Proposed structure M.E. Computer Engineering to be implemented from July-2008

**Term-I**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lect.</td>
<td>Pract.</td>
</tr>
<tr>
<td>510101</td>
<td>Applied Algorithms</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510102</td>
<td>Emerging trends in Computer Architecture</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510103</td>
<td>Principles and Practices for IT Management</td>
<td>03</td>
<td>100</td>
</tr>
<tr>
<td>510104</td>
<td>Elective-I</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510105</td>
<td>Elective-II</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510106</td>
<td>Laboratory Practice-I</td>
<td>--</td>
<td>06</td>
</tr>
<tr>
<td>510107</td>
<td>Seminar-I</td>
<td>04</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>15</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

**Term-II**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lect.</td>
<td>Pract.</td>
</tr>
<tr>
<td>510108</td>
<td>Distributed System</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510109</td>
<td>High Performance Database Systems</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510110</td>
<td>Network Design, Modeling and Analysis</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510111</td>
<td>Elective-III</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510112</td>
<td>Elective-IV</td>
<td>03</td>
<td>--</td>
</tr>
<tr>
<td>510113</td>
<td>Laboratory Practice-II</td>
<td>--</td>
<td>06</td>
</tr>
<tr>
<td>510114</td>
<td>Seminar-II</td>
<td>--</td>
<td>04</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>15</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>
### Term-III

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lect.</td>
<td>Pract.</td>
</tr>
<tr>
<td>510115</td>
<td>Seminar-III</td>
<td>04</td>
<td>--</td>
</tr>
<tr>
<td>510116</td>
<td>Project stage-I</td>
<td>18</td>
<td>--</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>22</td>
<td>--</td>
</tr>
</tbody>
</table>

### Term-IV

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lect.</td>
<td>Pract.</td>
</tr>
<tr>
<td>510116</td>
<td>Project stage-II*</td>
<td>18</td>
<td>--</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>18</td>
<td>--</td>
</tr>
</tbody>
</table>

* : The term work of project stage II of semester IV should be assessed jointly by the pair of internal and external examiner along with the oral examination of the same

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Elective-I</th>
<th>Subject Code</th>
<th>Elective-II</th>
</tr>
</thead>
<tbody>
<tr>
<td>510104 A</td>
<td>Advance Software Engineering</td>
<td>510105 A</td>
<td>Information and Network Security</td>
</tr>
<tr>
<td>510104 B</td>
<td>Intelligent Systems</td>
<td>510105 B</td>
<td>Advanced Compilers</td>
</tr>
<tr>
<td>510104 C</td>
<td>Internet Routing Design</td>
<td>510105 C</td>
<td>Web Services and SOA</td>
</tr>
<tr>
<td>510104 D</td>
<td>Mobile Computing</td>
<td>510105 D</td>
<td>Embedded System Design</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Elective-III</th>
<th>Subject Code</th>
<th>Elective-IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>510111 A</td>
<td>Software Design and Architecture</td>
<td>510112 A</td>
<td>Software Project Management</td>
</tr>
<tr>
<td>510111 B</td>
<td>Pattern Recognition and Machine Vision</td>
<td>510112 B</td>
<td>Infrastructure Management</td>
</tr>
<tr>
<td>510111 C</td>
<td>Network Programming</td>
<td>510112 C</td>
<td>Data Warehousing and Data Mining</td>
</tr>
<tr>
<td>510111 D</td>
<td>Advanced Internet Programming</td>
<td>510112 D</td>
<td>Open Elective(Self Study)**</td>
</tr>
</tbody>
</table>

****: Open elective subject –BOS computer engineering will declare the list of subjects which can be taken under open elective.
Applied Algorithms

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Introduction to Probability and Problem Solving:

2. Analysis of Algorithms

3. Fundamental Computing Algorithms
   Numerical algorithms, Sequential and binary search algorithms. Quadratic sorting algorithms and O (n log n) sorting algorithms. Algorithms on graphs and their complexities.

4. Approximation Algorithms
   Introduction, Absolute approximation, Epsilon approximation, Polynomial time approximation schemes, Probabilistically good algorithms.

5. Advanced Algorithmic Analysis
   Amortized analysis, online and offline algorithms, randomized algorithms. Dynamic programming: matrix chain multiplication and longest common subsequence, Greedy algorithms: action-selection problem and Huffman codes, combinatorial optimization.

