M.TECH IN COMPUTER SCIENCE AND ENGINEERING

*With effect from 2009 -2010 Academic Session*

### First Semester

<table>
<thead>
<tr>
<th>Theory</th>
<th>Professional Core</th>
<th>Contact Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1. Analysis and Design of Algorithm</td>
<td>-</td>
<td>3-1-0</td>
<td>4 credits</td>
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<tr>
<td>2. Advanced Computer Architecture</td>
<td>-</td>
<td>3-1-0</td>
<td>4 credits</td>
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<tr>
<td>3. Object Oriented System</td>
<td>-</td>
<td>3-1-0</td>
<td>4 credits</td>
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<tr>
<td><strong>Professional Electives (Any TWO)</strong></td>
<td>-</td>
<td>3 – 0 – 0</td>
<td>3 credits each</td>
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<tr>
<td>1. Real-Time Systems</td>
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<td>2. Computational Intelligence</td>
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<tr>
<td>3. Service Oriented Architecture</td>
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<tr>
<td>5. Wireless Sensor Network</td>
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<td>6. Stochastic Process</td>
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<td>7. Formal Language &amp; Automata Theory</td>
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<table>
<thead>
<tr>
<th>Practicals / Sessionals</th>
<th>Contact Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1. Software Technologies Lab. - I</td>
<td>0-0-4</td>
<td>4 credits</td>
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<tr>
<td>2. Pre-thesis work &amp; Seminar</td>
<td>0-0-3</td>
<td>2 credits</td>
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<td><strong>Total</strong></td>
<td><strong>24 Credits</strong></td>
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### Second Semester

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<tr>
<th>Theory</th>
<th>Professional Core</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>1. Software Engineering</td>
<td>-</td>
<td>3-1-0</td>
<td>4 credits</td>
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<tr>
<td>2. Distributed Operating System</td>
<td>-</td>
<td>3-1-0</td>
<td>4 credits</td>
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<tr>
<td><strong>Professional Electives (Any Three)</strong></td>
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<td>3-0-0</td>
<td>3 credits</td>
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<tr>
<td>1. Distributed Database System</td>
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<td>2. Compiler Construction</td>
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<td>3. Mobile Computing</td>
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<td>4. Cryptography</td>
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<td>5. J2EE</td>
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<td>6. Speech Processing</td>
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<td>7. Pattern Recognition</td>
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<td>8. VLSI Design</td>
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<td>9. Embedded System</td>
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<td>10. Non- Linear Optimization Engineering</td>
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<td>11. Simulation and Modeling</td>
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<td>12. Graph Theory</td>
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<tr>
<th>Practicals / Sessionals</th>
<th>Contact Hours</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1. Software Technologies Lab. - II</td>
<td>0-0-4</td>
<td>4 credits</td>
</tr>
<tr>
<td>2. Pre-thesis work &amp; Seminar</td>
<td>0-0-3</td>
<td>2 credits</td>
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<tr>
<td>3. Comprehensive Viva-voce -I</td>
<td>0-0-3</td>
<td>2 credits</td>
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<td><strong>Total</strong></td>
<td><strong>25 Credits</strong></td>
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### Third Semester

**Theory**

<table>
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<tr>
<th>Open Elective (Any One)</th>
<th>L-T-P</th>
<th>Credit</th>
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<tbody>
<tr>
<td>1. Data Mining and Data Warehousing</td>
<td>3-0-0</td>
<td>3 credits</td>
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<td>2. ERP</td>
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<td>3. Digital Image Processing</td>
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<td>4. Software Project Management</td>
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<td>5. Bio-Informatics</td>
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**THESIS Part –I**

14 Credits

**Total**

17 Credits

### Fourth Semester

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<tr>
<td>Thesis Part - II</td>
<td>20</td>
<td>Credits</td>
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<tr>
<td>Seminar</td>
<td>2</td>
<td>Credits</td>
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<tr>
<td>Comprehensive Viva-Voce-II</td>
<td>2</td>
<td>Credits</td>
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**Total**

24 Credits

**Grand Total = 90 Credits**
Analysis and Design of Algorithm

UNIT-1

Algorithm paradigms, Asymptotic notations, Recurrences, Divide and conquer (Merge sort, Heap sort, Quick sort and its correctness proofs) Lower bounds of sorting, Counting sort.

