

**FACULTY OF ENGINEERING**

**Syllabus for the  
M.E. ( Information Technology )  
(w.e.f 2008-2009)**

**UNIVERSITY OF PUNE**

**THE SYLLABUS IS PREPARED BY:**

**Ad. Hoc B.O.S. in Information Technology  
University of Pune**

**PEER REVIEW BY:**

- Prof. S.Y.Prabhu. (Chairman)
- Dr. Shridhar Shukla  
G.S. Labs, Pune.
- Mr. Prabhu, Mr. Bendre.,  
KPIT Cummins.
- Mr. Dilip Bhonde,  
Symmetric, Pune.
- Dr. Sachin Lodha,  
T.C.S., Pune.
- Prof. Ashutosh Mucharikar,  
Cummins College of Engg for Women, Pune.
- Prof. G.R. Pathak.  
Sinhagad College of Engg, Pune.  
Alumni of M.E. CSE (IT) Course.
- Dr. Anupam Bhide.  
Calsoft, Pune
- Mrs. Jaya Panvalkar.  
NVIDIA India, Pune.
- Prof. Shashi Kelkar.  
Adjunct Professor. IIT, Powai, Mumbai.

**Note:- This syllabus is subject to change without prior notice by the concerned BOS**

**Proposed structure M.E. (Information Technology) to be implemented  
from July-2008**

**Term-I**

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Total	Credits
514421	Applied Algorithms	03	--	100	--	--	100	3
514402	Software Engineering Methodologies	03	--	100	--	--	100	3
514403	Advance O.S	03		100			100	3
514422	Elective-I	03	--	100	--	--	100	3
514423	Elective-II	03	--	100	--	--	100	3
514424	Laboratory Practice-I	--	06		50		50	3
514425	Seminar-I		04		50		50	2
	<b>Total</b>	<b>15</b>	<b>10</b>	<b>500</b>	<b>100</b>		<b>600</b>	<b>20</b>

**Term-II**

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Marks	Credits
514426	Net centric Computing	03	--	100	--	--	100	3
514409	Advance Trends in Database Systems	03	--	100	--	--	100	3
514427	Management Trends in Information Technology	03	--	100	--	--	100	3
514428	Elective-III	03	--	100	--	--	100	3
514439	Elective-IV	03	--	100	--	--	100	3
514430	Laboratory Practice-II	--	06		50		50	3
514431	Seminar-II	--	04	--	50	--	50	2
	<b>Total</b>	<b>15</b>	<b>10</b>	<b>500</b>	<b>100</b>		<b>600</b>	<b>20</b>

### Term-III

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Total	Credits
514432	Seminar-III	--	04	--	50	--	50	2
514433	Project stage-I	--	06	--	50	--	50	6
	<b>Total</b>	--	<b>10</b>	--	<b>100</b>		<b>100</b>	<b>8</b>

### Term-IV

Subject Code	Subject Title	Teaching Scheme		Examination Scheme				
		Lect.	Pract.	Paper	TW	Oral	Marks	Credits
514433	Project stage-II*	--	12	--	150	50	200	12
	<b>Total</b>	--	<b>12</b>	--	<b>150</b>		<b>200</b>	<b>12</b>

\* :-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
514404 A	Software Architecture	514405 A	Information Assurance and Security
514404 B	Real Time and Embedded Systems	514422 B	Network Programming
514422 C	Bioinformatics	514405 C	Geographical Information Systems

Subject Code	Elective-III	Subject Code	Elective-IV
514411 A	Internet and Web Technologies	514428 A	Internet Routing Design
514411 B	Advanced Topics in Operating Systems	514412 B	Advance Network Programming
514411 C	Mobile Computing and M Commerce	514412 C	High Performance Computer Networks
514428 D	User Interface Design	514429 D	Open Elective II(Self Study)** / Service Oriented Architecture

\*\* Open Elective - Institute will Interact with Industry to offer a need based topic.  
-BOS Information Technology will declare the list of subjects which can be taken under open elective.

