BERHAMPUR UNIVERSITY

Course of studies
FOR
M.Tech. (Computer Science)

Self Financing Course
2011-2013

FIRST AND SECOND SEMESTER EXAMINATION-2012
THIRD AND FOURTH SEMESTER EXAMINATION-2013

Course Structure for M.Tech. in Computer Science
2011-2013

1st semester

MTCS 1.1	Design and Analysis of Algorithms	(40+60) marks
MTCS 1.2	Advanced Computer Architecture	(40+60) marks
MTCS 1.3	Object Oriented Data structures	(40+60) marks
MTCS 1.4	Discrete Mathematical Structures	(40+60) marks
MTCS 1.5	Elective-1	(40+60) marks
MTCS 1.6	Lab –I (Object Oriented Systems Lab)	100 marks

One from the elective courses for MTCS 1.5:

1 VLSI design
2 Object Oriented Systems
3 Principles of Programming Languages
4 Embedded systems
5 Computer Graphics

2nd semester

MTCS 2.1	Computer networks	(40+60) marks
MTCS 2.2	Advanced Operating systems	(40+60) marks
MTCS 2.3	Advanced Data Base Systems	(40+60) marks
MTCS 2.4	Elective-2	(40+60) marks
MTCS 2.5	Elective-3	(40+60) marks
MTCS 2.6	Lab – II (Network / Database Lab)	100 marks

One from the elective courses for MTCS 2.4:

6 Computational Number Theory
7 Theoretical Computer Science & Automata
8 Data warehousing and data mining
9 Compiler design
10 Pattern recognition

One from the elective courses for MTCS 2.5:

11 Advanced Software Engineering
12 Optimization technique
13 Distributed Data Base systems
14 Financial Information System
15 Formal Methods

3rd semester

MTCS 3.1	Intelligent Systems	(40+60) marks
MTCS 3.2	Cryptography and network security	(40+60) marks
MTCS 3.3	Elective – 4	(40+60) marks
MTCS 3.4	Elective – 5	(40+60) marks
MTCS 3.5	Lab – III (Open Source Software lab)	100 marks
MTCS 3.6	Project synopsis and comprehensive viva voce	100 marks

One from the elective courses for MTCS 3.3

16 Mobile Computing
17 Service Oriented Computing and Web technology
18 Agent Based Computing
19 Electronic Commerce
20 Software Project Management

One from the elective courses for MTCS 3.4

21 Soft Computing
22 Digital Image Processing
23 Parallel Computing
24 Bio-informatics
25 Social Network

4th semester

MTCS 4.1 Project work/Dissertation and Comprehensive Viva voce 300 marks

Note:

(i) The Department will announce the list of electives to be offered in a particular semester depending on the availability of resources and the students must have to choose from within the list only.

(ii) A student has to decide on the topic of his/her project in the 3rd semester itself and must start his/her work in the form of literature survey and exposure to the technology/methodology to be used for the purpose. At the end of the 3rd semester the student has to submit a detail synopsis of the project and appear in a viva voce for evaluation. The same project has to be continued in the 4th semester.

MTCS 1.1 Design and Analysis of Algorithms

UNIT-1

Review of Data Structures: Stack, Queue, Linked lists, binary tree and graph, Time complexity and space complexity-notations, Omega notation and Theta notation, Big O notation.

Divide and conquer: Binary search, Quick sort, Merge sort, Strassen's Matrix Multiplication.

UNIT-2

Greedy method: Job sequencing with dead lines, Minimum cost spanning trees, Single source shortest path problem, All pairs shortest path problem

Dynamic Programming: General method, applications-Matrix chain multiplication, Optimal binary search trees.

UNIT-3

Backtracking and Branch and Bound: General method (Backtracking), N-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles, General method (Branch and Bound), Traveling sales person problem, Branch and Bound solution.

UNIT-4

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

Books:

1. Computer Algorithms/C++, E.Horowitz, S.Sahani and S.Rajasekharan, Galgotia Publishers Pvt. Limited.
2. Introduction to Algorithms, 2nd Edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, PHI Pvt.Ltd./ Pearson Education.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson Education.
4. Algorithms, Robert Sedgewick, Addison- Wesley

MTCS 1.2 Advanced Computer Architecture

UNIT-1:

Basic Computer Organization: system modeling, design levels, gate level, register level, processor level
Control Design: Instruction sequencing, instruction interpretation, hardwired control, micro-programmed control, control memory, address sequencing, micro program, microinstruction format, vertical micro

instruction, horizontal micro instruction, design of control unit, bit slice processor, nano-programmed computer

UNIT-2:

Memory Organization, Memory hierarchy, memory device characteristics, main memory, RAM, Serial Access memory, Virtual memory, Associative memory, interleaved memory, cache memory, mapping in the cache

UNIT-3:

Parallel Processing: Types of parallel processing, performance evaluation, Bern Stein Conditions, Parallel algorithm implementation, Pipeline, Arithmetic Pipeline, Instruction Pipeline, Pipeline Control, Vector Processing, Array Processors

UNIT-4:

Multiprocessors, Multiprocessor Architecture, Fault Tolerant Computers
Case studies of different architectures like Pentium, SPARC, VAX

Books:

1. Computer Architecture and Organization by J. P. Hayes (McGraw Hill)
2. Computer System Architecture by Morris Mano (PHI)

MTCS 1.3 Object-Oriented Data Structures

UNIT-1

Abstract Data Types, Stack, Queue, Circular queue, deque, application of these data structures, recursion, infix, postfix, prefix representations and their conversion, priority queues.

UNIT-2

Singly linked list, linked stacks and queue, doubly linked lists, operations on the list structures, application of linked lists.

UNIT-3

Binary tree, tree traversals, binary search tree, applications of binary tree, Representation of Graph, adjacency matrix, adjacency list, multi list, graph traversals, depth first, breadth first.

UNIT-4

AVL- tree, Top-Down splay trees, Red-Black trees, bottom-up insertion, top-down Red-Black trees, top-down deletion, AA-trees.

