and Ullman; Introduction to Automata Theory, Languages and Computation, Addison Wesley
- Peter Linz; An introduction to Formal Languages and Automata, Narosa Publishing House.
- Michael Sipser; Introduction to the Theory of Computation; 2nd Edition, Thomson (India Edition).
- K. L. P. Mishra, N. Chandrasekaran; Theory of Computer Science (Automata, Languages and Computation), P. H. I.
- J. C. Martin, Introduction to Languages and the Theory of Computation, Mc-Graw Hill International Edition.

CSIT-502
DISTRIBUTED SYSTEMS

Total Marks:100 **LTPC (4-1-1-6)**

Introduction to Distributed Systems: Definition of a distributed system. Design goals- connecting uses and resources, transparency, openness, scalability. Hardware concepts- multiprocessors, homogeneous & heterogeneous systems. Software concepts- distributed operating systems, network operating systems, middleware. The client-server model- clients & servers, application layering, client-server architectures.

Communication: Remote Procedure Call- basic RPC operation, parameter passing, examples. Remote Object Invocation- distributed objects, integrating clients and objects, static versus dynamic RMI, parameter passing, examples and case study. Message oriented communication- persistence and synchronicity in communication, transient communication, persistent communication.

Processes: Threads- introduction, threads in distributed systems. Clients- user interfaces, software for distribution transparency. Servers- general design issues, object servers. Code migration. Software agents- definition, software agents in distributed systems, Agent Technology.

Naming: Naming entities- names, identifiers & addresses, name resolution, name space implementation, the Domain Name System.

Synchronization: Clock synchronization- physical clocks, synchronization algorithms, uses. Logical clocks. Global state. Election algorithms- the Bully algorithm, Ring algorithm. Mutual exclusion- definition, algorithms. Distributed transactions- the transaction model, classification, implementation, concurrency control.

Consistency and Replication: Introduction, reasons for replication, object replication, consistency models.

Fault Tolerance: Introduction- basic concepts, failure models. Reliable client-server communication- point-to-point communication. Reliable group communication- basic reliable-multicasting schemes, atomic multicast. Distributed commit. Recovery.

Distributed File Systems: Introduction: characteristics of file systems, distributed file system requirements, File service architecture: flat file service, directory service, client module. Detailed case study of Sun Network File System (NFS).

Recommended Readings:

1. Tanenbaum & Steen; Distributed Systems Principles and Paradigms; Pearson Education, 2004.
2. Coulouris, Dollimore & Kindberg; Distributed Systems Concepts and Design, 3/e; Pearson Education.2006.

CSIT-503
COMPILER DESIGN

Total Marks: 100 **LTPC (4-1-1-6)**

Introduction: What is a compiler? Phases of compiler. Overview of working of a compiler

Lexical Analysis: NFA, DFA, conversion from NFA to DFA. Regular expression. Regular expression to NFA conversion. Minimisation of DFA. Writing a lexical analyser for C using Lex.

Syntax analysis: Grammar representation. Derivation and parse tree. Ambiguity and possible elimination. Top down parsing. Recursive descent and predictive top down parsing. Elimination of Left recursion. Bottom up parsing. Operator precedence parsing, LR parsing (including SLR and LALR). Error detection and recovery. Parser table construction. Writting a parser for a subset of C using yacc.

Code generation: Symbol table contents, implementation. Type checking. Syntax directed translation. Forms of intermediate codes. Abstract Syntax Trees, Directed Acyclic Graph, Three address code. Intermediate code generation for different language constructs like arrays, boolean expressions, if, if-else, while, case or switch, function calls. Writing a intermediate code generator and an interpreter for the intermediate code for the parser developed in 3 above. Target code generation issues. Runtime storage management.

Code Optimisation: DAG, basic blocks, Common sub-expression elimination, variable propogation, code motion, strength reduction, elimination of dead code, loop optimisation. Data flow analysis.

Recommended Readings

- Aho, Sethi, Ullman; Compilers, Principles, Techniques, Tools, Pearson Education
- Introduction to Compiler Construction, A.V.Aho. Ravi Sethi, J.D.Ullman; Pearson Education.
- Compiler Design in C, Holub., P.H.I.
- Compiler Design, Santanu Chattopadhyay, P.H.I.
- The Essence of Compilers, Hunter, Pearson Education.

