## TEACHING SCHEME OF M.TECH (COMPUTER ENGINEERING)

**SEMESTER- I**

| SUBJECT CODE | SUBJECT NAME | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| 1MCS01 | Advanced Data Structures | 40 | 60 | 100 |
| 1MCS02 | Software System Design | 40 | 60 | 100 |
| 1MPS03 | Critical System Design | 40 | 60 | 100 |
| 1MPS04 | Information System Security | 40 | 60 | 100 |
| 1MPS05 | Software System Lab | 60 | 40 | 100 |
| | **GRANDTOTAL** | 220 | 280 | 500 |

**SEMESTER- II**

| SUBJECT CODE | SUBJECT NAME | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| 2MCS01 | Advanced Database Management Systems | 40 | 60 | 100 |
| 2MCS02 | Design of Embedded Systems | 40 | 60 | 100 |
| 2MCS03 | Distributed Algorithms | 40 | 60 | 100 |
| 2MCS04 | Elective-I(Any One )<br>Advanced Computer Graphics<br>High-Performance Scientific Computing<br>Advanced Real-Time System Design | 40 | 60 | 100 |
| 2MCS05 | Advanced Database Lab | 60 | 40 | 100 |
| | **GRANDTOTAL** | 220 | 280 | 500 |

**SEMESTER- III**

| SUBJECT CODE | SUBJECT NAME | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| 3MCS01 | Parallel and Distributed Computing | 40 | 60 | 100 |
| 3MCS02 | Elective<br>Reconfigurable Computing<br>Artificial Intelligence & Fuzzy Systems<br>Network System Design | 40 | 60 | 100 |

Syllabus

| | | | | |
|---|---|---|---|---|
| 3MCS03 | Seminar | 40 | 60 | 100 |
| 3MCS04 | Dissertation Part-I | | | 200 |
| | GRANDTOTAL | 120 | 180 | 500 |

**SEMESTER- IV**

| SUBJECT CODE | SUBJECT NAME | INTERNAL | EXTERNAL | TOTAL |
|---|---|---|---|---|
| 4MCS01 | Dissertation Part-II | 200 | 200 | 400 |
| | | | | |
| | GRANDTOTAL | | | ` 400 |

Syllabus

## 1MCS01: Advanced Data Structures

Advanced data structures: self-adjustment, persistence and multi-dimensional trees. Randomized algorithms: Use of probabilistic inequalities in analysis & applications. Geometric algorithms: Point location, convex hulls and Voronoi diagrams, Arrangements. Graph algorithms: Matching and Flows. Approximation algorithms: Use of Linear programming and primal dual, local search heuristics. Parallel algorithms: Basic techniques for sorting, searching, merging, list ranking in PRAMs and Interconnection networks.

**Suggested Reference Materials:**


1. Motwani and Raghavan"Randomized Algorithms",Cambridge University Press
2. Preparata and Shamos"Computational Geometry",Springer Verlag
3. Mehlhorn"Data Structures and Algorithms:1,Searching and Sorting",Springer Verlag EATCP Monograph on Theoretical Computer Science
4. Papadimitrou and Steiglitz"Combinatorial Optimization",Princeton University Press
5. Joseph Ja'Ja'"Introduction to Parallel Algorithms"Addison-Wesley.
6. Vaizirani" Approximation Algorithms",Springer


## 1MCS02: Software System Design

Concepts and techniques relevant to production of large software systems: Structured programming. Requirements, specification and analysis. Top-down design and development. Information hiding, abstraction, modularity, object oriented techniques. Separate compilation, configuration management, program libraries. Design patterns, UML Documentation. Validation. Quality assurance, safety. Testing and test case generation. Software metrics. Cost analysis and estimation, manpower and time management. Organization and management of large software design projects; use of CASE tools.

**Suggested Reference Materials:**


1. Sommerville,"SoftwareEngineering",Addison-Wesley,1999.
2. PetersandPedrycz,"SoftwareEngineering:anEngineeringApproach",Wiley,1999.
3. Pressman“SoftwareEngg”,PHI


## 1MCS03 Critical System Design

Introduction to time critical systems, Application, Design Issues, Characterization and classification of time-critical system and tasks, release time, deadlines & timing constraints, reference model, priority assignment & scheduling, clock driven approach, weighted round robbing approach, priority driven approaches, resources & resource access control, assumption on resources & their uses, protocols. Scheduling flexible computations and tasks with temporal distance constraints. Introduction to clock synchronization & Case studies.

**Suggested Reference Materials:**


1. J.W.S. Liu "Real-Time Systems",Pearson Education Asia.
2. S.T.Lavi, A.K. Agarawal "Real-Time system design", McGraw Hill
3. P.A.Laplante"Real-TimeSystemsDesignandAnalysis,An Engineer’s Handbook,"IEEE Press.
4. K.Mauch"Real-Time Micro computer system design,An introduction",McGrawHill.