Books:

1. Data Structures and Algorithms in Java, Goodrich and Tamassia, John Wiley and Sons
2. Object-Oriented Data Structures using Java, Nell Dale, Daniel T. Joyce and Chip Weems
3. The Java Programming Language, Arnold, Gosling, and Holmes, Addison-Wesley

MTCS 1.4 Discrete Mathematical Structures

UNIT-1

The Foundations: Logic and Proof and Functions
Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof, Functions, Proof Strategy, Mathematical Induction, Recursive Definition and Structural Induction

UNIT-2

Counting
The Basic of Counting, The Pigeonhole Principle, Permutation and Combinations, Binomial Coefficients,
Advanced Counting Techniques
Recurrence Relations, Solving Recurrence Relations, Divide-and-Conquer Algorithms, Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

UNIT-3

Graphs
Introduction to Graphs, Graph Terminology, Representing Graph and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems,
Trees
Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees

UNIT-4

Boolean Algebra
Boolean Functions, Representing Boolean Functions, Lattice as Partially Ordered Sets, Boolean Algebra, Finite State Machines.

Books:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen. TMH
2. Discrete Mathematics for Computer Scientist and Mathematicians by Joe L. Mott, Abraham Kandel and Theodore P. Baker. PHI
3. Discrete Mathematical Structures with Applications to Computer Science by J. P. Tremblay and R. Manohar. McGraw-Hill Book Company.
4. The art of Computer Programming (Volume – 1) by Knuth. Narossa publications.

MTCS 1.5 (Elective 1)

Only One from the following courses

1. VLSI design
2. Object Oriented Systems
3. Principles of Programming Languages
4. Embedded systems
5. Computer Graphics

MTCS 1.6 : Lab - I (Object Oriented Systems Lab)

1.VLSI Design

UNIT-I

Introduction to VLSI design methodologies, Historical perspective, full custom, semi custom, and programmable design, VLSI design flow, design hierarchy, design styles, floor planning, timing analysis, front end and back end design, MOS Transistor, Review of structure and operation of MOSFET (n-MOS Enhancement type), MOSFET V-I Characteristics.

UNIT-II

Introduction to low-level design,
MOS structure: Band diagram, NMOS, PMOS, CMOS digital logic gates Inverters.
Digital design: static logic, switch logic, dynamic logic design style.
Analog design: Differential amplifiers, current mirrors, design of operational amplifiers.

UNIT-III

Introduction to high-level design, hardware description language
VHDL: Behavioral modeling, sequential processing, data types, subprogram & packages, attributes, configurations.
Synthesis: HDL (RTL description), constraints, technology library, synthesis: translation, Boolean optimization, flattening, factoring, mapping gates.
High-level design flow.

UNIT-IV

Fabrication process, wafer preparation, oxidation, photo and ion lithography, etching, diffusion, ion implantation, metalization.
Layout design: stick diagrams and layout of digital circuits

Books:

1. VLSI design and techniques, by Puknell & Eshraghian, PHI
2. VHDL by Douglas Perry, TMH Pub.
3. VLSI Technology, by S.M. Size, McGraw Hill
4. VLSI Design Techniques for Analog and Digital circuit- Geiger et. al., McGraw Hill

2.Object Oriented Systems

UNIT-1

Object Orientation as a programming paradigm, class structure, constructors, destructors, operator overloading, types of inheritance, polymorphism, virtual functions, generic programming with templates, exception handling.

UNIT-2

Object Oriented modeling concepts, Object model, dynamic model & functional model
Object Oriented modeling using UML, Structural modeling: relationships, class diagrams, interfaces, types and roles, packages, object diagrams.

UNIT-3

Behavioral modeling: Use cases, use case diagrams, interaction diagrams, activity diagrams, events & signals, state chart diagrams. Architectural modeling: Components, deployment, collaborations, patterns & frameworks, component diagrams, deployment diagrams.

UNIT-4

Distributed objects, communication between distributed objects, distributed object model, RMI, RPC, events and notifications, Jini distributed event notification, CORBA.

BOOKS:

1. Object-Oriented programming with ANSI & Turbo C++, A.N. Kamthane, Pearson
2. The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.
3. Fundamentals of Object Oriented Design in UML, Meilir Page-Jones, Pearson
4. Distributed Systems Concepts and Design, G. Coulouris, J. Dollimore, T. Kindberg, Pearson.

3. Principles of Programming Languages

UNIT-1

Programming paradigms, Language description: syntactic structure, abstract syntax trees, context-free grammars, semantic methods, synthesized attributes, attribute grammars, static types and Lambda calculus

UNIT-2

Imperative programming: structured programming, syntax-directed control flow, programming with invariants, proof rules for partial correctness, data representation, procedure activation, parameter passing methods, activation records.

UNIT-3

Functional programming: expression, types, function declaration, lexical scope, functional programming with Lists, structure of Lists, List manipulation, storage allocation for Lists.

UNIT-4

Introduction to logic programming: computing with relations, programming techniques in PROLOG, control s in PROLOG.
Introduction to concurrent programming: implicit synchronization, concurrency as interleaving, liveness properties, access to shared data, Concurrency in ADA.

Books:

1. Programming Languages: concepts and constructs, Ravi Sethi, Pearson
2. Programming Languages: Design and implementation, T.W. Pratt, M.V. Zelkowitz, PHI,
3. Programming Languages and paradigms, D.A. Wait, PHI

4. Embedded Systems

UNIT-1

Introduction to embedded system, processor in the system, software embedded into system, embedded system on chip.
Devices and device drivers: I/O devices, timer and counting devices, I/O buses, ISA, PCI, parallel and serial port device drivers, interrupt servicing mechanisms.

UNIT-2

Software and programming concept: processor and memory selection for embedded systems, embedded programming in C++, multiple processes and application, sharing data by multiple tasks and routines, inter process communication.

UNIT-3

Operating system services, I/O subsystems, network operating systems, real-time and embedded system operating systems, need for a well tested and debugged Real-Time Operating System (RTOS).

