10/01/2008

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

Term-I

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Total	Credits
510101	Applied Algorithms	03	--	100	--	--	100	3
510102	Emerging trends in Computer Architecture	03	--	100	--	--	100	3
510103	Principles and Practices for IT Management	03		100			100	3
510104	Elective-I	03	--	100	--	--	100	3
510105	Elective-II	03	--	100	--	--	100	3
510106	Laboratory Practice-I	--	06		50		50	3
510107	Seminar-I		04		50		50	2
	Total	**15**	**10**	**500**	**100**		**600**	**20**

Term-II

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Marks	Credits
510108	Distributed System	03	--	100	--	--	100	3
510109	High Performance Database Systems	03	--	100	--	--	100	3
510110	Network Design, Modeling and Analysis	03	--	100	--	--	100	3
510111	Elective-III	03	--	100	--	--	100	3
510112	Elective-IV	03	--	100	--	--	100	3
510113	Laboratory Practice-II	--	06		50		50	3
510114	Seminar-II	--	04	--	50	--	50	2
	Total	**15**	**10**	**500**	**100**		**600**	**20**

Term-III

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Total	Credits
510115	Seminar-III	--	04	--	50	--	50	2
510116	Project stage-I	--	18	--	50	--	50	6
	Total	**--**	**22**	**--**	**100**		**100**	**8**

Term-IV

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Marks	Credits
510116	Project stage-II*	--	18	--	150	50	200	12
	Total	**--**	**18**	**--**	**150**		**200**	**12**

* : 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

Subject Code	**Elective-I**	Subject Code	**Elective-II**
510104 A	Advance Software Engineering	510105 A	Information and Network Security
510104 B	Intelligent Systems	510105 B	Advanced Compilers
510104 C	Internet Routing Design	510105 C	Web Services and SOA
510104 D	Mobile Computing	510105 D	Embedded System Design

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

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

51510101 Applied Algorithms

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits: 03

1. Introduction to Probability and Problem Solving:

Summation Formulas and properties, Bounding Summations, **Counting and Probability**: Probability Axioms, Discrete and continuous Probability Distribution, Conditional Probability, Baye's Theorem, Discrete Random Variables, Expected Value of Random Variable, Variance and standard deviation, Geometric and Binomial distribution, **Proof Techniques** contradiction, mathematical induction, strong induction, recursive mathematical definitions.

2. Analysis of Algorithms

Review of algorithmic strategies, **Asymptotic analysis**: upper and lower complexity bounds. Identifying differences among best, average and worst Case Behaviors. Big O, little O, omega and theta notations, Standard complexity classes. Empirical measurements of performance. Time and space tradeoffs in algorithms. Analyzing recursive algorithms using recurrence relations.

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

PRAM Model: Parallel computers and models, performance measures. Parallel Complexity: The NC Class, Basic Lower and Upper Bounds. Algorithms for Parallel Computers: Pointer Doubling, CRCW algorithms and EREW algorithms. Brent's Theorem and Work Efficiency.

Reference Books:

1. Kishore S. Trivedi, "Probability & Statistics with Reliability, Queing, and Computer Science Applications" PHI
2. Cormen, Leiserson, Rivest, "Algorithms", PHI
3. Bressard, "Fundamentals of Algorithms", PHI
4. Horowitz, Sahni, "Fundamentals of Computer Algorithm", Galgotia
5. Lakshmivarahan S., Dhall S., "Analysis and Design of Parallel Algorithms", McGrawHill
6. S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley, 2000
7. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley
8. Knuth, "Art of Programming", Addison Wesley
9. C Papadimitriou and K Steiglitz, "Combinatorial Optimization", 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

EPIC Concepts, Multi core Architecture, **Case Study :** Intel Itanium Processor, multiprocessors ,Symmetric & CC-NUMA multiprocessors, SMP Servers-File Servers/ Graphics Servers/Internet Servers. Cluster Computing : Clustering- challenges, support for clustering, COW s, support for single system image Communication substrate, MPI/PVM ,HPCC suites, Cluster Monitoring and Management Tools. Cluster of servers, .Blade Servers

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), Quadrinet(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"
2. Data Manual of respective processors.
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:

1. Joseph Phillips, “IT Project Management”, Tata McGraw-Hill 2003 Edition
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
6. Industrial Energy Conservation- D.A.Ray, Pergamon Press
7. Resisting Intellectual Property-Halbert, Taylor & Francis Ltd ,2007

510104 Elective-I

510104A Advanced Software Engineering

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs/week	Theory: 100 Marks
	Total Credits : 03

1. Introduction to Software Engineering
Introduction, Socio-technical Systems, Dependability, Software Processes, Software Requirements, RE Processes, Systems Models, Critical Systems Specification, Formal Specification

2. Design Engineering
Architectural Design, Distributed Systems Architecture, Application Architectures Object-oriented Design, Real-time Systems, User Interface Design

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:

1. Software Engineering, Ian Sommerville, 8th Edition, Addison-Wesley, 2006,ISBN-10: 0321313798, ISBN-13: 9780321313799
2. Software Engineering: A Practitioner's Approach, 6/e, Roger S Pressman, McGraw Hill, 2005, ISBN: 0072853182

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

Searching for solutions, Search strategies: Time, space, optimality and completeness issues. Un-informed search methods: Breadth-first, Depth-first, Iterative deepening, Bi-directional search, Avoiding repetitions, Constraint satisfaction search. Informed search methods: Best first search: Greedy search, A*, Heuristic functions, Memory bounded search: IDA*, SMA*. Iterative improvement algorithms: Hill climbing, Simulated annealing, Application in CSPs.

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

Practical planners: Spacecraft assembly, Job shop scheduling, Space mission scheduling, Buildings and aircraft carriers. Hierarchical decomposition: Extending the language, Modifying the planner. Analysis of hierarchical decomposition: Decomposition and sharing, Decomposition versus approximation. More expressive descriptions: Conditional effects, Negated and disjunctive goals, Universal quantification, A planner for expressive operator descriptions. Resource constraints: Using measures in planning, Temporal constraints.

7. Planning and Acting

Conditional planning and execution monitoring, Conditional planning: The nature of conditional plans, Algorithm for generating conditional plans, Extending the plan language. A simple re planning agent: Bounded vs. unbounded indeterminacy, Simple re planning with execution monitoring. Fully integrated planning and execution. Discussion and extensions: Comparing conditional planning and re planning, Coercion, abstraction and aggregation.

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:

1. Russell S., Norving P., "Artificial Intelligence – Modern Approach"
2. Henry P., "Artificial Intelligence", 3rd Ed., Winstone
3. Patric H., "Lisp programming language", Winstone

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

Addressing and Internet Service: An Overview, Network Routing, IP Addressing, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology, Architecture, Network Management Architecture, Public Switched Telephone Network

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

Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing, Protocol, Link Cost.

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 Address Lookup Algorithms : Impact, Address Aggregation, Longest Prefix Matching, Naïve Algorithms, Binary , Multibit and Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches

IP Packet Filtering and Classification : Classification, Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for *d* Dimensions,

6. Quality of Service Routing

QoS Attributes, Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching , Routing Protocols for QoS Routing, QOSPF: Extension to OSPF for QoS Routing, ATM PNNI.

7. Routing and Traffic Engineering

Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Problem Illustration: Layer 3 VPN, LSP Path Determination: Constrained Shortest Path Approach, LSP Path Determination: Network Flow Modeling Approach, Layer 2 VPN Traffic Engineering, Observations and General Modeling Framework, Routing/Traffic Engineering for Voice Over MPLS.

REFERENCES:

1. Network Routing: Algorithms, Protocols, and Architectures Deepankar Medhi and Karthikeyan Ramasamy (Morgan Kaufmann Series in Networking)
2. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)

510104D Mobile Computing

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

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
2. Jerry D. Gibson, The Mobile Communication Handbook , IEEE Press
3. William C.Y. Lee, Mobile Communication Design Fundamentals , Wily Series In Telecommunication
4. Jochen Schiller, Mobile Communication, Pearson Education Asia
5. Garg V., Joseph E. Wilkes, “Wireless and personal Communications Systems”, Prentice Hall

510105 Elective-II
510105A Information and Network Security

Teaching Scheme
Lectures: 3hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

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

Military and civil security, vulnerability and threat models, End-end security (COMSEC), link encryption (TRANSEC), compartments. Privacy. Authentication. Denial of service. Non-repudiation. Overview of private-key and public-key cryptographic algorithms: DES, RSA. Encapsulation. Encryption principles. Issues in multi-level secure systems. Internet security models: IPv4/IPv6 encapsulation header

3. Security Policies and Design Guidelines

Policies: Policy creation, Regularity considerations, Privacy regulations. Security: Infrastructure and components. Design Guidelines. Authentication: Authorization and accounting. Physical and logical access control. User authentication: Biometric devices.