Syllabus

## 1MCS3.3: Mathematical Foundation of Computing

Introduction to Information theoretic and Quantum computing and the notion of an effective procedure.RAM model, Primitive and partial recursive functions, Lambda-calculus, Logic -- completeness and incompleteness, Decidability and Church Turing hypothesis. Limitations of the standard model.Coding and Information Theory. Thermodynamics of computation.Quantum computation and quantum algorithms. Physical aspects of computation.

**Suggested Reference Materials:**


1. Cutland NJ" Computability: An Introduction to Recursive Function Theory",Cambridge University Press,1980.
2. Davis M,Weyuker EJ "Computability, Complexity,and Languages",Academic Press,1983.
3. Boolos GS, Jeffrey R "Computability and Logic",Cambridge University Press,1989.
4. Hindley R,Seldin JP "Introduction to Combinatory and Lambda-Calculus",Cambridge University Press,1986.
5. Feynman RP" Lectures on Computation,Penguin",1996


## 1MCS04 Information System Security

Multi level model of security, Cryptography, Secret Key Cryptography, Modes of Operation, Hashes and Message Digest, Public Key Algorithm, Security Handshake Pitfall, Strong Password Protocol; Case study of real time communication security; Introduction to the Concepts of Security, Security Approaches, Principles of security, Types of attacks; Cryptographic Techniques: Plain text and Cipher text , Substitution Techniques, Transposition Techniques Encryption and Decryption, Symmetric and Asymmetric Key Cryptography. Computer-based symmetric Key Cryptographic; Algorithms: Algorithm Types and Modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), Advanced Encryption Standard (AES);Computer-based Asymmetric Key Cryptographic Algorithms; Cryptography, An Overview of Asymmetric Key Cryptography, The RSA algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm; Public Key Infrastructure (PKI) Digital Certificates, Private Key Management , The PKI Model, Public Key Cryptography Standards(PKCS); Internet Security Protocols Secure Socket Layer(SSL) ,Secure Hyper Text Transfer Protocol(SHTTP),Time Stamping Protocol(TSP), Secure Electronic Transaction(SET), SSL versus SET, 3-DSecure Protocol Electronic Money ,Email Security; User Authentication Mechanisms: Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication; Practical Implementations of Cryptography/Security: Cryptographic Solutions Using Java, Cryptographic Solutions Using Microsoft, Cryptographic Toolkits, Security and Operating Systems; Network Security: Brief Introduction to TCP/IP, Firewalls, IP Security,Virtual Private Networks(VPN); Case Studies on Cryptography and Security:

**Suggested Reference Materials:**


1. AtulKahate"CryptographyandNetworkSecurity"TataMcGraw-Hill
2. CharlieKaufman,RadiaPerlman,MikeSpeciner"NetworkSecurities"Pearson,
3. J.A.Coopeer"ComputerCommunicationSecurities"TMH,
4. D.W.DaviesW.L.Price"securitiesForcomputer Networks"
5. JohnWileySons,L.Stein"WebSecuritiesA stepbystepGuide" AddisonWesley.


### Semester -II

## 2MCS01: Advanced Database Management System

Overview of DBMS, concurrency control, failure recovery. Introduction to distributed database management systems, Semantic Database Models and Systems, Object-Oriented Database Systems, Relational Extensions: Design Techniques, Extension Techniques Object/Relational Systems: Open ODB, Transaction Management, Interface, OSQL, Odapter, Case Study of an ORDBMS, Related Development, Current Product Scenario. Standard For OODBMS Products and Applications: ODM – Standards, ODMG, Smalltalk Binding, SQL, User Defined ADT in SQL, Routines, ADT Subtypes and Inheritance, Tables, Procedural Facilities, Other Type Constructions, Generic ADT Packages, Language Bindings

**Suggested Reference Materials:**


1. CSRPrabhu,"Object Oriented DataBase Systems"approaches and Architectures,PHI,
2. F.H.Lochousky, DCT sichritzis"DBMS"NewYork Academic Press.

3. F.H.Lochousky,DCT sichritzis"Data Models"PHI.
4. C.J.DATE"Introduction to DataBase to Management System"Addison Wesley.
5. N.Goodman,V.Hadzilacos"Concurrency Control andRecovery in DataBase System"AddisonWesley

Syllabus

## 2MCS02 Design of Embedded Systems

Embedded Computing Requirements: Characteristics and applications of embedded systems; Components of Embedded Systems; challenges in Embedded System Design and design process; Formalism for system design.