6. Parallel Algorithms

Reference Books:
1. Kishore S. Trivedi, “Probability & Statistics with Reliability, Queing, and Computer Science Applications” PHI
2. Cormen, Leiserson, Rivest, “Algorithms”, PHI
510102 Emerging trends in Computer Architecture

Teaching Scheme:
Lectures: 4 Hrs/Week

Exam Scheme:
Theory Paper: 100 Marks
Total Credits: 03

1. Advanced Computer System architecture
Case studies: IBM cluster, Beowulf cluster-caltech, Digital true Unix cluster(springerlink.com/content), next generation clusters- infiniband.
MPP - Technology, new generation of MPPs, Distributed memory MPPs -, Achieving high performance on NOW

2. System Interconnects:
Basics revised, Gigabit network technologies – Giga Bit Ethernet, Myrient (Myricom), Quadriinet(Quadrics), PARAM net (CDAC), ATM switches & networks – ATM architecture, inter network connectivity

3. Threading, synchronization and communication
Multithreaded Architecture, approaches to multi threading, Software multithreading, Synchronization mechanisms, TCP/IP protocol suite, fast & efficient communication-Log P Communication model, communication algorithms, Case Study: IBM Power IV, V

4. Storage
Storage Area Network (SAN), Network attached storage and direct storage. Storage area network versus system area network, Computer Architecture Research Challenges: How Computer Architecture Trends may Affect Future Distributed Systems

5. Grid Computing
Grid fundamentals – Cluster to grid computing, Grid computing models- ARC model, ARCC model, Sneha-Samuham computing model, Grid architecture considerations, Standards for grid -OGSA, OGSI, OGSA-DAI, Grid FTP, WSRF, Web services related standards, Grid architecture models, Computational grid, Data grid, Grid topologies, Basic methodology

6. Parallel programming:
Paradigms, parallel programming models, shared memory programming, message passing programming – paradigms, MPI, PVM, Threads, Data parallel programming – model, Case study – High performance FORTRAN, CCC, HP Java, Other data parallel approaches

Reference Books
1. Kai Hwang, Zhiwei Xu -"Scalable Parallel Computers"
3. Introduction to grid computing - Bart Jacob, Michael Brown
4. Grid Computing – A research Monograph - D. Janakiram (TMGH)
5. Parallel Programming
6. Storage Networks – Wulfgong Muller (Wiley)
510103 Principles and Practices for IT Management

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Management Perspectives
Role and importance of management, process of management – planning, organizing, staffing, directing, controlling. Nature, purpose and principles of management, Business policy, tools and techniques of strategic management, business ethics and social responsibilities

2. Preliminary planning of an IT Project
Gathering project Information, defining the project goals, establishing project priorities, requirements analysis, risk management, budgeting a project, creating a work breakdown structure, estimation

3. Organizing an IT Project
Organizing a Project Team: - Assessing internal scales, creating a team, managing team issues, resources procurement
Preparing and Implementing the project plan: - Defining the project schedule, project network diagram creation and analysis, project constraints, tracking project progress and financial obligations
Revising the project plan:- need for revision , establishing change control, implementing the project changes, coping with project delays

4. Group Dynamics and Team Management
Theories of Group Formation – Formal and Informal Groups and their interaction, Importance of teams - Formation of teams – Team Work, Leading the team, Team Meeting. Conflict Management - Traditional vis-à-vis Modern view of conflict, Conflict Process - Strategies for resolving destructive conflict, Stress management, employee welfare, energy management and energy audit,

5. Modern approaches to management
Concept of Knowledge management, change management, technology management, supply chain management, introduction to Intellectual property Rights (IPR) and cyber laws, process and project quality standards – six sigma, CMM, CMMI, PCMM, Impact of IT quality management systems, learning organizations

6. Applications of IT in management
Application of IT in functions like finance and accounting, stores, purchase, product design and development, quality control, logistics, customer relationship, marketing, project management, health care, insurance, banking, agriculture and service sector.

