Biju Patnaik University of Technology, Orissa

Course for M.Tech. Syllabus

(Information Technology Engineering)

M.TECH IN INFORMATION TECHNOLOGY

With effect from 2009 -2010 Academic Session

First Semester

Theory	*Contact Hours*	
Professional Core	L-T-P	Credit
1. Software Engineering & Development Methodologies	3-1-0	4
2. Data Ware Housing & Data Mining	3-1-0	4
3. Information Theory and Coding Techniques	3-1-0	4
Professional Electives (Any Two) (3 Credits each)	3-0-0	3

1. Computational Intelligence
2. Advanced Computer Architecture
3. Advanced Operating System
4. Pattern Recognition
5. Multimedia Communication Systems
6. Real Time System
7. Wireless Sensor Network

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. J2EE	3-1-0	4
2. Enterprise Resource Planning	3-1-0	4
Professional Electives(Any Three) (3 credits each)	3-0-0	

1. Distributed Database System -
2. Compiler Construction
3. Mobile Computing
4. Cryptography
5. Speech Processing
6. VLSI Design
7. Embedded System
8. Non- Linear Optimization Engineering
9. Simulation and Modeling
10. Graph Theory

Practicals / Sessionals	*Contact Hours*	
	L-T-P	Credit
1. Software Technologies Lab - II	0-0-6	4
2. Pre-thesis work & Seminar	0-0-3	2
3. Comprehensive Viva-voce – I		2

Total 25 Credits

Third Semester

Theory	*Contact Hours*	
Open Elective (Any One)	L-T-P	Credit
	3-0-0	*3*

1. Digital Image Processing
2. Software Project Management
3. Bio-Informatics
4. Formal Language and Automata

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

Software Engineering & Development Methodologies

Evaluation of Software Design Technique: Adhoc Base, Control Base, Data Structure, Data Flow, Objective Oriented. Process Model: SDLC, Component Base Software Developer Model, Unified Model, Fountain Model, 4P Approach: People, Process, Project, Product. Software Metrics: Process Metrics: LOC, COCOMO, PF, OO Process Metric, Use Case Process Metric.
Product Metrics: FP, Architectural Design Metrics, Metrics for OO Design, Class Oriented Metric, Coupling Metric, Cohesion Metric. Metrics for Testing. Project Metrics: Web Engg.
Object Technology: Object, Classes, Message, Class Hierarchy, Inheritance, Abstract, Encapsulation, Polymorphisms. Relationship: IsA, Has A, UsesA. Object Oriented Modeling:
Booch Notation, Rumbaugh Object Modeling Technique, Jacabson Model: Use Case, Abstract Use Case, Actor, Abstract actor. Use case Model: Domain Object Model, Analysis Object Model, Design Model, Testing Model, Implementation Model
UML Diagram: Class Diagram, Object Diagram, Sequence Diagram, Collaboration Diagram, Activity Diagram, State Chart Diagram, Component Diagram, Deployment Diagram
Object Oriented Analysis: Class: Interface Class, Control Class, Entity Class.Developing Use Case: Use case Element, Description, Case Study (i.e ATM), Class Classification Approach, Noun Phase Approach, Classical Approach, Function Point Approach, Structural Approach, CRC Card
Object Oriented Design: Component Level Design, Cohesive, Coupling
Object Oriented Testing: System Testing: Requirement Specification, Integration Testing:
Sequence Testing, Inheritance Testing, Polymorphism Testing, Encapsulation Testing
Unit Testing: Class Testing, Method Testing

Text Book: Software Engineering by Pressman McGraw Hill

Data Ware Housing & Data Mining

Introduction to Data Mining, Paradigm, Computing Paradigm, Business Paradigm, Business Problem Definition, Operational & informational Data stores, Data Warehouse Definition & characteristics, Data Warehouse Architecture, Client /Server Computing Model & Data Warehouse, Overviews of Client/server Architecture, Server specialization in client/server computing Environment, Server Function, Server H/W Architecture RISC verses CISC, Multiprocessor System, SMP implementation, Parallel Processors and Cluster Systems, Distributed Memory Architecture, Cluster System, Advances in Multiprocessing Architecture, Server Operating System, Operating System Implementation
Data Warehousing Component, Overall Architecture, Data Warehouse Database Sourcing, Acquisition, Cleanup &transformation Tools, Metadata, Access Tools, Data Marts, Data Warehouse Administration and Management, Information Delivery System, Business & Data Warehouse, Business Consideration :Return & Investment, Design Consideration, Implementation Consideration, Benefits of Data Warehousing, Mapping the Data Warehouse to Multi Processor Architecture, Database architecture for Parallel Processing, Shared Memory Architecture, Shared Disk Architecture, Shared Nothing Architecture, Combined Architecture
Introduction to Data Mining, Measuring Data Mining effectiveness: Accuracy , speed & Cost, Embedding Data Mining into your Business Process, Discovery verses Prediction, Comparing the Technology, Business Score Card, Application Score Card, Algorithm Score card, Decision Tree, CART, CHAID, Growing the Tree, When does the Tree stop growing, Strength & Weakness, Algorithm Score Card, Neural Network, Different types of neural N/W, Kohonen feature maps, Nearest Neighbor and Clustering, Business Score Card Where to use clustering & nearest neighbor prediction, Clustering for clarity, Clustering for out layer analysis, Nearest Neighbor for prediction, Application Score Card