Embedded Processors: RISC vs. CISC architectures; ARM processor – processor architecture and memory organization, instruction set, data operations and flow control; SHARC processor – memory organization, data operations and flow control, parallelism within instructions; Input and output devices,supervisormode,exceptionandtraps;Memorysystem,pipeliningandsuperscalarexecution.

Embedded Computing Platform: CPU Bus – Bus protocols, DMA, system bus configurations, ARM bus; Timers and counters, A/D and D/A converters, Keyboards, LEDs, displays and touch screens; Design examples.

Embedded Software Analysis and Design: Software design pattern for Embedded Systems; Model programs–dataflow graphs and control/dataflow graphs; Assembly and linking; Compilation techniques; Analysis and optimization of execution time, energy, power and program size.

Embedded System Accelerators: Processor accelerators, accelerated system design

**Recommended Book:**

1. Computer as Components by Wayne Wolf published by Elsevier Inc
2. ARM System Developer's Guide by Andrew S.Loss published by Elsevier Inc
3. Embedded System Design by Steve Heath published by Elsevier Inc
4. EmbeddedSystemdesign:AunifiedhardwareSoftwareIntroductionbyFrankVahid&TonyGivagipublishedbyJohnWiley&Sons Inc.

## 2MCS03 Distributed Algorithms

Models of synchronous and asynchronous distributed computing systems: synchronous networks, asynchronous shared memory, asynchronous networks; basic algorithms for synchronous and asynchronous networks: leader election, breadth first search, shortest path, minimum spanning tree; advanced synchronous algorithms: distributed consensus with failures, commit protocols; asynchronous shared memory algorithms: mutual exclusion and consensus; relationship between shared memory and network models; asynchronous networks with failures

**Suggested Reference Materials:**

1. Nancy Lynch,"Distributed Algorithms"Morgan Kaufmann.
2. GerladTel,"Introduction to Distributed Algorithms"Cambridge University Press.

## 2MCS04(A) Advanced Computer Graphics

Rendering: Ray tracing, Radiosity methods, Global illumination models, Shadow generation, Mapping, Anti-aliasing, Volume rendering, Geometrical Modeling: Parametric surfaces, Implicit surfaces, Meshes, Animation: spline driven, quaternion, articulated structures(forward and inverse kinematics),deformation
--purely geometric, physically-based.

**Suggested Reference Materials:**

1. AlanWatt and MarkWatt:"Advanced Animation and Rendering Techniques,Theory and Practice",AddisonWesley.

Syllabus

## 2MCS04(B) High Performance Scientific Computing

Overview of Scientific Computing, Tools-Elements of Mat-Lab, Elements of IDL, Elements of AVS, Scientific Visualization Architecture- Computer Performance. Vector Computing. Distributed-memory MIMD Computing.SIMD Computing. Applications-Advection. Computerized Tomography. Are view of selected topic from Numerical Analysis.

**Suggested Reference Materials:**

1. G.H.Golub,J.M.Ortega"Scientificcomputing-AnintroductionWithparallelcomputing"AcademicPress,
2. LloydD.Fosdick,ElizabethR.Jessup,Carolyn"anintroductiontoHighPerformanceScientificcomputing"PHI

## 2MCS04(C) Advanced Real-Time System Design

**Advance Real-Time Systems:** Multiprocessor scheduling, load sharing techniques, performance metric in Real-Time Systems. Resource management and resource reclaiming in uni-processor and multiprocessor systems. Scheduling flexible computations and tasks with temporal distance constraints. Practical factors and overheads in scheduling, task synchronization, fault tolerance in multi processor systems, Real-Time communication. Introduction to object oriented approaches; case study of distributed Real-Time Systems.

## Semester -II
## 3MCS01 Parallel & Distributed Computing

Introduction to Parallel and Distributed Systems, goals, hardware concepts, software concepts, client server model; communication, layered protocols, remote procedure call, objective invocation, message & stream oriented communication; processes, threads, clients, servers; naming entities, mobile and unreferenced entities; clock synchronization, algorithms, transaction; consistency and replication, data-centric & client-centric models, protocols; fault tolerance, process resilience, reliable client-server & group Communication, commit, recovery; security, channels, access, security control; distributed object-based systems explanation and comparison
;distributed file systems (SUN, CODA) and comparison; distributed document-based system and coordination-based systems, multimedia systems, Parallel Programming Languages and Algorithms.

**Suggested Reference Materials:**

1. Andrew S.Tanenbaum,martenvansteen“Distributed Systems Principals and Paradigms”Pearson Edu.
2. George Coulouris,Jean Dollimore,TimKindberg“Distributed Systems Concepts and Design”Pearson Edu.
3. JoelM.Crichlow“An Introduction to Distributed & Parallel Computing”2nded.PHI.
4. M.Sasikumar,DineshShikhare PRaviPrakash"Introduction to parallel Processing"PHI
5. Andrew S.Tanenbaum"Distributed Operating System"TMH
6. K.H.Wang“Advanced Computer Architecture”TMH.