Reference Books:
2. Management-Tasks, Responsibilities and practices, Peter Drucker
3. Management Theory and Practice- Ernst Dale
4. Management Information System-Javadekar
5. Business Policy- Azhar Kazmi
510104 Elective-I

510104A Advanced Software Engineering

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Introduction to Software Engineering

2. Design Engineering

3. Software Development Methodologies
Iterative Software Development, Software Reuse, CBSE, Critical Systems Development Software Evolution

4. Software Management
Verification and Validation, Software Testing, Critical Systems Validation, Managing People, Software Cost Estimation, Quality Management, Process Improvement, Configuration Management

5. Alternative Paradigms
Extreme Programming, Agile Software Engineering, Clean Room Software Engineering, Introduction to Formal Methods, soft systems

6. Advanced Software Engineering Process
Software Process Improvement, Software Economics, Software Quality, Software Metrics, Software Maintenance, Risk management, Requirement Engineering

Reference Books:

510104 B Intelligent Systems

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Intelligent Agents
Introduction. How agents should act, structure: Table-driven, Simple reflex, Goal-based, Utility-based, Agents that keep track of world, Environments.

2. Problem Formulation
Problem solving, Formulating problems: Knowledge and problem types, Well-defined problems and solutions, Measuring problem-solving performance, Choosing states and actions.

3. Search Methods

4. Planning
A simple planning agent. From problem solving to planning: Representation of actions, Representation of states, Representation of goals, Representation of plans. Basic representation for planning: Representations for states and goals, Representation for actions, Situation space and plan space, Representations for plans.

5. Partial Order Planning
Example: partial order planning, Initial plan, Achieving preconditions, Protected links and threats, Promotion and demotion, Recovering from dead ends. A partial-order planning algorithm, Planning with partially instantiated operators, Knowledge engineering for planning: Blocks world, Shakey's world.

6. Practical Planning

7. Planning and Acting

8. Uncertain Knowledge and Reasoning
Uncertainty, Probabilistic Reasoning Systems, Making simple decisions, Making complex decisions. Reasoning: Agents that reason logically, First-order logic, Inferences in 1st order logic

Reference Books:
510104C Internet Routing Design

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1 Networking and Network Routing: An Introduction

2 Routing Algorithms:
Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra’s Algorithm, Widest Path Algorithm, Dijkstra-Based Approach, Bellman–Ford-Based Approach, k-Shortest Paths Algorithm.
OSPF and Integrated IS-IS: OSPF: Protocol Features, OSPF Packet Format, Integrated IS-IS, Key Features, comparison
BGP: Features, Operations, Configuration Initialization, phases, Message Format.
IP Routing and Distance Vector Protocol Family: RIPv1 and RIPv2

3 Routing Protocols: Framework and Principles

4. Internet Routing and Router Architectures
Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability.
Router Architectures: Functions, Types, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures

5. Analysis of Network Algorithms
Network Bottleneck, Network Algorithmics, Strawman solutions, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms.
IP Packet Filtering and Classification: Classification, Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for d Dimensions,
6. Quality of Service Routing

7. Routing and Traffic Engineering

REFERENCES:

1. Introduction
Applications, history of mobile communication, introduction to GSM system, GSM background, GSM operational and technical requirements.

2. GSM Architecture
GSM network structure, cell layout and frequency planning, mobile station, base station systems, switching sub systems, home locations, register, Visiting Location Register (VLR), equipment identity register, echo canceller.

3. Time and Frequency Axis Representation
Time domain representation, structure of TDMA slot with frame; Time organization of signaling channels, frequency hopping.

4. Mobility Management
Signaling protocols, steps in formation of a call, location updates, MS-PSTN call, PSTN-MS call, MS-MS call, call handover.

5. Security Management
Authentication, encryption, characteristics of SIM, equipment identification

6. Spectral Efficiency of GSM Systems
FDMA, TDMA, CDMA.

7. GSM Protocols
Physical layer, data link layer, MTP3, SCCP, TCAP protocol, Application layers-RR layer, MM-layer, CC-layer, message formation, MAP protocol-MAP protocol for MM, MAP protocol for basic service support.

Reference Books:
1. Asha Mehrotra, GSM System Engg. ,Artech House
4. Jochen Schiller, Mobile Communication, Pearson Education Asia
510105 Elective-II
510105A Information and Network Security

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures: 3hrs/week</td>
<td>Theory: 100 Marks</td>
</tr>
<tr>
<td>Total Credits: 03</td>
<td>Total Credits: 03</td>
</tr>
</tbody>
</table>

1. Introduction
Management of malicious intent, threat scenarios, critical infrastructures, security targets and policies, security mechanisms, examples of applications and their different security requirements, multi-lateral security, privacy and data protection, computer misuse legislation, Operating system and network security. Cyber laws.