UNIT-4

Hardware and software co-design: embedded system design and co-design issues, design cycle in the development phase for an embedded system, use of software tools.
Case study of an embedded system for a smart card.

Books:

1. Embedded system architecture, programming and design, raj Kamal, TMH
2. Hardware and software co-design of embedded systems, Ralf Niemann, Kluwer academic.
3. Embedded real-time systems programming, S.V. Iyer and Pankaj Gupta, TMH

5.Computer Graphics

UNIT-1
Overview of Graphics System: Video Display Devices, Raster-scan System, Random-scan Systems, Graphics Monitors and Workstations, Input Devices, Hard-copy Devices and Graphics Software
Output Primitives: Points and Line, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse-Generating Algorithms, Other Curves, Pixel Addressing and Object Geometry and Filled-Area Primitives

UNIT-2
Two-Dimensional Geometric Transformations: Basic Transformations, Matrix Representations and Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformation between Coordinate Systems, Affine Transformations, Transformation Functions, Raster Methods for Transformations
Two-Dimensional Viewing: The Viewing Pipeline, Viewing Coordinate reference Frame, Window-to-Viewport Coordinate Transformation, Two-Dimensional Viewing Functions, Clipping operations, Point Clipping, Line Clipping, Polygon Clipping, Curve Clipping, Text Clipping and Exterior Clipping

UNIT-3
Three-Dimensional Geometric and Modeling Transformations: Translation, Rotation, Scaling, Composite Transformations, Three-Dimensional Transformation Functions, Modeling and Coordinate Transformations
Three-Dimensional Viewing: Viewing Pipeline, Viewing Coordinates, Projections, View Volumes and General Projection Transformations and Clipping

UNIT-4
Illumination Models and Surface-Rendering Methods: Light Sources, Basic Illumination Models, Displaying Light Intensities, Halftone Patterns and Dithering Techniques, Polygon-Rendering Methods, Ray-Tracing Methods, Radiosity Lighting Model and Environment Mapping
Color Models and Color Applications: Properties of Light, Standard Primaries and the Chromaticity diagram, Intuitive Color Concepts, RGB Color Model, YIQ Color Model, CMY Color Model, HSV Color Model
Computer Animation: Design of Animation Sequence, General Computer-Animation Functions, Raster Animations, Computer-Animation Languages, Key-Frame Systems and Motion Specifications

Books:

1. Computer Graphics by Donald Hearn and M. Pauline Baker. Prentice-Hall of India – 2nd Edition.
2. Computer Graphics – principles & practice by Foley, Van Dam, Feiner and Hughes. Pearson Education.
3. Computer Graphics, Schaum's Outline series.
4. Mathematical Elements for Computer Graphics by D. F. Rogers & J. A. Adams. TMH Publications
5. Computer Graphics by Newmann and Sproull, TMH Publications.

MTCS 2.1 Computer Networks

Unit – 1

OSI, Reference Models, Protocols, Theoretical Basics of Data Communication Signals: Analog and Digital, Periodic and Aperiodic Signals, Analog Signals, Time and Frequency Domains, Error Detection and Correction: Types of Errors, Detection, Vertical Redundancy Check (VRC), Longitudinal Redundancy Check (LRC), Cyclic Redundancy Check (CRC), Checksum, Error Correction, Network Topology.

Unit – 2

Network layer design issues, Routing Algorithm: The Optimality Principle, Shortest Path Routing, Flooding, Flow-Based Routing, Hierarchical Routing, Routing for Mobile Hosts, broadcast Routing, Multicast Routing, Congestion Control Algorithm : Congestion Prevention, Policies, Congestion Control in Virtual Circuit Subnets, Choke Packets, Jitter Control, Congestion Control for Multicasting.

Unit – 3

Internetworking: Connectionless Internetworking, Tunneling, Internetwork Routing, Fragmentation, Firewalls, The Network Layer in the Internet: IP Protocol, IP Addresses, Subnets, TCP/IP, Practical Suit: TCP/IP Protocol Suite, Addressing, IP Versions, TCP Service, TCP features, Segment, TCP Connection, Flow Control, Error Control, Congestion Control.

Unit – 4

ATM Networks: Cell Formats, Connection Setup, Routing and Switching, Service Categories, Quality of Service, Traffic Shaping and Policing, Congestion Control, ATM LANs, IP over ATM: ATM Wans, Carrying a Datagram in Cells, Routing the Cells, ATMARP, LIS, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.

Books:

1. Data Communication and Networking by Behrouz A. Forouzan, 2nd edn., TMH.
2. TCP/IP Protocol Suite by Behrouz A. Forouzan, 3rd Edition, TMH.
3. Computer Networks by Andrew S.Tanenbaum, 3rd Edition PHI Publication.

MTCS 2.2 Advanced Operating Systems

Unit – 1

Operating system services, process management, process scheduling, inter-process communication, CPU scheduling, process synchronization, critical-section (producer-consumer problem), semaphores.

Unit – 2

Deadlocks, deadlock characterization, methods for handling deadlocks: Deadlock prevention, avoidance, detection and recovery, memory management, virtual memory, page replacement techniques, file allocation methods, free-space management, disk scheduling.

Unit 3

Motivations for distributed systems, System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Networks, Communication Primitives, Inherent Limitations of a Distributed System, naming and transparency, design issues, distributed file systems, distributed coordination: event ordering, mutual exclusion, concurrency control, deadlock handling, election algorithms.

Unit 4

File system Architecture, Mechanisms for Building Distributed File Systems, Design Issues, Naming and Name Resolution, Caches on Disk or Main Memory, Writing Policy, Cache Consistency,

Distributed Scheduling : Issues in Load Distributing, Components of a Load Distributing Algorithm, Stability, Load Distributing Algorithms, Performance Comparison, Selecting a Suitable Load Sharing Algorithm, Requirements for Load Distributing, Load Sharing Policies: Case Studies, Task Migration, Issues in Task Migration.

