M.TECH IN COMPUTER SCIENCE AND ENGINEERING

With effect from 2009 -2010 Academic Session

First Semester

	Theory		*Contact Hours*	
	Professional Core		L-T-P	Credit
1.	Analysis and Design of Algorithm	-	3-1- 0	4credits
2.	Advanced Computer Architecture	-	3-1- 0	4 credits
3.	Object Oriented System	-	3 -1-0	4 credits
	Professional Electives (Any TWO)	-	3 – 0 – 0	3 credits each
1.	Real-Time Systems			
2.	Computational Intelligence			
3.	Service Oriented Architecture			
4.	Computer Graphics			
5.	Wireless Sensor Network			
6.	Stochastic Process			
7.	Formal Language & Automata Theory			

	Practicals / Sessionals		*Contact Hours*	
			L-T-P	Credit
1.	Software Technologies Lab. - I	-	0-0-4	4 credits
2.	Pre-thesis work & Seminar	-	0-0-3	2 credits

Total 24 Credits

Second Semester

	Theory		*Contact Hours*	
	Professional Core		L-T-P	Credit
1.	Software Engineering	-	3-1- 0	4credits
2.	Distributed Operating System	-	3-1- 0	4credits
	Professional Electives (Any Three)			
1.	Distributed Database System	-	3-0- 0	3credits
2.	Compiler Construction			
3.	Mobile Computing			
4.	Cryptography			
5.	J2EE			
6.	Speech Processing			
7.	Pattern Recognition			
8.	VLSI Design			
9.	Embedded System			
10.	Non- Linear Optimization Engineering			
11.	Simulation and Modeling			
12.	Graph Theory			

	Practicals / Sessionals		*Contact Hours*	
			L-T-P	Credit
1.	Software Technologies Lab. - II	-	0-0-4	4 credits
2.	Pre-thesis work & Seminar	-	0-0-3	2 credits
3.	Comprehensive Viva-voce -I	-	0-0-3	2 credits

Total 25 Credits

Third Semester

Theory	*Contact Hours*	
Open Elective (Any One)	L-T-P	Credit
1. Data Mining and Data Warehousing	3-0-0	3 credits
2. ERP		
3. Digital Image Processing		
4. Software Project Management		
5. Bio-Informatics		
THESIS Part –I		14 Credits
Total		17 Credits

Fourth Semester

Thesis Part - II	20 Credits
Seminar	2 Credits
Comprehensive Viva-Voce-II	2 Credits
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:

1. Michael Goodrich and Roberto Tamassia, "Algorithm Design", John Wiley and Sons, 2002.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C/C++", Pearson Education India.
3. T. H. Cormen, C. E. Leiserson, and R. L. Rivest, " Introduction to Algorithms", Prentice Hall of India.
4. Horowitz, Sahni, and Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia publications, 1999.

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:

1. Henessy and Patterson, "Computer Architecture—A Quantitative Approach", Pearson press, 3rd Edition, 2003.
2. K.Hwang and F.A.Briggs, "Computer Architecture and Parallel Processing", Mc-Graw Hill, 1984.
3. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, programmability", Mc-Graw Hill,
4. M.Singhal and N.G.Sivaratri, "Advanced concepts of Operating Systems", Tata-Mc-Graw Hill Publication, 2001.
5. Crowley, "Operating Systems".

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

Class & object diagrams: Terms, concepts, examples, modeling techniques, class & object diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self in messages. Sequence diagrams: Terms, concepts, differences between collaboration and sequence diagrams, depicting synchronous messages with/without priority call back mechanism broadcast message.

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:

1. Grady Boach, James Rambaugh, Ivar Jacobson : The unified modeling language user gude, Addison wesey.
2. Mieiar Page-jones : fundamentals of object oriented design in UML, Addison Wesley, 2000
3. Larmen

Professional Electives (Any TWO)

Real Time Systems

UNIT-1 [10Hrs]

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteistics 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 [10Hrs]

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP.Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies.

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 [5Hrs]

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.

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases.

UNIT-4 [5Hrs]

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:

1. Real-time Systems Theory and Practice by Rajib Mall, Pearsons Publication.

Computational Intelligence

Introduction to Soft Computing: Soft computing constituents and conventional Artificial Intelligence, Neuro-Fuzzy and Soft Computing characteristics.

Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning: Introduction, Basic definitions and terminology, Set-theoretic operations, MF Formulation and parameterization, More on fuzzy union, intersection, and complement, Extension principle and fuzzy relations, Fuzzy If-Then rules, Fuzzy reasoning.

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.
Supervised learning neural networks: Perceptions, Adaline, Back propagation multi layer perceptions, Radial Basic Function networks.
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.
Unsupervised learning and other neural networks: Competitive learning networks, Kohonen self-organizing networks, learning vector quantization, Hebbian learning, principal component networks, and the Hopfield network.
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.
Coactive Neuro-fuzzy modeling: towards generalized ANFIS: Framework, Neuro functions for adaptive networks, Neuro-Fuzzy spectrum, Analysis of adaptive learning capability.

Books:

1. J.S.R. Jng, C.T. Sun and E. Mizutani,"Neuro-fuzzy and Soft Computing", PHI.
2. S. Rajasekaran, G.A. Vijaylakshmi Pai,:Neural Networks, Fuzzy Logic, and Genetic Algorithms," PHI.

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

Text Book: Service-Oriented Architecture: Concepts, Technology and Design, by Thomas Erl, Prentice Hall Publication, 2005

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, Goraud and Phong shading, Ray tracing algorithm, Radiosity computation;
Computer animation: Fundamental concepts.
Books:

1. Foley, "Computer Graphics: Principles and practice", 2nd Edition.
2. Mel Slater, "Computer Graphics and Virtual Environments 1/e", Pearson Education.
3. D.F.Rogers, "Procedural elements for Computer Graphics", Mc. Graw Hill, 1985.
4. K. A. Plastock and Borden Kelly: Schaum's Outline of Computer Graphics, 1986.
5. Newman and Sproull : Principles of interactive Computer Graphics, Mc. Graw Hill, International Students Edition, Kogakusha, 1981.
6. S. Harrington : Computer Graphics A Programming Approach, Mc. Graw Hill, 1986.

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

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization, Theoretical analysis of localization techniques.
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:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: Kazem Sohraby, Daniel Minoli, Taieb Znati , Wiley Inter Science.
2. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
3. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati , Springer.
4. Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press
5. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and Milind Tambe , Kluwer Publications.
6. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

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

1. Probability, Random Variables and Stochastic Processes, 4th Edn., A. Papoulis and S. U. Pillai, TMH Publication
2. Probability, Random Variables and Random Signal Principles, 4th Edn, P. Z. Peebles Jr., TMH Publication
3. Probability and Stochastic Processes: A Friendly Introduction for Electrical and Computer Engineers- Roy D.Yates , David J.Goodman Wiley, John & Sons, Incorporated 2004.
4. Probability and stochastic processes for engineers- Carl W. Helstrom , Macmillan Publication 2007

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 μ-Recursive Functions, Godel Numbering, Ackermann's function, recursive and general recursive functions;
Computability and decidabilty: Computable functions, computable sets, decision problems, Fix-point theory of programs, functions and functionals, Verification methods, Lambda calculus and applications.

Reference Books :

1. Martin, " Introduction to language and the theory of computation" 3/e , TMH edition, 2009
2. Hopcroft & Ullman, " Introduction to Automata Theory, Languages and Computation", Narosa publications, 1999.

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.