2. Security Models


4. Network Layer Security
Routing algorithm vulnerabilities: route and sequence number spoofing, instability and resonance effects. Information hiding: DMZ networks, route aggregation and segregation. ICMP redirect hazard: denial of service. ARP hazard: phantom sources, ARP explosions and slow links. Defending against Chernobyl packets and meltdown. Fragmentation vulnerabilities and remedies: (ICMP Echo overrun).

5. Transport and Application Layer Security
Techniques for - fault detection, isolation and repair. Secure network infrastructure services: DNS, NTP, SNMP, Privacy enhanced mail (PEM), Secure binding of multimedia streams, Secure RTP. Secure RSVP. Mobile systems: Address Export and re-use. Session key management: Blind-key cryptosystems (NTP).

6. Firewalls

7. Key and Certificate Management
8. Security in Wireless Networks
How it is different, Methods and procedures, MIN/ESN, shared secret data authentication, Token based, public key based.

Reference Books:

7. Cheswick W., Bellovin S., ”Firewalls and Internet Security: Repelling the Wily Hacker”, 2nd ed., Addison-Wesley
8. Garfinkel S., Spafford G., “Practical Unix and Internet Security”, O'Reilly
510105B Advanced Compilers

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Basics of Compiler Design
Planning a compiler, approaches to compiler design, compiler development tools – Lex and Yaac.

2. Code Generation
Efficient code generation for expressions, code generator generators, code generation for pipelined machines, register allocation techniques.

3. Code Optimization
Classical theory of data flow analysis, bi-directional data flows, unified algorithm for data flow analysis, theory of data flow analysis, program representation for optimization - SSA form.

4. Parallel Compilers
Motivation and overview, Structure of a Parallelizing compiler. Parallelism detection: data dependence, direction vectors, loop carried and loop independent dependences.

5. Compilation for Distributed Machines
Data partitioning, instruction scheduling, register allocation, machine optimization. Dynamic compilation.

6. Advanced Topics
Just in time (JIT) compilers, Auto scheduling compilers.

Reference Books:
1. Aho, Ulman, Sethi, “Compiler Principles and Techniques”, Addison Wesley
510105C Web Services and SOA

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Web services Technologies
   What is Web services, Evolution and differences with Distributed computing, WSDL, SOAP, UDDI, Transactions, Business Process Execution Language for Web Services, WS-Security and the Web services security specifications, WS-Reliable Messaging, WS-Policy, WS-Attachments

2. SOA Fundamentals
   Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment

3. SOA Planning and Analysis
   Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, non-runtime qualities), business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets (ESA)

4. SOA Design and implementation
   Service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance

5. Managing SOA Environment
   Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrics), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle

6. Web 2.0 technologies
   Introduction to Ajax, Ajax Design Basics, JavaScript, Blogs, Wikis, RSS feeds
Reference Books

510105D Embedded System Design

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Introduction to Embedded Systems
Classification, characteristics, design metrics, requirements, trends. Brief Review of Sensors, signal conditioning and data converters. RAM technology and programming of EPROM.

2. Embedded Hardware
Dedicated processor and General Purpose Processors. 32 bit ARM architecture, High performance processors- Intel Xscale/IBM PowerPC/MIPS R5000, Development environment.

3. Interfacing of Microprocessor to Peripherals

4. Target Devices
Different types of ASICS: FPGA, CPLD architectures.

5. Real Time Operating Systems (RTOS)
OS Services, goals and structures, features, characteristics, process management, memory management, File system organization and implementation, I/O subsystem, Real time task models and performance metrics, Real time features of Vx works, WIN CE, QNX, Nucleus, RT Linux. Network OS, Inter Process communication of Processes, Tasks and Threads, OS Security Issues, One case study.

6. Programming Concept and Embedded Programming

Reference Books:
4. Barr M., “RTOS”.
5. Smith M., “Application specific Integrated circuits”.
510106 Laboratory Practice – I

Teaching Scheme  Examination Scheme
Practicals: 6 Hrs/week  Term Work: 50 Marks

Total Credits : 03

Experiments/Assignments based on 510101 and 510105 and/or small project. The lab in
charge should frame minimum of five assignments.