Books:

1. Operating system concepts (5^{th} eds), Silberschatz, & Galvin (John Wiley)
2. Systems programming & operating systems, D.M. Dhamdhere (TMH)
3. Distributed Operating System: Concepts and Design, P. K. Sinha, (PHI)
4. Distributed Systems: Principles and Paradigms, A. Tanenbaum & M. V. Steen. (PHI)

MTCS 2.3 Advanced Database Systems

Unit 1

Overview of database concepts, database models, database design, process of normalization, database tuning, Query processing, Query optimization: cost-based and heuristic optimization, relational algebra equivalences and query transformation

Unit 2

Transaction management, ACID properties, serializability, recovery techniques, log-based, shadow paging and check pointing, Concurrency control, lock-based and time-stamp based protocols.

Unit 3

Distributed database concepts, data fragmentation, transparency, distributed DBMS architectures,top-down and bottom-up distributed database design, distributed query processing, distributed transaction management, distributed concurrency control, distributed deadlock and recovery.

Unit 4

Parallel databases, architectures, I/O parallelism, parallel query evaluation, inter query and intra query parallelism, parallelizing individual operations

Concept of Data warehousing, architecture, multidimensional data model, OLAP operations, XML database, DTD, storage of XML data, Preliminary concepts on mobile databases, multimedia databases

Books:

1. Database Management systems (2^{nd} eds) by R. Ramakrishnan & J. Gehrke (McGraw Hill)

2. Database system concepts (4^{th} eds) by Silberschatz, Korth & Sudarshan (McGraw Hill)

3. Data warehousing, data mining & OLAP by A. Berson & S.J. Smith (TMH)

MTCS 2.4 (Elective – 2)

Only One from the following courses

6 Computational Number Theory
7 Theoretical Computer Science & Automata
8 Data warehousing and data mining
9 Compiler design
10 Pattern recognition

MTCS 2.5(Elective – 3)

Only One from the following courses

11 Advanced Software Engineering
12 Optimization technique
13 Distributed Data Base systems
14 Financial Information System
15 Formal Methods

MTCS 2.4 (Elective – 2)

6. Computational Number Theory

Unit 1

Prime numbers, unique factorization, Congruences, Fields and Rings Euclid's Algorithm for the Greatest Common Divisor, Distribution of Prime Numbers

Unit 2

Residue Number Systems (RNS), Implementation of the Basic Arithmetic Operations Using RNS, Chinese Remainder Theorem, Parallel Arithmetic Based on RNS

Unit 3

Some Basic Facts from Complexity Theory, simple crypto systems, public key cryptography, RSA Cryptosystem - what appears to make it secure, Fast Implementation of RSA - Fast Algorithms for Modular Exponentiation, A Survey of the Most Recent Results in Cryptanalysis, Other Cryptosystems Based on Number Theoretic, Considerations - Diffie-Hellman, Digital Signature Standard, Merkle-Hellman.

Unit 4

Network Security, Secrete Key algorithm, public key algorithms, Digital signature algorithms, Social Issue

Books:

1. A course in number theory and cryptography – Neal Koblitz, Springer
2. B. Schneier,"Applied Cryptography", John Wiley & Sons, Inc.
3. Algorithms- Robert Sedgewick Addition Wesley.

7. Theoretical Computer Science & Automata

Unit - 1

Theory of Automata: Definition of an automaton, Description of a finite automation, transition system, properties of transition functions, acceptability of a string by a finite automation, nondeterministic finite state machines, The equivalence of DFA and NDFA, Mealy and Moore models, minimization of finite automata.

Unit – 2

Formal Languages: Basic definitions and examples, Chomsky classification of languages, languages and their relation, recursive and recursively enumerable sets, operations on languages, languages, languages and automata.
Regular Sets and Regular Grammars: Regular expressions, finite automata and regular expressions, pumping lemma for regular sets, closure properties of regular sets, regular sets and regular grammars.

Unit – 3

Context-free Languages: Context-free languages and derivation trees, ambiguity in context-free grammars, simplification of context-free grammars, normal forms for context-free grammars, pumping lemma for context-free languages, decision algorithms for context-free languages.

Pushdown Automata: Basic definitions, acceptance by pda, pushdown automata and context-free languages, parsing and pushdown automata.

Unit – 4

Turing Machines and Linear Bounded Automata: Turing machine model, representation of Turing machines, languages acceptability by Turing machines, design of Turing machines, universal Turing machines and other modifications, the model of linear bounded automaton, Turing machines and Type 0 grammars, linear bounded automata and languages, halting problem of Turing machines, NP-Completeness.

Book:

1. Theory of Computer Science (Automata, Languages and Computation) by K.L.Mishra and N.Chandrasekaran. 2nd edition PHI publications.

8. Data Warehousing and Data Mining

Unit 1 Concept of Data warehousing, 3-tier architecture, multidimensional data model, schemas for multidimensional databases, OLAP, ROLAP, MOLAP and HOLAP operations, data mining: characterization & discrimination, association analysis, classification and prediction, cluster analysis.

Unit 2 Concept hierarchies, interestingness measures, data mining query language, data generalization and summarization-based characterization, Mining association rules, mining single-dimensional Boolean association rules, Apriori algorithm for finding frequent itemsets, iceberg queries, mining multilevel association rules, mining distance-based association rules, correlation analysis.

Unit 3 Classification and prediction: decision tree based classification, Bayesian classification, classification by back propagation, k-nearest neighbor classifier, prediction based on linear and multiple regression, Cluster analysis: categorization of clustering methods, partitioning methods, k-Means and k-Medoids, hierarchical methods, Density-based clustering (DBSCAN)

Unit 4 Mining spatial databases, mining multimedia databases, mining text databases, mining WWW, classification of web documents, web usage mining, data mining applications in e-commerce and intrusion detection.

Books:

1. Data mining; Concepts and techniques by J. Han and M. Kamber (Morgan Kaufmann)
2. Data Mining by A.K. Pujari (University press)

9. Compiler Design

Unit-1 Introduction to compilers, compilers and Interpreters, Phases of Compiler: Lexical analysis, syntax analysis, Intermediate code generation, code optimization, object code generation, symbol table management, error handling, multi-pass compilers, cross compiler, Lexical analysis: role of lexical analyzer, design of lexical analyzer, finite state machine, transition diagram, regular expression, conversion of NDFSM to DFSM, regular expression to FSM, Compiler Tools like yacc, lex.