CSIT-504

LTPC (- - - 3)

Each student will have to deliver at least 2 seminars talks on topics assigned by the department. Evaluation will be done by the teachers in the department which will reflect the performance of the students in all the seminars. A separate committee may be constituted by the department for evaluation, consisting of three teachers from the department.

CSIT-505
PROGRAMMING LANGUAGES

Total Marks:100 **LTPC (4-1-1-6)**

Programming Language concepts

Factors influencing the evolution of programming languages - influence of architecture and operating system, implementation methods. Development in programming methodology, desirable features and design issues. Language processors. Syntax, semantics and Virtual Computers, Binding and Binding time.

Paradigms and Languages

Imperative Programming Languages

Statements, data types, subprograms, sequence control, data control, dynamic allocation using pointers, operating and programming environment, Subprogram activation- parameter passing methods, scope rules for names. Nested procedures. Syntax and translation.

Object Oriented Languages

Data abstraction: object oriented thinking, class, grouping of data and operations, constructors and destructors, templates.
Inheritance: Extending a class, casting up the hierarchy, single and multiple inheritances, virtual base class.
Polymorphism: Compile time polymorphism, operator and function overloading, static binding, run-time polymorphism, virtual functions, pure virtual functions, abstract class, dynamic binding.
Exception handling.
[As OOP has been covered in semester 1 in depth, a quick review of the above concepts will be made.]

Functional Programming Languages
Principles of functional programming. Types-values, bindings and functions, environment and scope, recursive functions, polymorphic functions, type variables.
Lists and programming with lists (LISP).
Functional programming in C++.

Logic Programming Languages
Review of Predicate Logic. Logic as a language for problem solving. Facts, rules, queries and deductions, sentence structure. General structure and computational behavior of logic programs. Unification algorithm. Procedural interpretation of Logic. Algorithmic view of logic program execution. A brief introduction to PROLOG.

Recommended Readings:

- T.W. Pratt and M. V. Zelkowitz: Programming Languages: Design and Implementation; PHI.
- Ravi Sathi, Programming Languages, Concepts and Constructs, Pearson Education, Asia, LPE
- B. Stroustrup, The C++ Programming Language, Addison Wesley Publishing Company, 1995.
- W. Lloyd, Foundations of Logic Programming, Springer 1984.
- Carlo Ghezzi, Mehdi Jazayeri, Programming Language Concepts, J. Wiley & sons.
- E. Horowitz : Fundamentals of Programming Languages; Galgotia Publications Pvt Ltd.
- K. C. Louden; Programming Languages-Principles and Practice; Thompson (2 nd Indian Edition);

IT-501 CS-607

WEB PROGRAMMING TECHNOLOGIES

Total Marks: 100 **LTPC(4-0-2-6)**

Internet basics: History and basic idea of Internet; Internet services: telnet, e-mail, ftp, WWW.

Web page design: Designing web pages with HTML- use of tags, hyperlinks, URLs, tables, text formatting, graphics & multimedia, imagemap, frames and forms in web pages. Use of Cascading Style Sheet in web pages.

Creating interactive and dynamic web pages with JavaScript: JavaScript overview; constants, variables, operators, expressions & statements; user-defined & built-in functions; client-side form validation; using properties and methods of built-in objects.

Markup language basics: Standard Generalized Markup Language (SGML) - structures, elements, Content models, DTD, attributes, entities.

Extensible Markup Language (XML): Introduction- using user-defined tags in web pages; displaying XML contents; XML DTDs; use of XSL.

Web Browsers: functions and working principle of web browsers; plug-ins & helper applications; conceptual architecture of some typical web browsers.

Introduction to Client/Server Computing: client-server computing basics; types of Client/Server systems; middleware; N-tired systems: 2-tier/3-tier/4-tier systems; Fat Clients versus Fat Servers.

Web Servers: Web services and web server functionality; web server composition; registration; HTTP, IP address, DNS & ports; conceptual architecture of some typical web servers.

Server-side scripting: overview of CGI, ASP, and JSP. Server side scripting using PHP; Web database connectivity- introduction to ODBC; PHP with database connectivity.

Exposure to Advanced Web Technologies: Distributed Object based models- DCOM, CORBA, EJB; Web services and Related Technologies- ISAPI, SOAP, UDDI, WSDL; Other Advanced Web Technologies- AJAX, ISAPI, .NET.

Web Security: Firewalls- definition and uses, network layer firewalls and application layer firewalls; Proxy servers.