510107 Seminar – I

Teaching Scheme  Examination Scheme
Practicals: 4 Hrs/week/student  Term Work: 50 Marks

Total Credits : 02

Seminar on state-of-art topic.
510108 Distributed Systems

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Introduction of Distributed Systems
   Introduction, Examples of distributed systems, Resource sharing and the Web, Challenges, System models- Architectural models, Fundamental models

2. Communication
   Interprocess Communication- Introduction, The API for the Internet protocols, External data representation and marshalling, Client-server communication, Group communication, Interprocess communication in UNIX, Distributed Objects and Remote Invocation-Communication between distributed objects, Sun RPC, Events and notifications, Java RMI.

3. Synchronization
   Clocks, events and process states, Synchronizing physical clocks, Logical time and logical clocks, Global states, Mutual exclusion, Elections, Multicast communication, Distributed transactions

4. Distributed File Systems
   Introduction, File service architecture, Sun Network File System, Andrew File System Name Services-Name services and the Domain Name, Directory services, Global Name Service, X.500 Directory Service, Peer-to-Peer Systems

5. Distributed Shared Memory
   Design and implementation issues, Sequential consistency, Release consistency, Other consistency models

6. Distributed System Security
   Introduction, Potential attacks to computer systems, Cryptography, Authentication, Access control, Digital signatures, Design principles, DCE security service

7. Web Services
   Introduction, Web services-SOAP; Service descriptions and IDL for web services, A directory service for use with web services, XML security, Coordination of web services, Grid
**Text Books:**

**Reference Books:**
2. Andrew S. Tanenbaum & Maarten van Steen,"Distributed Systems -Principles and Paradigms" PHI Publication
3. Distributed Systems, Sape Mullender (Editor),Addison-Wesley Publication
510109 High Performance Database Systems

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. High performance Issues and concerns in databases, Database Tuning and Performance: benchmarking, TPC benchmarks, object oriented benchmarks; TP Monitors, Object Transaction Management
2. Query Optimization: Physical layer, Access Methods, Query Optimization, DBMS buffers, caches, and optimisation high level query languages and low level primitive operations, join algorithms.
3. Advanced concepts in Transaction Management: ACID properties, pessimistic locking, optimistic locking, flat transactions, nested transactions, deadlock detection and management; Recovery: write-ahead logging, shadow paging; Indexing structures: Btrees, hash files, multi-attribute indexing; Distributed databases, Schemas, Architectures, Queries, Transactions
4. Data warehousing: Heterogeneous information; the integration problem; the Warehouse Architecture; Data Warehousing; Warehouse DBMS, Data Warehouse Models and OLAP operations. ETL, materialized views, Dashboards, BI
5. SQL Extensions: Aggregations, SQL 3 , SQL 2006 XML integration
6. Data Mining: KDD process, Data mining applications, Data mining Techniques and Algorithms
7. Emerging trends in databases: Active and Deductive databases, Main Memory databases, OR Databases, Semantic databases
8. Emerging database technology case studies: XML, Hibernate, Directory services and LDAP

Reference Books
4. Jiawei Han, Micheline Kamber, “Data Mining”, Second Edition, Elsevier
1. Essentials of Probability


2. Delay Models in Data Networks

Multiplexing of Traffic on a Communication Link, Queuing Models- Little’s Theorem, Little’s Theorem, Probabilistic Form of Little’s Theorem, Application of Little’s Theorem, The M/M/1 Queuing System, Arrival Statistics, Service Statistics, Markov Chain Formulation, Deviation of the Stationary Distribution, Occupancy Distribution upon Arrival, Occupancy Distribution upon Departure, The M/M/m, M/M/∞, M/M/m/m, AND Other Markov Systems, The M/M/m: The m-Server Case, M/M/∞: The Infinite-Server Case, M/M/m/m: The m-Server Loss System, ltidimensional Markov Chains- Applications in Circuit Switching, The M/G/1 System, M/G/1 Queues with Vacations, Reservations and Polling, Priority Queuing

3. Inside an IMP

Queuing in the Network Layer at an IMP, Basic Single Queue Model, Applications of Queuing Analysis Outside of Networking, The Poisson Arrival Model, Properties of a Poisson Process, Interarrival Times of a Poisson Process, The M/M/1 Queue, Aside: Queuing Notation, Aside: The D/D/1 Queue, State Analysis of an M/M/1 Queue, Balance Equations, Solving the Balance Equations, The Finite Buffer Case: M/M/1/N, Blocking Probability and the Right Size Buffer, Throughput in the Finite Buffer Case, Approximation of a Finite Buffer System by the Infinite Buffer Model, Little's Formula and Queuing Delay, Applying Little's Formula to an M/M/1 Queue, Applying the M/M/1 Results to a Single Network Link, Other Queuing Models
4. Network Design
Problem definition: Multipoint line layout heuristics, CMST algorithm, ESAU-William’s algorithm, Sharma’s algorithm, Unified algorithm, Bin packing, Terminal assignments, Concentrator location