UNIT-II

Randomization (Randomization quick sort, Primality testing), Dynamic Programming (Floyd-Warshall Algorithm, Longest Common Subsequence, Matrix chain multiplication), Greedy Method (Single source shortest path, M, Knapsack problem, Minimum cost spanning trees, Task scheduling).

UNIT-III

Polynomial time, Polynomial-time verification, NP completeness and reducibility, NP completeness proofs, Cook’s theorem, NP complete problem

UNIT – IV

Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid’s algorithm), Internet algorithm (text pattern matching, tries, Ukonnen’s algorithm).

Books:

ADVANCED COMPUTER ARCHITECTURE

Introduction: Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance;
CISC and RISC processors, Pipelining: Basic concepts, instructions and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Exception handling, pipeline optimization techniques;
Hierarchical memory technology: Inclusion, Coherence and locality properties, cache memory organizations, techniques for reducing cache misses, virtual memory organization, mapping and management techniques, memory replacement policies;
Instruction-level parallelism: basic concepts, techniques for increasing ILP, super-scalar, super-pipelined and VLIW processor architectures, array and vector processors;
Multiprocessor architecture: Taxonomy of parallel architectures;
Centralized shared-memory architecture: Synchronization, memory consistency, interconnections networks, Distributed shared-memory architecture, cluster computers.
Books:
OBJECT ORIENTED SYSTEM

UNIT-1

Real world domains, object oriented approach and technology, objects instances and concepts, Objects and classes of objects, generalized object oriented software, Development cycle, Object oriented programming language, object-oriented analysis of a real world domain object model. The notation of encapsulation and information hiding, object identity: entity and attributes, data and knowledge: The notion of inheritance, Relationship between objects: Association, Generalization/ Specialization, Aggregation, Object and States, Dynamic behavior of objects.

UNIT-II

Object-Oriented analysis: introduction, Techniques for information gathering for RA, use case driven object oriented analysis, concepts and principles, identifying the elements of an object model, Management of Object-Oriented Software projects, Object oriented analysis, domain analysis and generic components of object-oriented analysis model, object behavior model.

The intent of object-oriented metrics, the distinguishing characteristics and metrics for the object-oriented design model, class oriented metrics, operation oriented metrics, metrics for object oriented testing, metrics for object-oriented projects.

UNIT-III

Introduction to UML : The meaning of object-orientation, object identity, encapsulation, information hiding, polymorphism, genericity, importance of modeling, principles of modeling, object oriented modeling, conceptual modeling of the UML, Architecture.

Basic structural modeling : classes, relationships, common mechanisms, diagrams, advanced structural modeling : advanced relationship interfaces, roles, packages, instances.

UNIT-IV


UNIT-V

Behavioral modeling: interactions, use cases, use case diagrams, activity diagrams. Advanced Behavioral modeling: Events and signals, state machines, process and threads, time and space, state chart diagram. Architectural Modeling: Terms, concepts, examples, modeling techniques for component diagrams and deployment diagram

Suggested Reading:

3. Larmen
UNIT-1

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints

Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

UNIT-2


Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

UNIT-3

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.


UNIT-4

Real-time Communication: Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN. Soft Real-time communication in a LAN. Hard real-time communication in a LAN. Bounded access protocols for LANs. Performance comparison, Real-time communication over packet switched networks. Qos framework, Routing, Resource reservation, Rate control, Qos models.

Books:

Computational Intelligence


Fuzzy Inference System: Mamdani fuzzy models, Sugeno Fuzzy Models, Tsukamoto fuzzy models, other considerations.

Least Square Method for system Identification: System Identification, Basic of matrix manipulations and calculus, Least-square estimator, Geometric interpretation of LSE, Recursive least-square estimator, Recursive LSE for time varying systems, Statistical Properties and maximum likelihood estimator, LSE for nonlinear models.