Unit-2 Syntax Analysis: syntactic specification of programming language, context free grammar, derivation of parser tree, basic parsing techniques, types of parser, shift-reduce parser, operator grammar, operator precedence grammar, operator precedence parsing, LL(1) grammar, predictive parser

Unit-3 Intermediate code generation: syntax directed translation schemes, implementation of SDTS, intermediate codes: polish notation, abstract syntax tree, three address codes, quadruples, triples, indirect triples, translation of assignment statement, Boolean expression, declarative statement.
Symbol table and error handling: data structure of symbol table, types of errors, lexical and semantic errors.

Unit-4 Code optimization: sources of code optimization, loop optimization, identification of loops, DAG representation, Object code generation: problem of code generation, simple code generation, register allocation and object code generation, peep hole optimization, parallel compilers

Books:

1. Principles of compiler Design by Aho & Ullman (Narosa)
2. Compiler design : Theory and Practice by Burrett (McGraw Hill)

10. Pattern Recognition

UNIT - 1

Introduction to Pattern recognition, pattern recognition systems, the design cycle, learning and adaptation.

Bayesian Decision Theory : Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, and decision surfaces.

UNIT - 2

Normal density: Univariate and multivariate density, discrete features, compound Bayesian decision theory.

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT- 3

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Data description and clustering – similarity measures, criteria function for clustering.

UNIT-4

Pattern recognition using discrete hidden Markov models: Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs, Continuous hidden Markov models : Continuous observation densities, multiple mixtures per state.

Books:

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley
2. Pattern Recognition and Image Analysis – Earl Gose, Richard John Baugh et al, PHI 2004

MTCS 2.5(Elective – 3)

11. Advanced Software Engineering

Unit 1

A generic view of Software Engineering, software process models: waterfall, prototyping, RAD, spiral models, Software project management, software measurement, function-oriented & size-oriented metrics, metrics for software quality.

Unit 2

Software specifications & requirements analysis, analysis modeling: data, functional and behavioral modeling, Architectural design, Software testing, Object-oriented testing, system integration.

Unit 3

Software maintenance, Software risk analysis and management, Software quality assurance, software reliability, software configuration management, SCM process, Re-engineering, BPR, software re-engineering, reverse & forward engineering.

Unit 4

Component-based software engineering, component-based development, client-server software engineering, Web engineering: process, framework and design issues, Computer-Aided software engineering.

Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGrawHill International Edition.
2. Software Engineering- Sommerville , 7th edition, Pearson education.
3. Software Engineering Fundamentals – A. Behforooz & F. J. Hudson, Oxford Univ.Press.

12. Optimization Technique

Unit-I
Introduction: Overview of simplex method, integer programming, assignment model, transportation model

Unit-II
Queuing theory: (M / M / 1) : (∞ / FCFS) Model, (M / M / 1) : (∞ / SIRO) Model,
(M / M / 1) : (N / FCFS) Model, PERT-CPM

Unit-III
Game Theory: Solution of games with saddle point(s), rectangular games with saddle point(s), minimax-maxmin principle for mixed strategy games, equivalence of rectangular games and linear programming, fundamental theorem, solution of MxM games model by linear programming, 2/2 games without saddle point(s), principle of dominance to reduce the size of games, graphical method for 2xN and Nx2 games, matrix method for MxN games without saddle point(s), algebraic method of solution of general games.

Unit-IV
Goal Programming Model: Concept of Goal programming, Goal programming as an extension of linear programming, formulation of Goal programming model, methodology of solution procedure, special method of Goal programming.

Books:

1. Operation Research by S.D.Sharma, 12th edition. Keder Nath Ram Nath and Co, Meerut.
2. Introduction to Operation Research by Hillier and Liberman, 7th edition. Tata-McGraw-Hill publication.

13. Distributed Data Base Systems

Unit 1

Distributed Data processing, issues and challenges in distributed data base systems, types of fragmentation, levels of distributed transparency, architectural models for distributed DBMS: client-server, peer-to-peer and multi database.

Unit 2

Distributed data base design, design issues and strategies, fragmentation and allocation problems
Distributed query processing: characterization of query processors, query decomposition, data localization, optimization of distributed queries.

Unit 3

Distributed transaction management, ACID property, types of transactions: flat, nested & workflows, Distributed concurrency control, lock-based concurrency control: centralized 2PL, primary copy 2PL, distributed 2PL, timestamp- based concurrency control, Basic, Conservative and multiversion TO algorithm.

Unit 4

Distributed Deadlock management, prevention, avoidance, detection and resolution, Reliability concepts and measures in distributed database systems, failures and fault tolerance, local and distributed reliability protocols, dealing with site failures and network partitioning

Books:

1. Principles of Distributed Database Systems – M.T. Ozsu & P. Valduriez, 2nd edition, Pearson education.
2. Distributed Databases Principles and Systems – S. Ceri, G. Pelagatti, McGraw-Hill.

14. Financial Information Systems

Unit-1

Business finance an introduction, finance function of an enterprise and its components, scope of finance function, sources of finance – internal sources of finance and its components, external sources of finance and its components

Unit-2

Analysis and interpretation of financial statements, types of analysis of financial statements, ratio analysis, comparative statements, common size statements, limitations of ratio analysis.

Unit-3

Concept of working capital, financing working capital, fund flow and cash flow statement and working capital analysis.

Unit-4

Financial reporting: concept, objectives, benefits of financial reporting. Specific issues in corporate reporting. Segment reporting, social reporting and interim reporting. Improving financial reporting.

15.Formal Methods

Unit 1

Introduction to formal methods, need for formal specification, developing formal specification of systems, use of formal methods in software engineering, brief outline of CSP and Z formal languages.

Unit 2

RAISE formal Specification Language: type, value and axiom declaration, built-in types, products, functions: total and partial functions, function expressions: explicit, predicative, implicit definitions, Sets, set type and value expressions, Lists: list type and value expressions.