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

Network partitioning, firewall platforms, partitioning models and methods, Secure SNMP, Secure routing interoperability: virtual networks (DARTnet/CAIRN). Transparent and opaque network services. Source masking and hidden channels.

7. Key and Certificate Management

Secure binding of public and private values: DNS certificates. Making and distributing key media: randomization, lifetime issues. Key agreement protocols: STS protocol and IETF work orders. Key Escrow: the Clipper chip. One-time passwords: schemes based on S/KEY, PKI components and Applications. Exploiting diversity and redundancy: Byzantine generals. Time-stamping and reliable ordering of events: NTP. Consensus and agreement protocols.

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:

1. Stallings, W., "Cryptography and Network Security: Theory and Practice", Second Edition, John Wiley
2. Schneier, B., "Applied Cryptography - Protocols, Algorithms, and Source Code in C", Second Edition. John Wiley and Sons, 1995
3. Stinson D., "Cryptography - Theory and Practice", CRC Press, Boca Raton, FA, 1995
4. Stein L., "Web Security: A Step-by-Step Reference Guide", Addison Wesley Longman, Inc., 1998
5. Gollmann, D., "Computer Security", Wiley, 1999
6. Anderson R., "Security Engineering: A Guide to Building Dependable Distributed Systems", Wiley
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
9. Amoroso E., "Fundamentals of Computer Security Technology", Prentice-Hall
10. Blacharski D., "Network Security in a Mixed Environment"

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 Parallelzing 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
2. Muchnik, “Advanced Compiler Design and Implementation”, Kauffman(1998)
3. Wolf M., “Optimizing Super Compiler for Super Computers”, Pitman(1989)
4. Banerjee U., kluwer, “Loop Optimization”, PHI (1997)

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 metrices), 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

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design**"**, Prentice Hall Publication, 2005.
2. Norbert Bieberstein, Sanjay Bose, Marc Fiammante, Keith Jones, Rawn Shah, **"**Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap**"**, IBM Press Publication, 2005.
3. *Sandy Carter*, "The New Language of Business: SOA & Web 2.0**",** IBM Press, 2007.
4. Thomas Erl, **"**Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services**",** Prentice Hall Publication, 2004
5. Dave Chappell, "Enterprise Service Bus**",**O'Reilly Publications, 2004
6. Sanjiva Weerawarana, *Francisco Curbera, Frank Leymann, Tony Storey, Donald F. Ferguson*, "Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS-Addressing, WS-BPEL, WS-Reliable Messaging, and More**",** Prentice Hall Publication, 2005
7. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services**",** Addison Wesley Publication, 2004
8. *Thomas Mattern, Dan Woods*, "Enterprise SOA: Designing IT for Business Innovation**",** O'Reilly publications, April 2006

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
Buses & protocols, ISA, EISA, PCI, ARM, I^2C, CAN, FIREWIRE, USB. Wireless protocol: Bluetooth and IEEE 802.11, 802.15, 802.16.: Introduction, features, area of applications. Interface for IRDA, SMART card and WEB enabling. Case study of emerging Serial and Parallel Bus standards (USB 2.0, IEEE1394,PCI, Compact PCI, PCI-X).

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
Programming in assembly Language and High level language C /C++ and/OR Java. Compilers and Cross Compilers, Source Code Engineering Tools, Programme modeling concept in single and multiprocessor system software, Software Engineering Practices in the Embedded Software Development Process.,

Reference Books:

1. Vahid F., Givargies T., “Embedded Systems Design”, John WILEY X SONS 2002
2. Raj Kamal, “Embedded Systems- Architecture, Programming and Design”, TMH 2003
3. Gupta R., “Co-synthesis of Hardware and Software for Digital embedded systems”, Kluwer.
4. Barr M., “RTOS”.
5. Smith M., “Application specific Integrated circuits”.
6 Liu, “Real-Time systems”, Pearson Ed. Asia
7. Manual of ARM processor.