Text Book: Data Warehousing, Data Mining & OLAP by Alex & Stephen, McGraw Hill

Information Theory and Coding Techniques

Introduction to information Theory, Information and entropy, properties of entropy of a binary memory less source, Measure of Information, Source Coding, Shannon-Fano coding, Huffman coding, Lempel ZIV coding, channel coding, Channel capacity, noisy channel coding theorem for DMC. Linear block codes, generator matrices, parity check matrices, encoder syndrome and error detection-minimum distance, error correction and error detection capabilities, cyclic codes, coding and decoding. Coding convolutional codes, encoder, generator matrix, transform domain representation state diagram, distance properties, maximum likelihood decoding, Viterbi decoding, sequential decoding, interleaved convolutional codes.

Text Book:
1. Elements of Information Theory , T.M.Cover, J.A.Thomas, Wiley
2. R.McEliece, The Theory of Information and Coding, Addison-Wesley.

Professional Electives (Any TWO)
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.

Advanced Computer Architecture

Introduction to parallel processing: Evaluation of Computer System, parallelism in Uniprocessor system, Parallel computer system, Architectural classification Schemes, Parallel Processing Applications. Memory and Input-Output Subsystems : Hierarchical Memory Structure, Virtual memory System, Memory allocation and Management, Cache Memories and Management, Input-Output Subsystems. Principles of pipelining and vector processing: Pipelining, Instruction and Arithmetic Pipelines, Principles of Designing Pipelined Processor, Vector Processing Requirements. Structure and Algorithms for array processors: SIMD Array Processors, SIMD Interconnection Networks, Parallel Algorithms for array Processors, Associative Array Processing. Multiprocessor architecture and programming: Inter-processor Communication Mechanisms, System Deadlocks and Protection, Multiprocessor Scheduling Strategies, Parallel Algorithm for Multiprocessor. Data flow computer and VLSI Computations: Data Driven Computing and Languages, Data flow Computer Architectures, VLSI Computing Structures.

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Text Book :

1. J. L. Heressy and D. A. Pattersan "Computer Architecture A Quantitative approach", Morgan Kaufmann, 1990.
2. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, programmability", Mc-Graw Hill.

Advanced Operating System

System Architecture Types, Distributed Operating Systems, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Global State, Chandy-Lamport's Global State Recording Algorithm, Cuts of a Distributed Computation, Termination Detection, Mutual Exclusion Algorithms, Performance Measures, Non-Token-Based Algorithms, Token-Based Algorithms, Comparative Performance Analysis, Deadlock Handling Strategies, Centralized Deadlock-Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms, Agreement Protocols, Distributed File Systems, Distributed Shared Memory, Distributed Scheduling, Multiprocessor Operating Systems.

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Text Book :

1. M. Singhal and N. G. Sivaratri, "Advanced concepts in Operating Systems", Tata McGraw Hill Publications, 2001.
2. Coulouris, "Distributed Systems: Concepts and Design", Pearson Education.

Pattern Recognition

Introduction, Machine perception, Pattern Recognition Systems, Design cycle, Learning & adaptation,(Ch.1) Bayesian Decision Theory in discrete & continuous features(Ch. 2.1 to 2.6, and 2.9) Maximum likelihood and Bayesian parameter estimation (Ch.3.1 to 3.5, 3.10) Nonparametric techniques (Ch. 4.1 to 4.6) Linear discriminant functions (Ch. 5.1 to 5.9), Non-metric method (Ch. 8.1 to 8.3, 8.6 , 8.7)

Text Book: R. O. Duda, P. E. Hart and D. G. Stork, "Pattern Classification" Wiley Publ. 2nd Edition

Multimedia Communication Systems

Multimedia Information Systems , A framework for Multimedia systems ,Multimedia conferencing model, Multimedia distributed processing model, Media and data streams, Audio, Video and animation, data compression, Multimedia Operating System , Multimedia networks, Multimedia information representation, Compression techniques, Standards for Multimedia Communication, Digital Communication basics, Multimedia Communication Systems, Synchronization, Multimedia applications.

Book: 1. Multimedia Communications by Buford, Pearson
2. Multimedia: Computing, Communications & Applications by Ralf & Klara, Pearson Ch: 11, 15, 17
3. Multimedia Systems by Fred Halsal, Pearson Ch: 1 to 6
4. Multimedia: Computing, Communications & Applications by Ralf & Klara, Pearson Ch: 1 to 9

Real Time Systems

UNIT-1 *[10Hrs]*

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, Modeling 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.

Book:

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

Wireless Sensor Network

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.

Software Technologies Lab. - I

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.