Recommended Readings:

- Oliver, Dick; SAMS Teach Yourself Html 4 in 24 Hours; Techmedia.
- Ashbacher, Charles; SAMS Teach Yourself XML in 24 Hours; Techmedia.
- SAMS Teach Yourself JavaScript in 24 Hours; Techmedia.
- SAMS Teach Yourself PHP in 24 Hours; Techmedia.
- Lehnert, Wendy. G.; Web 101 making the 'Net for you; Pearson Education.
- Sebesta, Robert; World Wide Web Programming.
- www.w3c.org
- www.w3schools.com
- www.enterprosejavaworld.com

CSIT 601
ARTIFICIAL INTELLIGENCE

Total Marks: 100 **LTPC (4-1 -1 -6)**

Historical foundation of AI. AI application areas. AI problem, Underlying assumptions, AI techniques, Level of models, success criteria. Problem as a state space search, Production Systems, Problem characteristics, PS characteristics, Design issues of search programs.

Heuristic Search Techniques : Generate and test, Hill Climbing, Best-First Search, Problem reduction.

Knowledge representation and Mapping, Approaches, Issues. Predicate logic. Representing simple facts in logic, Instance and isa relationship, Computable function and predicity, Resolution, Natural Deduction.

Knowledge representation using rules, Procedural vs declarative, logic programmes, Forward vs backward recovery, matching. Nonmonotonic reasoning and logic. Implementation: Depth first abd breath first search.

Introduction to statistical reasoning. Probability and bays theorem, Fuzzy logic concept. Concept of weak slot and filter, and strong slot and filter structure. Fundamental of Natural Language Processing : Syntactic processing, semantic analysis. Concept of Expert Systems : Representation using domain knowledge, Expert System shell, knowledge acquisition.

Suggested Books:

- Artificial Intelligence : E. Rich & K. Knight : Tata McGraw Hill.
- Artificial Intelligence: Structures and Strategies for Complex Problem solving: George Luger, Pearson Education.
- Principles of Artificial Intelligence: Nils J Nisson: Narosa

Recommended Readings:

- Tanenbaum & Steen; Distributed Systems Principles and Paradigms; Pearson Education, 2004.
- Coulouris, Dollimore & Kindberg; Distributed Systems Concepts and Design, 3/e; Pearson Education.2006.

CSIT-603
DATA MINING AND WAREHOUSING

Total Marks: 100 **LTPC(4-1-1-6)**

Introduction to Data Mining

Basic Concepts : Data Mining, kinds of patterns that can be mined, Data Mining versus Database systems, Data preparation, cleaning and visualization.

Data Warehousing : Differences between database systems and Data Warehouse, Data Warehouse architecture and its components, Warehouse versus Data Mining (OLTP & OLAP), OLAP tools, Data cubes, Multidimensional Data.

Data Mining Techniques

Association Rules : What is an association rule? Mining association rules, frequent sets and border sets, algorithms for mining association rules – A priori algorithm, Pincer-search algorithm, Border algorithm, FP-tree growth algorithm, generalized association rule, association rule with item constraints.

Clustering : Hierarchical versus Partitional clustering, types of data in clustering, Partitional algorithms – k-means, k-mediods, PAM, CLARA, CLARANS. Density based clustering algorithm – DBSCAN. Hierarchical algorithms – BIRCH, CURE. Categorical clustering algorithms – ROCK, CACTUS.

Decision Trees : Introduction, tree construction principle, decision tree generation algorithms – CART, ID3, C4.5

Other techniques for Data Mining : Concepts of Genetic algorithms, Artificial Neural Network and Rough sets and their application in the domain of data mining. Introduction to Web Mining, Text Mining, Temporal data mining.

Recommended Readings

- K. Puzari, "Data Mining Techniques", University Press
- Jiawei Han & Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann & Harcourt India.
- K. P. Soman, Shyam Diwakar and V. Ajay; Insight into Data Mining : Theory and Practice ; P.H.I (Eastern Economy Edition); 2008.
- K. Jain and R. C. Dukes, "Algorithms for Clustering Data", Prentice-Hall
- K. Cios, W. Pedrycz and R. Swiniarski, "Data Mining : Methods of Knowledge Discovery", Kluwer Academic Publishers, Boston, 1998.

CSIT-604
EMBEDDED SYSTEM

Total Marks :100 **LTPC(4-0-2-6)**

Introduction: - What is an embedded system? Why is it special? What types of processor are used? What are the other peculiarities?