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:

1.George Coulouris, Jean Dollimore and Tim Kindberg, *"Distributed Systems, Concepts and Design"*, Fourth Edition, Addison Wesley
2. Pradeep K. Sinha, "Distributed Operating Systems Concepts and Design" , PHI Publication

Reference Books:

1. Future Directions in Distributed Computing Research and Position Papers Series: Lecture Notes in Computer Science , Vol. 2584 Schiper, A.; Shvartsman, A.A.; Weatherspoon, H.; Zhao, B.Y. (Eds.) 2003, X, 219 p., Softcover ISBN: 978-3-540-00912-2
2. Andrew S. Tanenbaum & Maarten van Steen,"Distributed Systems -Principles and Paradigms" PHI Publication
3. Distributed Systems, Sape Mullender (Editor),Addison-Wesley Publication
4. Reliable Distributed Systems: Technologies, Web Services, and Applications, Kenneth P. Birman Springer; 1 edition
5. Galli D.L., "Distributed Operating Systems: Concepts and Practice", Prentice-Hall 2000.

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 t5ransactions, 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

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan “Database System Concepts”, Fifth Edition, TMH
2. Thomas Connolly, Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management “, 3rd edition, Pearson Education, LPE
3. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”,
4. Jiawei Han, Micheline Kamber, “Data Mining”, Second Edition, Elsevier
5. Ian H. Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Second Edition, (Morgan Kaufmann Series in Data Management

510110 Network Design, Modeling and Analysis

Teaching Scheme
Lectures: 3 Hrs/week

Examination Scheme
Theory: 100 Marks
Total Credits : 03

1. Essentials of Probability

Probability on a Sample Space, Basic Operations on Events, Probability on Events, Other Properties, Conditional Probability, Bayes Formula ,Independence, Random Variables, Random Variable as a Measurement, Probability Mass Function for a Random Variable, Cumulative Distribution Function, PMF and CDF for the 3 Coin Toss Example, Expectation of a Random Variable, Important Random Variables, Bernoulli Random Variable, Binomial Random Variable, Geometric Random Variable, Poisson Random Variable, Continuous-valued Random Variables, Properties of Continuous Random Variables, Expectation of a Continuous Random Variable, Important Continuous Random Variable: Exponential, Memory less Property of the Exponential

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

1. Kershenbaum A., "Telecommunication Network Design Algorithms", Tata McGraw Hill
2. Keshav S., "An Engineering Approach to Computer Networking," Addison-Wesley,1997.
3. Bertsekas D. and Gallager R., "Data Networks," 2nd Ed., Prentice-Hall, Englewood Cliffs, N.J., 1992.
4. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill
5. Stallings W., "High Speed Networks and Internet : Performance and Quality of Service", Prentice-
Hall
6. Zacker, "Networking – The Complete Reference", Tata McGraw Hill

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
Designing, Describing, and Using Software Architecture, IS2000: The Advanced Imaging Solution, Global Analysis, Conceptual Architecture View, Module Architecture View, Styles of the Module Viewtype, Execution Architecture View, Code Architecture View. Component-and-Connector Viewtype, Styles of Component-and-Connector Viewtype, Allocation Viewtype and Styles.

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:

1. David Budgen, "Software Design", 2nd edition, Pearson Education (LPE)
2. Applied Software Architecture ,Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional; 1st edition (November 4, 1999) ,ISBN-10: 0201325713 , ISBN-13: 978-0201325713
3. Essential Software Architecture, Ian Gorton Springer; 1 edition (2006) ISBN-10: 3540287132 ISBN-13: 978-3540287131
4. Design and Use of Software Architectures, by Jan Bosch, Addison-Wesley Professional; 1st edition (May 19, 2000) ISBN-10: 0201674947 ISBN-13: 978-0201674941
5. Documenting Software Architectures: Views and BeyondPaul Clements, *Software Engineering Institute*, Felix Bachmann Len Bass, *Software Engineering Institute* David Garlan James Ivers Reed Little Robert Nord Judith Stafford Publisher: Addison-Wesley Professional 2003 ISBN-10: 0201703726 ISBN-13: 9780201703726
6. Enterprise Patterns and MDA: Building Better Software with Archetype Patterns and UMLJim Arlow, Ila Neustadt ,Addison-Wesley Professional, 2004, ISBN-10: 032111230X ISBN-13: 9780321112309