5. Network Analysis
Queuing Networks, Closed Queuing Network Example, Nodes in a Packet Switched Network (PSN), Queuing Network Model of Nodes in a PSN, Queuing Network Analysis of a PSN, performance analysis of Data Link Layer, Network layer, QoS,

6. Network Administration
Functions and responsibilities, Network planning and implementation, Sub-netting, Bandwidth management, security issues, Tools for BW and security management, modifying network implementation

Reference Books
5. Stallings W., “High Speed Networks and Internet: Performance and Quality of Service”, Prentice-Hall
510111 Elective-III
510111A Software Design and Architecture

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Software Design Process
Role of Software Design: Software design process, nature of design process, design in the software design process, design qualities; Transferring Design Knowledge: describe design solution, transferring design knowledge, design notations, design strategies, design patterns-design by template and design reuse, designing with patterns, patterns in the wider design context.

2. Design Practices
Stepwise refinement, incremental design, structured analysis and structured design, Jackson structured programming (JSP), Jackson system development (JSD), designing with objects, component-based design, formal approach to design

3. Introduction to Software Architecture
Software Architecture, Relationships to Other Disciplines, Multi-Disciplinary Overview, Foundations of Software Architecture, Software architecture in the context of the overall software life cycle, Architectural Styles, CASE study of Architectures

4. Software Architecture Design

5. Software Architecture Documentation
Advanced Concepts, Documenting Software Interfaces, Documenting Behavior, Choosing the Views, Building the Documentation Package

6. Archetype Patterns
Archetypes and Archetype Patterns, Model Driven Architecture with Archetype Patterns, Literate Modeling, Archetype Pattern, Customer Relationship Management (CRM) Archetype Pattern, Product Archetype Pattern, Quantity Archetype Pattern, Rule Archetype pattern.
Reference Books:

51011B Pattern Recognition and Machine Vision

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Modeling
   Maximum likelihood estimation and linear models, Least squares fitting, multi-dimensional models, Fitting a polynomial, unbiased model and prediction, Non-linear modeling and fitting, Principal components regression and cross-validation, introduction to kernel methods

2. Classification
   The least mean square classifier, Fisher’s discriminant Classification using a Mahalanobis and other distance functions, Discriminant function and the maximum Likelihood discriminant, Bayes minimum error rate and minimum risk discriminant Multi-Category Classification; LMS approximation, LDA and other Approaches, eg. Nearest neighbor, Classifier performance, Non-linear kernel methods, Non-linear regression and Levenberg-Marquardt algorithm

3. Image formation
   Homographies; mapping from a plane to a plane Euclidean, affine and projective invariants, cross-ratios, Application to plane figures and canonical frame of reference, Landmark point and Procrustes alignments, Principal components analysis, active shape models, Multi-scale methods

4. Flexible shape and Appearance models
   Incorporating the intensity, pixel and geometry, hierarchical PCA Application and FEM Extensions of statistical models, Estimation theory

5. Kalman filtering
   Linear Kalman filters and extensions, Application to corner tracking, motion estimation and 3D data fusion, Feature matching, differential and hierarchical approaches Epipolar and motion constraints: F matrix

6. Stereo and motion Estimation
   Optical flow and motion field, Over-determined systems and multiple camera stereo, Application: tracking, stereo data fusion and surface Triangulation Feature-based approaches, graph matching and interpretation tree

7. Object recognition
   Object recognition from invariants and use of geometrics hashing, Recognition by linear combination of views and virtual views, Eigenspace multi-view methods, applications

Reference Books

1. C Bishop, Neural Network for Pattern Recognition, OUP
3. E Trucco and A Verri, Introductory Techniques for 3-D Computer Vision, PHI
5. Forsyth D, Ponce, Computer Vision: A modern approach, PHI
51011C Network Programming

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. The Transport Layer: TCP and UDP with policy control
   TCP Connection Establishment and Termination, TIME_WAIT State, Port Numbers, Concurrent Servers, Buffer Sizes and Limitations.