Processors for embedded systems: - 8 bit processors 8085, 8051 and PIC 18FXX: - Architecture and instruction set. (already covered in microprocessor) 16 bit: - 8086 32 bit : - 80386 architecture and instruction set, ARM based processor architecture and instruction set.

Operating systems for embedded systems: -

Real time operating systems Issues: -

I/O programming: Synchronization, transfer rate and latency. Polled I/O issues. Interrupt driven I/O. ISR. Response time interrupt controller. Software interrupts and exceptions. Buffering of data and queuing of interrupt requests.

Concurrency control: Foreground/Background systems, Thread state and serialization, latency, prevention of interrupt overruns. Concurrent execution of threads, context switch, non-preemptive multitasking, preemptive multitasking. Critical sections:- disableing interrupts, disabling ask switch, spin lock, mutex and semaphore.

Scheduling in Embedded Systems: Conventional scheduling, deadline driven scheduling, rate monotonic scheduling, deadlock, watchdog timer.

Memory Management: Static allocation, dynamic allocation. Recursion and dynamic allocation. shared memory, reentrant functions.

Boot up and System initialization.

80x86 microprocessor with a C compiler (suited for RTOS) and uC/OS RTOS may be used for practicals.

Some real embedded application shall be taken up for practical.

Recommended Readings

- Fundamentals of Embedded Software by Daniel W Lewis, Pearson Education
- An Embedded Software Priomer by David E. Simon, Pearson Education

CS-604
QUEUING THEORY AND OPERATIONS RESEARCH

Total Marks: 100 **LTPC (4-1-1-6)**

Linear Programming Techniques: The simplex algorithm, Charma's method of penalties, the two-phase algorithm, problems of degeneracy and cycling.

Duality in Linear Programming: The duality theorem, Revised simplex algorithm. Revised simplex method versus the simplex method.
Sensitivity Analysis, changes in the requirement vector, the cost vector and the coefficient matrix.

Parametric Programming: parametrization of the cost vector of the requirement vector.
Theory of Games: 2-person zero sum game; Reduction of the game problem into a linear programming problem.
The Transportation problem: various algorithms such as the algorithm of stepping stones. Vogel's method.

Non-Linear Programming; constrained minima and maxima, Necessary and sufficient condition for maxima and minima; The Kuhn – Tucker principle; Quadratic Programming.
Queuing Theory: the Exponential Distribution; queue disciplines much as M/M/1, M/M/C, M/EK/1, M/G/1, etc.

Simulation: Event type simulation. Monte Carl'o Techniques, simulation techniques applied to queues.

Dynamic Programming: the recursion approach, computation procedures using Calculus
Geometric Programming; Generalization using Kuhn-Tucker Principle.

Integer Programming: Integer linear programming in 2 dimensions, General ILP and MILP problems.

Selected hard optimization problems: Review of NP hardness, TSP, Max clique problem, Multiprocessor scheduling problem.

Recommended Readings

- Linear Programming – S.L. Gass
- Optimization methods – K.V Mittal and G.Mohan
- Stochastic Processes – J. Medhi
- Operations Research – K.Swarup , P.K. Gupta and M. Mohan.
- Operations Research – by H. Taha.

IT-601

AGENT TECHNOLOGIES

Full Marks:100 **LTPC (4-1-1-6)**

Introduction to software agents: definition, attributes, different classes of software agents, uses of agents.

Agents and the user experience: user's interaction with agents, agents from direct manipulation to delegation, interface agents, designing agents, direct manipulation versus agents.

Agents for learning and intelligent assistance: agents for information sharing and coordination, agents that reduce work and information overload, agents for cooperative learning, the M System.

Agent communication, collaboration and mobility: agent oriented programming, Agent Communication Languages, agent based frameworks, communicative actions for artificial agents, Mobile agents.

Multiagent systems: objectives and objections, multiagent interactions, communication, Agent security issues, Black Box Security.

The FIPA model for software agents: Agent Lifecycle Management, Message Transport, Message Structure, Inter-agent Interaction Protocols, Ontologies, Security.

Agent Programming: overview of Java based programming environments- ABLE, AgentBuilder, Aglets, FIPA-OS, Gossip, JADE, JATLite, Jess, Voyager, ZEUS etc; Other non-java environments; Programming static and mobile agents in any one such environment.

