Syllabus
of
M.Tech
in
Information Technology

From 2009 -2010 Academic Session
## First Semester

### Theory

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>L-T-P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITPC101</td>
<td>Software Engineering &amp; Development Methodologies</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td>ITPC102</td>
<td>Data Ware Housing &amp; Data Mining</td>
<td>3-1-0</td>
<td>4</td>
</tr>
<tr>
<td>ITPC103</td>
<td>Information Theory and Coding Techniques</td>
<td>3-1-0</td>
<td>4</td>
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</tbody>
</table>

### Professional Electives (Any Two) (3 Credits each)

- CSPE102: Computational Intelligence
- ITPE102: Advanced Computer Architecture
- ITPE103: Advanced Operating System
- ITPE104: Pattern Recognition
- ITPE105: Multimedia Communication Systems
- CSPE101: Real Time System
- CSPE105: Wireless Sensor Network

### Practicals / Sessionals

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>L-T-P</th>
<th>Credit</th>
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<tbody>
<tr>
<td>CSPR101</td>
<td>Software Technologies Lab. - I</td>
<td>0-0-4</td>
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<tr>
<td>ITPT101</td>
<td>Pre-thesis work &amp; Seminar</td>
<td>0-0-3</td>
<td>2</td>
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</table>

**Total:** 24 Credits

## Second Semester

### Theory

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credit</th>
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<tbody>
<tr>
<td>ITPC201</td>
<td>J2EE</td>
<td>3-1-0</td>
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<tr>
<td>ITPC202</td>
<td>Enterprise Resource Planning</td>
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<td>4</td>
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### Professional Electives (Any One)

- CSPE201: Distributed Database System
- CSPE202: Compiler Construction
- CSPE203: Simulation and Modeling

### Practicals / Sessionals

<table>
<thead>
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<th>Credit</th>
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<tbody>
<tr>
<td>ITPR201</td>
<td>Software Technologies Lab - II</td>
<td>0-0-6</td>
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<tr>
<td>ITPT201</td>
<td>Pre-thesis work &amp; Seminar</td>
<td>0-0-3</td>
<td>2</td>
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<tr>
<td>ITCV201</td>
<td>Comprehensive Viva-voce – I</td>
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**Total:** 25 Credits
### Third Semester

<table>
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<th>Theory</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>Open Elective (Any One)</td>
<td>L-T-P Credit</td>
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<tr>
<td></td>
<td>3-0-0 3</td>
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</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ITPT401</td>
<td>Thesis Part - II</td>
<td>20</td>
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<tr>
<td>ITCV401</td>
<td>Seminar</td>
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</tr>
<tr>
<td>ITCV402</td>
<td>Comprehensive Viva-Voce-II</td>
<td>2</td>
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</tbody>
</table>

Total 24 Credits

Grand Total = 90 Credits
Software Engineering & Development Methodologies


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


Unit Testing: Class Testing, Method Testing

Text Book
Software Engineering by Pressman McGraw Hill
Data Ware Housing & Data Mining


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
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.


**Books:**
Advanced Computer Architecture


Text Book:

Advanced Operating System


Text Book:

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


Book:

1. Multimedia Communications by Buford, Pearson
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]
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.

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:

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
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:

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.
2ND Semester

J2EE

**Introduction:** Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The? Operator; Operator Precedence; Logical expression; Type casting; Strings; .Control Statements: Selection statements, iteration statements, Jump Statements.

**Classes, Inheritance, Exceptions, Applets:** Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes .Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading. Exception handling: Exception handling in Java. The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase( ) and getCodebase( ); ApletContext and showDocument( ); The AudioClip Interface; The AppletStub Interface; Output to the Console.

**Multi Threaded Programming, Event Handling:** Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

**Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and Imageicon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

**TEXT BOOKS:**

ENTERPRISE RESOURCE PLANNING

INTRODUCTION


PRE – IMPLEMENTATION STAGE


IMPLEMENTATION


PROJECT MANAGEMENT


POST IMPLEMENTATION


References:

DISTRIBUTED DATABASE SYSTEM


2. Distributed Database design – A framework, the design of database fragmentation, the allocation of fragments. Translation of global queries into fragment queries, query optimization.


4. Reliability: Basic concepts, commit protocols, consistent view of Network, Detection and Resolution of Inconsistencies, check points and cold restart.

5. Commercial Systems: Transclem’s ENCOMPASS
Distributed database systems, IBM’s Inter system communication, feature of distributed ingres and Oracle.


Text Book:

COMPILER CONSTRUCTION

Review of compiler fundamentals – Lexical analysis, parsing, semantic analysis, error recovery and intermediate code generation; Runtime storage management; Code Generation; Code improvement – Peephole optimization, dependence analysis and redundancy elimination, Loop optimization, procedural and inter-procedural optimization, instruction scheduling, optimization for memory hierarchy; compilation for high performance architecture; Probability and re-targetability;

Selected topics from Compilers for imperative: Object-oriented and markup languages, parallel and distributed programming and concurrency.