Unit 3

Maps: map type and value expressions, Subtypes, Variants: constant and record constructors, destructors, reconstructors, Case expressions, Let expressions, variables and sequencing, channels and communication, algebraic definition of processes, parameterized schemes

Unit 4

Duration calculus: real-time systems, overview of duration calculus, design of safety critical and real-time systems using DC, extended DC, mean value DC, probabilistic DC.

Books:

1. The RAISE specification language, The RAISE specification group, Prentice Hall International (UK)
2. Z An introduction to formal methods, Antoni Diller, Wiley
3. Formal methods for open object-based distributed systems, B. Jacobs, A. Rensink, Kluwer Academic pub.
4. UNU/IIST technical reports.

MTCS 2.6 Lab – II (Network / Database Lab)

MTCS 3.1:Intelligent Systems

UNIT - 1:

Characteristics of intelligent systems, approaches to building intelligent systems, intelligent agents, agent behavior.
Solving problems by searching, uninformed search strategies: BFS, DFS, searching with partial information, informed search, heuristic search strategies: Hill climbing, A*.

UNIT - 2:

Knowledge representation: first-order logic, actions, situations and events, semantic networks.
Planning: language of planning problems, planning with state-space search: forward and backward state-space search, partial-order planning.

UNIT - 3:

Acting under uncertainty, prior probability, conditional probability, application of Bayes' rule, Probabilistic reasoning, Bayesian networks, Dempster-Shafer theory, Use of fuzzy logic in representing vagueness
Neural networks, network structures, single layer and multi layer feed-forward neural networks, Back propagation training.

UNIT - 4:

Distributed Artificial Intelligence, Contract-net model

AI problem-solving using PROLOG, representation of facts, rules and queries, lists and recursions, unification, backtracking.

Books:

1. Artificial Intelligence, A Modern Approach (2^{nd} edn.) – S. Russell & P. Norvig, Pearson Education Publications
2. Artificial Intelligence – E. Rich & Knight, TMH
3. Artificial Intelligence and Intelligent systems – N.P. Padhy, Oxford Univ. Press.

MTCS 3.2 Cryptography and Network Security

UNIT - 1:

Security Attacks, Security Services, Security Mechanisms, a model for network security, Cryptography, classical encryption techniques: symmetric cipher, substitution and transposition techniques, steganography.

UNIT - 2:

Block ciphers, DES, block cipher design principles, AES cipher, multiple encryption, double and triple DES, Blowfish, placement of encryption functions, traffic confidentiality, key distribution

UNIT - 3:

Public-Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes (MACs), Hash Functions, Secure Hash Algorithm (SHA)

UNIT - 4:

Digital Signatures and Authentication: Digital Signatures, Authentication Protocols, Digital Signature Standard, PKI and IPSec, Web Security issues, SSL, Secure Electronic Transaction, Firewalls, Intrusion detection systems (IDS)

BOOKS:

1. Cryptography & Network Security - William Stallings, PHI
2. Security in Computing- C.P. Pfleeger & S.L. Pfleeger, Pearson
3. C Kaufman, R Pen maan, M Speciner, "Network security" Pearson
4. Introduction to Computer Security, M. Bishop & S. Venkatramanayya, Pearson

MTCS 3.3 (Elective 4)

Only One from the following courses

16 Mobile Computing
17 Service Oriented Computing and Web technology
18 Agent Based Computing
19 Electronic Commerce
20 Software Project Management

MTCS 3.4 (Elective 5)

Only One from the following courses

21 Soft Computing
22 Digital Image Processing
23 Parallel Computing
24 Bio-informatics
25 Social Network

16. Mobile Computing

UNIT-1:

Introduction to mobile computing, issues and applications, mobile communication architecture, wireless and cellular communication, wireless spectrum and channels, co-channel and interference, modulation, multiplexing, spread spectrum, media access control, SDMA, FDMA, TDMA, CDMA, GSM standard and CDMA standard.

Channel assignment schemes: fixed, dynamic, hybrid, flexible, distributed, centralized, channel borrowing, reassignment, ordering.

UNIT-2

Location management: no update, full update, lazy update, selective update, reporting cell, two tire architecture and hierarchical architecture, regional directory, two location algorithm, time-based, movement-based, distance-based, hybrid updation schemes, hand-off, guard channel assignment.

Analytic mobility model of PCS network, battery power management in portable devices

UNIT-3

Mobile transaction processing system: Mobile commerce, electronic payments and payment models for mobile users, e-tickets, ensuring atomic uses of e-tickets by mobile users.
Broadcasting in mobile environment, types and issues in broadcasting, periodic broadcast, broadcast disk, indexing on air, broadcast on demand, selecting broadcasting items, absolute validity interval, real time broadcasting, broadcasting with dead line, broadcasting with multiple data request.

Unit-4

Effect mobility on protocol stack, application adaptation for mobility, WWW and mobility.

Software engineering for mobile applications: Mobicharts, Use of mobicharts for specification and validation of mobile applications.
Introduction to J2ME, Mobile Application Development using J2ME, Case studies.

BOOKS:

1. Mobile Communication by J. Schiller (Pearson Education)
2. Mobile Computing by Ashoke Talukdar (TMH)
3. Wireless communication and networking by W. Stalling (Pearson Education)
4. Mobile Computing Handbook by Mohammad Ilyas, Imad Mahgoub (Auerbach)

17. Service Oriented Computing and Web Technology (Elective)

UNIT-1
Service oriented computing paradigm: computing with services, its suitability for the evolving open environment, a comparative view of objects, components and services, Service-oriented architecture: service provider, service consumer, service registry, SOA collaboration, service orchestration and service choreography.

UNIT-2
Coordination frameworks for web services: Web services conversational language(WSCL), Web services choreography interface, WS-coordination: coordination service, activation service, registration service, Service management, Notion of grid services

UNIT-3
Building SOC applications: elements of SOC design, steps of the SOC approach, service identification, domain decomposition, subsystem analysis, service allocation, component specification, technology realization mapping,.
Application of SOC to Supply Chain Management, e-procurement, e-Governance.