Recommended Readings:

- Software Agents –Jeffrey M. Bradshaw (edited by), AAAI Press/ The MIT Press, 2000.
- An Introduction to MultiAgent Susyems- Michael WoolDridge, John Willey and Sons Ltd.
- Constricting Intelligent Agents Using Java- Joseph P. Bigus and Jennifer Bigus, Wiley.
- Intelligent Software Agents- Richard Murch and T. Johnson, Prentice Hall, 2000.
- Online Documentations from WWW.

IT-603
E-COMMERCE TECHNOLOGY

Total Marks: 100 **LTPC (4-1-1-6)**

Electronic commerce fundamentals: History and basic idea of EDI and electronic messaging, definition of e-commerce; administration, business, and consumer models of e-commerce; e-commerce enablers- cost reduction, trust issues, products, processes, and markets.

Client-server computing in e-commerce: client-server computing basics, design technologies.

E-commerce Internet applications: overview of e-commerce standardization activities and standards; overview of Java enterprise solutions; brief introduction to web service development advanced features, like SOAP, WSDL, UDDI; use of agent technology- like mobile agents; designing an e-com site.

XML in e-commerce: introduction to XML, XML-based enterprise applications, limitations of XML; future of XML.

Cryptography in e-commerce: cryptography basics; private key encryption; public key encryption; cryptography and the WWW. Introduction to SSL.

Electronic payment systems: digital cash- Ecash, ECheque, Credit card based payment systems, Micropayments and Macropayments. Example protocols like iKP, payword, Millicent, SET, etc.

Search engines: intelligent search technology & personalization, information addition & retrieval.

Social impacts of e-commerce: changes in administration & business; electronic shopping; electronic forms; global e-commerce and future trends.

Laboratory: Laboratory assignments related to e-commerce Internet applications.

Recommended Readings:

- Laudon, K. C. & Traver, C. G.; E-Commerce Business, Technology, Society; Addison Wesley.
- Ince, Darrel; Developing Distributed and E-commerce Applications; Addison Wesley.
- Ashbacher, Charles; SAMS Teach Yourself XML in 24 Hours; Techmedia.
- Rayport, Jeffrey & Jaworski, Bernard; ECommerce; Burr ridge, IL: Irwin / McGraw-Hill.
- Stallings, William; Cryptography and Network Security: principles and Practice; Prentice Hall.
- Schneider, Bruce; Applied Cryptography; Wisley publication.
- The Internet (WWW) is to be used as a source of up-to-date reading materials for topics related to e-commerce.

IT-607
SOFTWARE PROJECT MANAGEMENT

LTPC (4-2-0-6)

UNIT I: Processes and project management, project management and the CMM, Case study: project management at one of thee leading IT Industries, Overview of ACIC case study. Project planning infrastructure: Project database, process planning.

UNIT II: Estimation and scheduling concept, bottom up and top down approaches, Overall scheduling, detail scheduling. Quality planning: Concept, quantitative quality management planning, defect prevention planning. Risk Management: Risk assessent, risk control, examples.

UNIT III: Concept of measurement, measurement, project tracking, ACIC measurement and tracking plan. Project management plan, Team management, customer communication and issue resolution. Configuration management, CM process. The ACIC configuration management plan.

UNIT IV: Project review, review process, data collection, monitoring and control, introduction of reviews and NAH Syndrome. Project monitoring and control: Project tracking, Milestone analysis, Activity level analysis using SPC, defect analysis and prevention. Process monitoring and audit. Project closure analysis.

Unit V: Using a project management tools, like Microsoft Project 2000

Recommended Readings:

- Software Project Management in Practice: Pankaj Jalote, Pearson Education
- Basics of Software Project Management: NIIT: Prantice Hall of India.
- Software Engineering: Ian Sommerville: Pearson Education (Addison Wesley)
- Software Engineering: A practitioner's Approach: Roger S. Pressman: McGraw Hill.

IT-608
SOFTWARE TESTING AND QUALITY ASSURANCE

LTPC (3-2-1-6)

UNIT I: Software quality, problems with traditional quality assurance, solution-improving the quality process, Quality control tools. MCCall Software quality model, Boehm software quality model.

UNIT II: Testing fundamentals, Terminologies, Approaches to managing software testing, The Most Important Tests (MITs) method.

UNIT III: Fundamental metrices for software testing, test inventory, How to build a test inventory, tools to automate test inventory.