Derivative-based optimization: Descent methods, the method of steepest descent, Newton’s methods, Step size determination, conjugate gradient methods, Analysis of quadratic case, nonlinear least-squares problems, Incorporation of stochastic mechanism.
Derivative-free optimization: Genetic algorithm simulated annealing, random search, Downhill simplex search, Swarm Intelligence, genetic programming.

Adaptive Networks: Architecture, Back propagation for feed forward networks, Extended back propagation for recurrent networks, Hybrid learning rule: combing steepest descent and LSE.


Learning from reinforcement: Failure is the surest path to success, temporal difference learning, the art of dynamic programming, Adaptive heuristic critic, Q-learning, A cost path problem, World modeling, other network configurations, Reinforcement learning by evolutionary computations.


Adaptive Neuro-fuzzy inference systems: ANFIS architecture, Hybrid learning algorithms, Learning methods that cross-fertilize ANFIS and RBNF, ANFIS as universal approximator, Simulation examples, Extensions and advance topics.


Books:

Service Oriented Architecture

Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements, service-oriented design process, design activities, Distributing service management and monitoring concepts


Computer Graphics

Introduction: Display of entities, geometric computation and representation, graphics environments;
Working principles of display devices: Refreshing Raster scan devices, vector devices, cathode ray tube terminals, plotters;

Display of colors: Look-up tables, display of gray shades, half toning;
Display and drawing of graphics primitives: Point, line, polygon, circle, curves, and texts; Coordinate conventions: World coordinates, device coordinates, normalized device coordinates, view-port and window, zooming and panning by changing coordinate reference frames;
Computations on polygons: Point inclusion problems, polygon filling, polygon intersections, clipping, polygonization of a point set, convex hull computation, triangularization of polygons;
Transformations in 2D and 3D: Translation, Rotation, Scaling, Reflection;
Projection: Perspective and parallel projections, isometric projection, Transformation matrices;
Volume and surface representation: Polygonal meshes, parametric curves and surfaces, Cubic and Bi-cubic Splines, Voxels, Octree and Medial axis representation, Sweep representation, surfaces and volumes by rotation of curves and surfaces, Fractal modeling;
Hidden surface and Line Elimination: Elimination of back surfaces, Painters’ algorithms, Binary space partitioning tree;
Rendering and visualization: Shading model, constant, Gouraud and Phong shading, Ray tracing algorithm, Radiosity computation;
Computer animation: Fundamental concepts.
Books:

Wireless Sensor Networks

Unit I
Introduction: the vision, Networked wireless sensor devices, Applications, Key design challenges.
Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

Unit II
Synchronization: Issues & Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

Unit III
Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.
Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.
Sleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms.

Unit IV
Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing, Routing to mobile sinks.
Data-centric networking: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.
Reliability and congestion control: Basic mechanisms and tunable parameters, Reliability guarantees, Congestion Control, Real-time scheduling.

Books:
**Stochastic Processes**

Introduction to Probability; the axioms, the concept of random variables; functions of one, two and sequence of random variables.

General Concepts of stochastic processes; random walks and other applications; spectral representation; spectrum estimation; mean square estimation; entropy; markov chains and markov processes and queuing theory.

Reference Book


**Formal Language and Automata Theory**

Formal languages and their related automata: Turing machines, Type-0 languages, Linear bounded automata and CSLs; Time and Tape bounded Turing machines, time and space bounds for recognizing CFLs;

Turing computability: Number theoretic computations by Turing machines and indexing; Axiomatic systems, their soundness and completeness,

Recursive function theory: Primitive recursive functions and primitive recursive predicates; Some bounded operations, Unbounded minimalization and $\mu$-Recursive Functions, Godel Numbering, Ackermann's function, recursive and general recursive functions;

Computability and decidability: Computable functions, computable sets, decision problems, Fix-point theory of programs, functions and functionals, Verification methods, Lambda calculus and applications.

Reference Books:


Lewis & Papdimitriou, "Elements of the Theory of Computation ", Prentice Hall

**Software Technologies Lab.**

Object-oriented programming concepts and implementation of abstract data types;
Implementation of graph algorithms; Linear programming with applications;
Basic of OS programming process creation and synchronization, shared memory and semaphore shell programming.