UNIT-4
Web services architecture, Web services standards, preliminary concepts of different web services technology options: Transport (HTTP, Java Message service), Service Communication protocol (SOAP), Service Description (XML, WSDL, ebXML), accessing web services, Service registry (UDDI), policy, security issues.

Books:

1. Service-Oriented Computing by M.P. Singh & M . N. Huhns (John Wiley & Sons Ltd)
2. Patterns: Service-Oriented Architecture & Web Services, IBM redbooks.

18. Agent Based Computing

UNIT- 1
Introduction to software agents, characteristics of agents, some applications of agents, building agents: situated, proactive and reactive agents, social agents, agent execution cycle, Multi agent systems

UNIT – 2
Agent based system development: system specification, goal specification, architectural design: specifying agent types, specifying agent interactions, protocol and message descriptors, FIPA agents

UNIT – 3
Agents capabilities, agent processes, plans, events, negotiation, collaboration, cooperation among agents, trust in agent based systems, Agent based software engineering

UNIT – 4
Mobile agents, execution environment, applications, security concerns, implementation issues and challenges, examples of some mobile agent based systems

Books:

1. Developing Intelligent Agent Systems by Lin Padgham & M. Winikoff, John Wiley
2. Agent Unlashed by Peter Wayner, AP Professional

19. Electronic Commerce

UNIT- 1
Introduction to e-Commerce, e-Commerce Infrastructure, Business Models and e-Commerce, e-Commerce Strategy, e-Commerce Security and Controls, Legal and Ethical Issues in e-Commerce, global, social, and other Issues in e-Commerce

UNIT – 2
e-commerce applications: e-Procurement, Supply Chain Management (e-SCM), electronic auction models, e-Customer Relation Management (e-CRM), Electronic Payment Systems

UNIT – 3
Mobile commerce: concepts and applications, security issues, mobile payment, authentication infrastructure for mobile users, context-aware services, mobile agent based m-commerce, security issues and countermeasures for mobile agent based m-commerce applications

UNIT – 4
M-payment solutions and fraud management, multi-party micro-payment, secure mobile payment service (SeMoPS), SeMoPS business model, Ad Hoc m-commerce, remote digital signing, key-evolving digital signature for wireless & mobile networks, smart card based protocol for secure and controlled access.

Books:

3. Electronic commerce: A managerial perspective (3rd ed.) by E. Turban, D. King, J. Lee, & D. Viehland, Prentice-Hall.
4. E-commerce (2nd Edition) by Laudon, K.C., and Traver, C.G.. Pearson.
5. Advances in Security and payment methods for Mobile Commerce by Wen-Chen Hu, C. Lee, and W. Kou, IDEA Group publishing

20. Software Project Management

Unit – 1

Overview of conventional software project management, principles of modern software management.

Software economics: Evolution of Software economics, pragmatic software cost estimation, Reducing software product size, improving software processes, improving team effectiveness, improving automation through software environments, achieving required quality.

Life-cycle phases: Engineering and production stages, inception phase, elaboration phase, construction phase transition phase, Artifacts of the process

Unit –2

Model-based software architectures and Process Architecture: management perspective, technical perspective. Workflows of the process: Software process workflows, Iteration workflows. Checkpoints of the process: Major milestones, minor milestones, periodic status assessments.

Iterative process planning: Work breakdown structures, planning guidelines, the cost and schedule estimating process, the iteration planning process, project organizations, evolution of organizations.

Unit – 3

Process automation and Project control: Automation building blocks, the project environment, Project control and process instrumentation: The seven core metrics, management indicators, quality indicators, life-cycle expectations, pragmatic software metrics, metric automation, Tailoring the process: Process discriminate, example: small-scale project versus large-scale project

Unit – 4

Modern project profiles: Continuous integration, early risk resolution, evolutionary requirements, teamwork among stakeholders, top 10 software management principles, software management best practices, Next-generation software economics and Modern process transitions: Next-generation cost models, modern software economics.

Books

Barry Boehm, "Software Project Management", Pearson Education Asia, 1998

21. Soft Computing

UNIT – 1

Introduction to Computational Intelligence Systems.

SUPERVISED NEURAL NETWORKS: Basic concepts of Artificial Neural Networks, Learning Schemes, Multi-layer feed-forward neural networks, Back Propagation Algorithm, Effect of tuning parameters of the back propagation neural network, Selection of various parameters in BPN, Variations of standard back propagation algorithm, Recurrent Neural Networks, Functional Link Neural Nets, Radial Basis Function Neural Nets, Hopfield Nets.

UNIT - 2

UNSUPERVISED NEURAL NETWORKS: Adaptive Resonance Theory: Introduction, ART1, ART2, Kohonen Neural Network: Self-Organizing Feature Map, Learning Vector Quantization.

UNIT – 3

FUZZY THEORY: Fuzzy Set Theory - Fuzzy vs Crisp - Crisp & Fuzzy Sets, Crisp & Fuzzy Relations, Fuzzy Systems - Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, De fuzzification Methods.

UNIT – 4

GENETIC ALGORITHMS: Basic Concepts, Creation of Off springs, Working Principle, Encoding, Fitness Function, Reproduction. Genetic Modeling, Inheritance Operators, Cross Over, Inversion & Deletion, Mutation Operator, Bit-wise Operators, Bit-wise operators in GA, Generational Cycle, Convergence of GA, Applications.

BOOKS

1. S. Rajasekaran, and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, & Genetic Algorithms Synthesis & Applications", PHI.
2. J.S.R. Jang, C.-T. Sun, E. Mizutani**,** "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", PHI, 2004.
3. Simon Haykin, "Neural Networks A Comprehensive Foundation", Pearson Education.
4. H. J. Zimmermann, "Fuzzy Set Theory and its Applications", Allied Publishers Ltd., Kluwer Academic Publishers.
5. B. Yegnanarayana, "Artificial Neural Networks", PHI.
6. A.P. Engelbrecht, "Computational Intelligence An Introduction", John Wiley & Sons Ltd.