UNIT IV: Risk analysis, applied risk analysis, path analysis, applied path analysis, data analysis techniques.

Unit V: Testing tools: static, dynamic tools. Characteristics of modern tools. Case studies on Testing tools.

Recommended Readings:

- Software Testing Fundamentals: Methods and Metrices: Marniw L. Huncheson: Wiley Publishing
- Software Engineering: K. K. Aggarwal, Y. Singh: New Age.
- Effective Software Testing: Elfriede Dustin: Pearson Education.

CS-609
APPLIED GRAPH THEORY AND ALGORITHMS

Total Marks:100 **LTPC(4-2-0-6)**

Shortest path problems (SP) : Various versions of the SP problem. Algorithms for single source SP problem, characterization and presence of SP, SP tree and its characterization, Ford's labeling method and its correctness Labeling and Scanning method - efficient scanning orders topological order for a cyclic networks, shortest-first search for non-negative network (Dijkstra), BFS search for several networks and its analysis, All-pair shortest path problem - Floyd's algorithm and its analysis.

Flows in Networks : Basic concepts, Maxflow-mincut Theorem, Ford and Fulkerson's augmenting path method, Integrality theorem - Maximum capacity augmentation and its analysis - Augmentation by blocking flows-Dinic's algorithm-analysis of number of blocking steps for general and unit networks.

Matching Problems: Basic concepts. Bipartite matchings and network flows. Non-bipartite matching-basic concepts, Edmonds- Blossom shrinking algorithm and its analysis.

Planarity and Graph Isomorphism: Review of basic results about planarity. Polynomial algorithm for testing of planarity and applications. Graph Isomorphism, Importance of the problem, Backtrack algorithm for general graph Isomorphism problem and its complexity. Isomorphism complete problems, polynomial time algorithm for planar graph isomorphism problem, Group theoretic methods and graph isomorphism problem.

Graph Colouring: Map and vertex colouring, the 6,5 and 4-colour theorems for planar graphs, colouring graphs on compact surfaces, chromatic number.

Physical Networks: Modelling physical networks, component equations, Kirchoff's laws, dual networks. Fundamental cycle and cutest equations, matrix form of the network equations, state equations.

Recommended Readings:

- G. Chartrand and O.R. Ollermann "Applied and Algorithmic Graph Theory", Mc-Graw Hill.
- R.E. Tarjan, "Data structures and Network Algorithms".
- E. Horowitz and S. Sahani, "Fundamentals of Computer Algorithms", Galgotia.
- N. Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI.
- C.M. Hoffman, "Graph Theoretic Algorithms and Graph Isomorphism".

CSIT 615
SYSTEM ADMINISTRATION AND NETWORKING

Total Marks:100 **LTPC(4-2-0-6)**

Major components of the Linux operating systems. File system, setting user and group ownership of files and directories and access permissions, basic commands for starting and stopping processes, basic process attributes and their role in access control, mounting and unmounting file systems and partitions.

Linux kernel program, starting and stopping a Linux system, setting up user and group accounts on single machines, the basics of backup and restore procedures.

Linux system monitoring and logging. Examining the list of running processes on the system and understand the data presented there. Monitoring memory usage and disk space usage on the system. Customizing system log configuration.

The rules governing IP address classes and netmasks, Configuring the resolver library to arrange for TCP/IP name service, Bringing interfaces up and down, and set their IP addresses and netmasks, Setting the default route in the kernel routing table. Understanding the significance of the /etc/services file and well-known port numbers, Configuring the inet daemon, Using telnet to contact servers directly, using the ping command to test network connectivity, netstat command to examine kernel tables pertaining to networking, traceroute command to discover network paths, tcpdump to examine all network traffic. Methods used to bring interfaces up and down.

Basics of configuring and using the Domain Name Service, sendmail, the Network Information System, Network File System: Structure and function of the Domain Name Service (DNS), Setting up a Linux machine to function as a DNS server, Configuring and using sendmail, Setting up an NIS domain with an NIS master server and NIS clients.

Basic network security issues and solutions.

Setting up a Linux machine to act as an NFS server, Setting up a Linux machine to act as an NFS client

Incremental back up. Monthly back. Mail server setup

Recommended Readings:

- Red Hat Linux: Proffitt: PHI
- UNIX Network Programming- Vol-I and Vol-II: Stevens: PHI
- Introduction to System Administration: IBM series: PHI

CSIT-618

DIGITAL SIGNAL PROCESSING

Total Marks: 100 **LTPC (4-1-1-6)**

UNIT-1: Introduction: signals, systems and signal Processing, Frequency in Continuous Time & Discrete Time Signals. Analog to Digital & Digital to Analog Conversion.