## 3MCS02(A) Reconfigurable Computing

**Evolution of programmable devices:** Introduction to AND-OR structured Programmable Logic Devices PROM, PLA, PAL and MPGAs; Combinational and sequential circuit realization using PROM based Programmable Logic Element (PLE); Architecture of FPAD, FPLA, FPLS and FPID devices.

**FPGA Technology:** FPGA resources - Logic Blocks and Interconnection Resources; Economics and applications of FPGAs; Implementation Process for FPGAs Programming Technologies-Static RAM Programming, Anti Fuse Programming, EPROM and EEPROM Programming Technology; Commercially available FPGAs-Xilinx FPGAs, Altera FPGAs; FPGA Design Flow Example-Initial

**Suggested Reference Materials:**

1. J.W.S.Liu:"Real-Time system",Pearson Education Asia.
2. S.T.Lavi, A.K.Agarwal:"Real-time system Design",McGraw Hill.
3. P.A.Laplante:"Real-time Systems Design and Analysis, An Engineer’sHandbook",IEEEPress.

Syllabus

4. P.D.Laurence,K.Mauch:"Real-timeMicrocomputersystemdesign,Anintroduction",McGrawHill.

Design Entry, Translation to XNF Format, Partitioning,Placeand Route, Performance Calculation and Design Verification.

**Technology Mapping for FPGAs:** Logic Synthesis - Logic Optimization and Technology Mapping; Lookup Table Technology Mapping - Chortle- crf Technology Mapper, Chortle-d Technology Mapper, Lookup Table Technology Mapping in mis-pga, Look up Table Technology Mappingin Asyland Hydra Technology Mapper; Multiplexer Technology Mapping-Multiplexer Technology Mapping in mis-pga.

**Logic Block Architecture:**Logic Block Functionality versus Area-Efficiency-Logic Block election,Experimental Procedure, Logic Block Area and Routing Model and Results.

**Routing for FPGAs:** Routing Terminology; Strategy for routing in FPGAs; Routing for Row-Based FPGAs-Segmented channel routing,1-channel routing algorithm, K–channel routing algorithm and results.

**Suggested Reference Materials:**

1. FPGA Based system Design by Wayne Wolf published by Pearson Education
2. Digital System Design Using Programmable Logic Devices by Parag KLala published by BS publications
3. Field-Programmable Gate Arrays by Stephen Brown published by Kluwer Academic Publishers

### 3MCS02(B)Artificial Intelligence & Fuzzy Systems

Neuro-Fuzzy and Soft Computing: Introduction to Neuro-Fuzzy and Soft Computing, Fuzzy Set Theory, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Adaptive Neural Networks,Supervised Learning Neural Networks, Learning from Reinforcement, Unsupervised Learning and Other Neural Networks, ANFIS: Adaptive Neuro-Fuzzy Inference Systems, Neuro-Fuzzy Control, ANFIS Applications (Printed Character Recognition, Adaptive Noise Cancellation), Fuzzy Sets and Genetic Algorithms in Game Playing, Soft Computing fo Color Recipe Prediction.

**Suggested Reference Materials:**

1. J.S.R. Jang, C.–T, Son,E. Mizutani“ Neuro-fuzzy and Soft Computing”PHI,
2. Russel and Norvig:"AI, a modern approach", Pearson Education
3. Richand Knight:"AI"Tata McGraw Hill
4. KMFu:"Neural Networksin Computer Intelligence",McGraw Hill

### 3MCS02(C )NETWORK SYSTEM DESIGN

Review of Protocols & Packet Format; Network Systems & the Internet, Network Systems Engineering, Packet Processing, Achieving high speed, Network Speed, Hardware, Software & hybrids.

A conventional computer system, Fetch-Store paradigm, Network Interface Card functionality, Onboard address recognition, Packet Buffering, Promiscuous mode.

IP Datagram, Fragmentation, Reassembly, Forwarding, TCP Splicing.

RISC vs. CISC, Network Processors, Ingress & Egress Processing, Parallel & Distributed Architecture, Network Processor Design, Examples of Commercial Network Processors, Overview of Intel Network Processor, Micro engine Programming, Core Programming.

Laboratory work: Build packet analyzer, IP fragmenter, Ethernet bridge, packet forwarding. Project should be assigned to students to build software component using IXP1200.

Syllabus

**Suggested Reference Materials:**


1. Network Systems Design using Network Processor, Douglas Comer, Pearson Education, ISBN81-7808-994-7
2. IXP1200 programming,Erik J.Johnson and Aaron Kunze, Intel Press.


Syllabus