2. Sockets and Socket Programming
   Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, socket Function. TCP Client-Server: TCP Echo Server, TCP Echo Client, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host. UDP Sockets: UDP Echo server, UDP Echo Client.

3. Routing Sockets
   Datalink Socket Address Structure, Reading and Writing, Interface Name and Index Functions

4. Name and Address Conversions
   Domain Name System, Functions. Advanced Name and Address Conversions: Functions and Implementation

5. IPv4 and IPv6 Interoperability
   IPv4 Client, IPv6 Server, IPv6 Client, IPv4 Server, IPv6 Address Testing Macros, IPV6_ADDRFORM Socket Option

6. Multicasting and Broadcasting
   Broadcast Addresses, Unicast versus Broadcast, Multicasting: Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, Simple Network Time Protocol, SNTP.

7. Threads
   Thread Functions: Creation and Termination, TCP Echo Server, Thread-Specific Data, Web Client and Simultaneous Connections

8. Client-Server Design Alternatives
   TCP Client Alternatives, TCP Test Client, Iterative Server, Concurrent Server, Thread Locking around accept, TCP Preforked Server, Descriptor Passing, TCP Concurrent Server, One Thread per Client, TCP Prethreaded Server.

Reference Books:
3. UNIX Internals – “A new Frontier”, PHI
510111D  Advanced Internet Programming

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Introduction to Web
   Introduction to WWW, TCP/IP, HTTP, FTP, UDP, N-Tier, Markup Languages – HTML, DHTML, DNS, URL, Browsers

2. Introduction to J2EE

3. Dynamic Web Programming – Part 1 (Client Side)
   Java Applets, Java script

4. Dynamic Web Programming – Part 2 (View)
   JSP, JSTL, ASP, PHP

5. Dynamic Web Programming – Part 3 (Model & Controller)
   Servlets, Servlet Life cycle, C#, Java beans, Introduction to EJBs, JDBC

6. APIs

Reference Books

1. Ravi Kalakota and Andrew B Whinston, “Frontiers of Electronic commerce”, Addison Wesley,
2. Eric Ladd, Jim O’ Donnel, “Using HTML 4, XML and Java”, Prentice Hall of India – QUE,
3. Jeffy Dwight, Michael Erwin and Robert Niles, “Using CGI”, prentice Hall of India – QUE,
4. Scot Johnson, Keith Ballinger, Davis Chapman, “Using Active Server Pages”, Prentice Hall of India,
8. Deitel & Deitel, Java How to Program, Prentice Hall
510112A   Software Project Management

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Introduction to Project Management
Project Activities, Structures and Frameworks, Strategy and Project Management, Project
Definition, Balancing Development Needs with Organizational Expectations, Driving the
Implementation: Recognizing and Overcoming Challenges

2. Project Planning and Scheduling
Best Practices for Project Planning, Developing Realistic Estimates Integrating the
Schedule and Critical Path, Cost and Quality Planning, Risk analysis and Planning

3. Complex Projects and Review
Introduction to Complex Projects, Assessing Project Viability, Managing Stakeholders,
Controlling Complex Project Risk, Procuring Products and Services, Preparing for
Project Phase Reviews, Reviewing Project Outcomes, Designing Critical Platforms for
Success, Improving Project Performance through Qualitative Analysis, Project
Organizations, Project Controls

4. Function Point Analysis
Software Measurement, Executive Introduction to Function Points, Measuring with
Function Points, Using Function Points Effectively, Introduction to Function Point
Analysis ,Sizing Data Functions, Sizing Transactional Functions ,General System
Characteristics, Calculating And Applying Function Points, Counting Advanced
Technologies Counting a GUI Application , Counting an Object-Oriented Application ,Tools.

Reference Books:
1. Quality Software Project Management by Robert T. Futrell, Donald F. Shafer,
   Linda I. Shafer Publisher: Prentice Hall PTR; 1st edition (January 24, 2002)ISBN-
2. Essentials of Software Project Management, second edition,by Richard Bechtold
   (Author) Publisher: Management Concepts; second edition (April 12, 2007)
3. Software Project Management by Bob Hughes, Mike Cotterell Publisher:
   by Edward Yourdon, Richard H. Thayer Publisher: Wiley-IEEE Computer
   0818680007
510112B  Infrastructure Management

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Infrastructure Management Overview
   Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today’s computing environment, Total cost of complexity issues, Value of Systems management for business