UNIT-2: Discrete Time Signals & Systems: Discrete Time Signals, Discrete Time Systems, Discrete Time Systems described by Difference equations, Correlation of Discrete Time Signals.

UNIT-3: Z-Transformation: Properties of Z-Transformation, ROC and properties Rotational & Inversion of Z-transformation, analysis of linear time invariant system in the Z-Domain.

UNIT-4: Frequency analysis of Signals: Frequency analysis of continuous Time Signals, Frequency analysis of Discrete Time Signals, Properties of the Fourier Transform for Discrete Time Signals.

UNIT-5: Sampling & Reconstruction of signals: Ideal Sampling & Reconstruction of Continuous Time signals, Nyquist's theorem for base band and band pass signals, aliasing, Discrete Time Processing of Continuous Time signals, Quantization, Pulse code Modulation (PCM).

UNIT-6: DFT (Discrete Fourier Transform): Frequency Domain Sampling, Properties of DFT, Linear Filtering Method based on DFT, Frequency Analysis of Signals using DFT. FFT algorithms to compute DFT.

UNIT-7: Design of Analog Filters, Digital Filter: Design of FIR Filter, Design of IIR Filter, Frequency Transformation. Introduction to power spectrum estimation, application of DSP in speech and image processing.

Recommended Readings:

- Digital Signal Processing (Principles, Algorithms & Applications)-By J.G. Proakis & D.G. Manolakis, PHI Publication.
- Theory & Application of Digital Signal Processing, By L.R. Rabiner & B. Gold, PHI Publication.
- Modern digital & Analog Communication Systems, By B.P. Lathi, Published by Oxford University Press.
- Digital Filters: Analysis & Design, By A. Antoniou, Tata McGraw-Hill Publication.

CSIT606

SPEECH PROCESSING

Total marks : 100 **LTPC (4-0-2-6)**

AIM

To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis, compression and recognition.

OBJECTIVE

- To introduce the models for speech production
- To develop time and frequency domain techniques for estimating speech parameters
- To introduce a predictive technique for speech compression
- To understand speech recognition, synthesis and speaker identification.

Prerequisites: Programming experience in C, C++.

UNIT-I: Digital Signal Processing

Introduction: signals, systems and signal Processing, Frequency in Continuous Time & Discrete Time Signals. Analog to Digital & Digital to Analog Conversion. Discrete Time Signals & Systems: Discrete Time Signals, Discrete Time Systems, Discrete Time Systems described by Difference equations, Correlation of Discrete Time Signals.

UNIT II : Fundamentals of speech signal

History of speech recognition research, The Speech Signal : Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production.

Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis.

UNIT III : Time domain methods for speech processing

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.

UNIT IV: Frequency domain methods for speech processing

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing

UNIT V: Linear predictive coding of speech

Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.

UNIT VI: Speech analysis

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.

UNIT VII: Automatic speech recognition
Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Vector quantization, speech coding

UNIT VIII : HIDDEN MARKOV model for speech recognition
Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models. Example of speech recognition project.

Practical :
Calculating formant frequencies, resonant frequency, cepstral coefficient, speech coding etc. for speech signals should be done in laboratory using Matlab.

Recommended Readings:

TEXTBOOK

- L. Rabiner and B.-H. Juang, Fundamentals of Speech Recognition, Prentice Hall, 1995, ISBN 0-13-015157-2
- L. R. Rabiner and R. W. Schafer, Digital Processing of Speech Signals, Prentice-Hall, 1978, ISBN 0-13-213603-1.

REFERENCES

- J.L Flanagan : Speech Analysis Synthesis and Perception - 2nd Edition - Sprenger Vertag, 1972.
- I.H.Witten : Principles of Computer Speech , Academic press, 1983.
- Speech Communications: Human & Machine - Douglas O'Shaughnessy, 2nd ed., IEEE Press.
- Discrete Time Speech Signal Processing: Principles and Practice - Thomas F. Quateri 1st ed., PE.
- Speech & Audio Signal Processing- Ben Gold & Nelson Morgan, 1 ed., Wiley.
- Speech Recognition - Claudio Becchetti and Lucio Prina Ricotti, Wiley