22. DIGITAL IMAGE PROCESSING

Unit-1

Image and scene, components of image processing systems, Mathematical preliminaries: Fuzzy sets and properties, mathematical morphology, Discrete cosine and sine transform, Hartley transform, Harr transform, Walsh transform.

Visual preliminaries: Brightness adaptation and contrast, shape detection and recognition, perception of colour, Image formation: Introduction, Geometric model, Photometric model, Digitization: Introduction, sampling, Quantization, visual detail in image, Digital image, elements of digital geometry.

Unit-2

Image Enhancement: Introduction, Contrast Intensification, Smoothing, Image sharpening, Image Restoration: Introduction, MMSE restoration, LSE restoration, Restoration by homomorphic filtering, Image compression: Introduction, Error criteria, Lossy and Loss-less compression, Image Registration: Introduction, Geometric transformation, Multi-valued image processing: Processing of colour images.

Unit-3

Image segmentation: Introduction, Region extraction, Pixel based approach, Multilevel thresholding, local thresholding, Edge and line detection: Introduction, Edge detection, Pattern fitting approach, Line detection.

Unit-4

Feature Extraction: Introduction, Representation, Topological attributes, Image Recognition: Introduction, Deterministic methods, Clustering, Statistical classification.

Books:

1. Digital Image Processing & Analysis – B. Chanda & D. DuttaMajumdar, PHI
2. Fundamentals of Digital Image Processing – Anil K Jain, PHI
3. Digital Image Processing, Rafel C. Gonzalez & Richard E. Woods, Pearson

23. Parallel Computing

UNIT - 1
Parallel Computers, Shared Memory Multiprocessor System, Message-Passing Multi-computer, Distributed Shared Memory, MIMD and SIMD Classifications, Architectural Features of Message-Passing, Programming Options, Process Creation, Message-Passing Routines, Evaluating Parallel Programs.

UNIT - 2
Pipelined Computations: Pipeline Technique, Computing Platform for Pipelined Applications, Pipeline Program Examples, Synchronous Computations :Synchronization, Synchronized Computations, Synchronous Iteration Programs
Load Balancing, Dynamic Load Balancing, Distributed Termination Detection Algorithms

UNIT – 3
Programming With Shared Memory: Shared Memory Multiprocessors, Constructs for Specifying Parallelism, Creating Concurrent Processes, Threads, Sharing Data
Sorting Algorithms: Potential Speedup, Rank Sort, Compare-and-Exchange Sorting Algorithms**(** Bubble Sort and Odd-Even Transposition Sort, Two-Dimensional Sorting, Mergesort, Quicksort, Quicksort on a Hypercube, Odd-Even Mergesort).

UNIT – 4
Numerical Algorithms: Matrix operations, Implementing Matrix Multiplication, Solving a System of Linear Equations, Iterative Methods.
Searching and Optimization: Applications and Techniques, Branch-and-Bound Search, Genetic Algorithms, Evolution and Genetic Algorithms, (Sequential Genetic Algorithms & Parallel Genetic Algorithms) Successive Refinement, Hill Climbing.

Book:

Parallel Programming - Allen Wilkinson, Pearson Education Asia, 2002.

24. Bio- informatics

Unit – 1
Introduction to Bioinformatics: Biological data in digital symbol sequences, geonomes-diversity size, and structure, proteins and proteomes, information content of biological sequences, prediction of molecular function and structure.
Bayesian modeling, graphical models, Probabilistic modeling and inference, sequence models

Unit – 2

Machine learning : Dynamic programming, gradient descent, EM/GEM algorithms, markov-chain, monte-carlo methods, simulated annealing, Evolutionary and genetic algorithms, Learning algorithms,

Neural networks: Back propagation, Neural networks: Applications, Sequence encoding and output interpretation, sequence correlations and neural networks,

prediction of protein secondary structure, application for DNA and RNA nucleotide sequences.

Unit – 3

Hidden markov models: Introduction, prior information and initialization, Likelihood and basic algorithms, learning algorithms, applications of HMMS: general aspects, Hidden markov models: applications, Protein applications , DNA and RNA applications, advantages and limitations of HMMs.

Unit – 4

Probabilistic models of evolution: phylogenetic trees

Introduction to probabilistic models of evolution, substitution probabilities and evolutionary rates, rates of evolution, data likelihood, optimal trees and learning, parsimony, extensions.

Applications of formal grammars to biological sequences, prior information and initialization, likelihood, learning algorithms.

Micro arrays and Gene Expression: Introduction to micro array data, probabilistic modeling of array data, clustering, gene regulation.

Books

1. T. K. Attwood & D. J. Parry-Smith, "Introduction to Bioinformatics", Pearson Education Asia, Third Indian reprint, 2002.
2. Pierre Baldi and Soren Brunak, "Bioinformatics; The machine Learning Approach", Affilliated East-West Press, 2003
3. Samir Nanavati, Michael Thieme, & Raj Nanavati, " Bioinformatics", Wiley-Dreamtech India Pvt. Ltd., 2002.

25. SOCIAL NETWORKS

Unit-I

Social network analysis in the behavioral sciences: The social network perspective, Historical and Theoretical foundations, Fundamental concepts in network analysis, distinctive features, Social network data: what are social network data, Boundary specification and sampling, types of network, network data, measurement and collection, Data sets.

Unit-II

Notation for social network data: graph theoretic notations, sociometric notation, signed graph and diagraphs, valued graphs and valued diagraphs, multi-graphs, hyper-graph, relation, matrices, properties of relation.

Unit-III

Basic Properties of Networks and Actors, Centrality and Power, Cliques and Subgroups.

UNIT-IV

Network position and Social roles, Structural equivalence, Automerphic equivalence and Regular equivalence.

Books:

1. S.Wasserman & K.Faust, Social Network Analysis: methods and applications, Cambridge University Press, (1999).
2. R.A.Hanneman, Introduction to Social Network Methods, (Available in Internet for download)