Suggested textbooks and references:
1) A. V. Aho, R. Sethi, Lam, and J. D. Ullman, “Compilers”, Pearson Education.

Simulation and Modeling


References:

Professional Elective – IV(Any One)
Mobile Computing


References:

Graph Theory

Basic Concepts: Graphs and digraphs, incidence and adjacency matrices, isomorphism, the automorphism group; Trees: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem, minimum spanning trees; Connectivity: Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem; Paths and Cycles: Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal, girth, circumference, the Chinese Postman Problem, the Travelling Salesman problem, diameter and maximum degree, shortest paths; Matchings: Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching (in both bipartite and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem; Extremal problems: Independent sets and covering numbers, Turan's theorem, Ramsey theorems; Colorings: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem; Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2-cell embeddings, graphs on other surfaces; Directed graphs: Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branchings; Networks and flows: Flow cuts, Max flow min cut theorems, perfect square; Selected topics: Dominating sets, the reconstruction problem, intersection graphs, perfect graphs, random graphs.

Text Books:
2. N. Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2004.

Reference Books:
VLSI Design

Introduction to VLSI Design Methodologies, Full Custom Design, Semi Custom Design and Programmable design, VLSI Design Flow, Design Entry, Synthesis, Floorplanning, Place & Route, Timing analysis, Front – end design and Backend design.

Front End Design: Introduction to high level design, Hardware Description Language.


Backend Design: Introduction to low level Design.

MOS Structure: Band Diagram, NMOS, PMOS, CMOS digital logic gates, Inverters

Digital Design: Static Logic & Dynamic logic design styles. Analog Design: Differential Amplifiers, Current Mirrors, design of operational amplifiers. Introduction to SPICE (T_Spice) for circuit simulation VLSI Technology.

Fabrication Process (NMOS & CMOS)

Wafer Preparation, Oxidation, Photo & Ion Lithography, Etching, Diffusion, Ion implantation, Metalization.


Design of Telecom Chips

Introduction to VLSI Design modulators, Demodulators, Transiver ICS, coder & Decoders. Companies Involved in Communication chip design.

Suggested text books and references
1) Application specific Integrated Circuits by Smith (For Unit –I)
2) VHDL by Douglas Perry, TMH Publication (for Unit-II)
3) VLSI Design & Techniques, Pucknell & Eshraghian, PHI (For Unit-III & Unit-V)
4) VLSI Technology, S. M. Size, Mc Graw Hill (For Unit-IV)
5) Resources from Internet : www.ti.com
Professional Elective – V (Any One)

Speech Processing

Speech Processing: Introduction; Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition. Indian language case studies; Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language case studies.

EMBEDDED SYSTEMS

Module – I   (12 Hours)
Introduction: Features of Embedded systems, Design matrices, Embedded system design flow, SOC and VLSI circuit.
ARM: An advanced Micro Controller, Brief history, ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplications instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions. FPGA

Module – II   (12 Hours)
Devices and device drivers, I/O devices, Serial peripheral interfaces, IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA, PCI, PCI – X and advance busses, Device drivers.
Real time operating system: Hard real time, firm real time, soft real time, Task periodicity: periodic task, sporadic task, aperiodic task, task scheduling, scheduling algorithms: clock driven scheduling, event driven scheduling.

Module – III   (08 Hours)
Low power embedded system design: Dynamic power dissipation, Static power dissipation, Power reduction techniques, system level power management.

Module – IV   (08 Hours)
Hardware and software partitioning: K-L partitioning, Partitioning using genetic algorithm, particle swarm optimization, Functional partitioning and optimization: functional partitioning, high level optimizations. Hardware software co-simulations

Text Books:
1. “Embedded System Design ” by Santanu Chattopadhay, PHI
2. “Embedded system architecture, programming and design” By Raj Kamal, TMH

Reference Books:
1. “Hardware software co-design of Embedded systems” By Ralf Niemann, Kulwer Academic.
2. “Embedded real time system programming” By Sriram V Iyer, Pankaj Gupta, TMH.
CRYPTOGRAPHY

Introduction to Cryptography: Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions
Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations
Formal Notions of Attacks: Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM-CCA2, Interrelations among the attack model
Random Oracles: Provable Security and asymmetric cryptography, hash functions One-way functions: Weak and Strong one way functions
Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)
Building a Pseudorandom Permutation: The Luby Rackoff Construction: Formal Definition, Application of the Luby Rackoff Construction to the construction of Block Ciphers, The DES in the light of Luby Rackoff Construction
Left or Right Security (LOR)
Message Authentication Codes (MACs): Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC
Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing
Assumptions for Public Key Signature Schemes: One way functions Imply Secure One-time Signatures
Shamir's Secret Sharing Scheme
Formally Analyzing Cryptographic Protocols
Zero Knowledge Proofs and Protocols

References
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCE BOOKS:

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