2. Preparing for Infrastructure Management
   Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL)

3. Service Delivery Processes
   Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management

4. Service Support Processes
   Configuration Management, Service desk, Incident management, Problem management, Change management, Release management

5. Storage and Security Management
   Introduction Security, Identity management, Single sign-on, Access Management, Basics of network security, LDAP fundamentals, Intrusion detection, firewall, security information management
   Introduction to Storage, Backup & Restore, Archive & Retrieve, Space Management, SAN & NAS, Disaster Recovery, Hierarchical space management, Database & Application protection, Bare machine recovery, Data retention

Reference Books:
510112C Data Warehousing and Data Mining

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Introduction to data mining (DM)

Kind of data, DM Functionalities, Classification of DM Systems, Issues in DM, What is Data warehousing (DW)? Its need, Multidimensional data model: Data cubes, Stars, snowflakes and fact constellations, defining schemas, concept hierarchies, OLAP, DW architecture: Steps for design and construction, Three-tier architecture, Types of OLAP servers, DW Implementation, back-end tools and utilities.

2. Data Preprocessing

Why to preprocess data?, Data cleaning: Missing Values, Noisy Data, Data Integration and transformation, Data Reduction: Data cube aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction Discretization and Concept Hierarchy Generation.
Data Mining Primitives, Languages and System Architectures: Task relevant data, Kind of Knowledge to be mined, DM Query languages: Syntax, Designing GUI, architectures of DM Systems.

3. Concept Description

What is concept description?, Data Generalization and summarization-based characterization, Attribute relevance, class comparisons.
Association Rule Mining: Market basket analysis, basic concepts, Finding frequent item sets: Apriori algorithm, generating rules, mining Multi-level Association rules from relational databases and Warehouses, Correlational analysis, constraint-based association mining.

4. Classification and Prediction

What is classification and prediction? Issues, Classification using Decision trees, Classification by Bayesian and Backpropagation, K-Nearest Neighbor classifiers, case-based reasoning, genetic algorithms, Rough and Fuzzy set approaches, Linear and non-linear regression, classifier comparison, Introduction of tools such as OLE DB/DBMiner/WEKA/iDA/ORACLE DM Tools, Combining Multiple Classification models: Bagging and Boosting.

5. Clustering

Introduction to clustering, types of data, partitioning methods: k-Means, Hierarchical clustering: BIRCH, CURE and Chameleon Clustering, Density (DBSCAN, OPTICS, DENCLUE), Grid (CLIQUE) and Model based clustering: Statistical and Neural network approach, Outlier Analysis: Statistical, Distance and Deviation-based Outlier detection.
6. Mining Spatial Databases
Spatial Data Cube and OLAP, Spatial Association, Clustering and classification
Mining Text Databases: Text Data Analysis and Information Retrieval, Text Mining:
Keyword-based Association and Document Classification
Mining the WEB: Mining Web’s link structure, Classification of Web pages, Web Usage
Mining

References

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann
4. H. Witten, E. Frank, “Data mining: Practical machine learning tools and

510112D Open Elective (Self Study)**

Teaching Scheme
Lectures: 3hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

** - BoS Computer Engineering will declare the list of subjects which can be taken
under Open elective
510113 Laboratory Practice – II

Teaching Scheme
Practicals: 6 Hrs/week

Examination Scheme
Term Work: 50 Marks
Total Credits : 03

Experiments/Assignments based on 510108, 51009, 510111 and/or 510112 and/or small project. The laboratory in charge should frame minimum of five assignments.

510114 Seminar – II

Teaching Scheme
Practicals: 4 Hrs/week/student

Examination Scheme
Term Work: 50 Marks
Total Credits : 02

Seminar on state-of-art topic.

510115 Seminar – III

Teaching Scheme
Practicals: 04 Hrs/week/student

Examination Scheme
Term Work: 50 Marks
Total Credits : 02

Seminar on Dissertation Topic.

510116 Project Stage – I

Teaching Scheme
Practicals: 18 Hrs/week/student

Examination Scheme
Term Work: 50 Marks
Total Credits : 06

Project will consist of a System Development in Hardware/Software. Project work should be carried out using Software Engineering principles and practices.

510116 Project Stage – II**

Teaching Scheme
Practicals: 18 Hrs/week/student

Examination Scheme
Term Work: 200 Marks
Total Credits : 12

** :- The Term Work of Project Stage-II will be assessed jointly by the pair of Internal and External examiner along with oral examination of the same.