510111B 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 fustion and surface Triangulation
Feature-based approaches, grapph 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
2. R O Duda, P E Hart , D G Stock, *Pattern Classification*, John Wiley and Sons, Second edition, 2001
3. E Trucco and A verri, *Introductory Techniques foe 3-D Computer Vision, PHI*
4. R Jain,R Kasturi, ,*Machine Vision*, McGraw Hill
5. Forsyth D , Ponce, *Computer Vision: A modern approach*, PHI

510111C 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:

1. Richard Stevens, Bill Fenner, “UNIX network programming Volume-1 - The Sockets Networking API”, 3rd edition.
2. W. Richard Stevens, “Advanced Programming in the Unix Environment”, Addison Wesley.
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

MVC Design Pattern, What Is J2EE?, J2EE Architecture, J2EE Components & Containers, Specification, Application servers, Struts

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

Java Mail API, JNDI, JMS, Introduction and evolution of Portals, Portal Application Development, Overview of IBM Portlet API, Overview of JSR 168 API, Developing sample JSR 168 portlet, Overview of Internationalization and localization.

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,
5. Margaret Levine Young, “Internet and WWW”, 2nd Edition, Tata McGraw Hill,
6. Herbert Schildt, The Complete Reference – Java 2 , 4th Edition, Tata McGraw Hill,
7. Keyur shah, “Gateway to Java Programmer Sun Certification”, Tata Mc Graw Hill
8. Deitel & Deitel, Java How to Program, Prentice Hall

510112 Elective-IV
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, 2002ISBN-10: 0130912972 ISBN-13: 978-0130912978
2. Essentials of Software Project Management, second edition,by Richard Bechtold (Author) Publisher: Management Concepts; second edition (April 12, 2007) ISBN-10: 1567261868 ISBN-13: 978-1567261868
3. Software Project Management by Bob Hughes, Mike Cotterell Publisher: McGraw-Hill Publishing Co.; 4Rev Ed edition (November 1, 2005) ISBN-10: 0077109899 ISBN-13: 978-0077109899
4. Software Engineering Project Management, 2nd Edition (Paperback) by Edward Yourdon, Richard H. Thayer Publisher: Wiley-IEEE Computer Society Pr; 2 Sub edition (May 10, 2000) ISBN-10: 0818680008 ISBN-13: 978-0818680007

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:

1. Foundations of IT Service Management: based on ITIL, by Jan Van Bon, Van Haren Publishing, 2nd edition 2005
2. Floyd Piedad, Michael Hawkins, "High Availability: Design, Techniques, and Processes", Prentice Hall, 2000
3. Harris Kern, Stuart Galup, Guy Nemiro, "IT Organization: Building a Worldclass Infrastructure", Prentice Hall, 2000
4. Rich Schiesser, "IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures", Prentice Hall PTR; 2001

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 resoning, 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 Publishers, 2001.
2. M. Kantardzic, "*Data mining: Concepts, models, methods and algorithms*, John Wiley & Sons Inc., 2003.
3. M. Dunham, "*Data Mining: Introductory and Advanced Topics"*, Pearson Education, 2003.
4. H. Witten, E. Frank, "*Data mining: Practical machine learning tools and techniques*", 2nd ed., Morgan Kaufmann Publishers, 2005.
5. R. J. Roiger, M. W. Geatz, "*Data mining: A tutorial-based primer*, Pearson Education, 2003.
6. C. L. Blake, C. J. Merz. 19 July 2002. UCI Repository of Machine Learning Databases, http:://www.ics.uci.edu/~mlearn/MLRepository.html.
7. http://www.cs.waikato.ac.nz/ml/weka
8. http://www.infoacumen.com
9. ftp://axon.cs.byu.edu/pub/randy/ml/drop/
10. http://www.crisp-dm.org.
11. http://www.dmg.org.

510112D Open Elective (Self Study)**

Teaching Scheme	**Examination Scheme**
Lectures: 3hrs/week	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.