## **514421 : Applied Algorithms**

### **Teaching Scheme**

Lectures: 3 Hrs/week

### **Examination Scheme**

Theory: 100 Marks  
Total Credits : 03

#### **1. Introduction to Problem Solving :**

Review of algorithmic strategies; proof Techniques such as implication, converse, inverse, contra positive, negation and contradiction. Structure of formal proofs, direct proofs, proof by counterexample, proof by contraposition, proof by contradiction, mathematical induction, strong induction, recursive mathematical definitions, well orderings.

#### **2. Analysis Of Algorithms**

Asymptotic analysis: upper and average 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. Advanced data structures:**

self-adjustment, persistence and multi-dimensional trees. Randomized algorithms: Use of probabilistic inequalities in analysis.

#### **5. Geometric algorithms;**

Point location, Convex hulls and Voronoi diagrams. Arrangements applications using examples.

#### **6. Graph algorithms**

Matching and Flows. Approximation algorithms.

#### **7. Approximation Algorithms :**

Use of Linear programming and primal dual, local search heuristics.

#### **8. Parallel Algorithms :**

Parallel algorithms; Basic techniques for sorting, searching merging, list ranking in PRAMs, and interconnection networks. Parallel computers and models, performance measures. Parallel Complexity: The NC Class, Basic Lower and Upper Bounds. Algorithms for Parallel Computers: Pointer Jumping, CRCW algorithms and EREW algorithms.

**Reference Books:**

1. Lakshminarayanan S., Dhall S., "Analysis and Design of Parallel Algorithms", McGrawHill
2. Cormen, Leiserson, Rivest, "Algorithms", PHI
3. S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley, 2000
4. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley
5. Horowitz, Sahni, "Fundamentals of Computer Algorithm", Galgotia
6. Knuth, "Art of Programming", Addison Wesley
7. C Papadimitriou and K Steiglitz, "Combinatorial Optimization", PHI  
Bressard, "Fundamentals of Algorithms", PHI

## 514402 : Software Engineering Methodologies

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Software Process Models:**

Software Process Framework, Process Patterns, Personal and Team Process Models, Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Agile process, Process Assessment, CMMI, Impact of Processes and Outcomes, Process Selection and applicability

#### **2. Requirements Engineering**

Requirements Engineering Tasks, Requirement Elicitation Techniques, Software Requirements: Functional, Non-Functional, Domain, Requirements Characteristics and Characterization, Requirement qualities, Requirement Specification, Requirement Traceability, System Analysis Model Generation, Requirement Prioritization

#### **3. UML 2.0 Concepts**

Programming In Small Versus Programming In Large, UML 2.0 History/ New Features MDA/ MOF/ XMI/ CORBA, Introduction to UML Metamodel , Extensibility Mechanisms and its usage, Introduction to OCL ,Specification techniques of diagrams in UML

#### **4. Behavioral Model**

Use Cases, Use Case Diagram Components, Use Case Diagram , Actor Generalization, Include and Extend, Template for Use Case Narrative , Using Use Cases Data Dictionary: Finding the Objects, Responsibilities, Collaborators, and Attributes , CRC Cards

#### **5. Dynamic Behavior:**

Sequence diagrams, object lifelines and message types, Refining sequence diagrams, Implementing memory in objects using state machines, States, events and actions, Nested machines and concurrency, Modeling methods with activity diagrams, Activity Diagrams: Decisions and Merges, Synchronization, Drilling Down, Iteration, Partitions, Parameters and Pins, Expansion Regions, Swimlanes, concurrency and synchronization, Communication Diagram, Timing Diagrams

#### **6. Design Engineering :**

Design quality, Design Concepts, The Design Model, Introduction to Pattern-Based Software Design, Architecture styles: Main program with sub program style, Abstract data type style, Repository, Layered.

**Architectural Design:** Software Architecture, Data Design and Architectural Design, User Interface Design: Rules, User Interface Analysis and Steps in Interface Design, Design Evaluation

## **7. Object Oriented Design :**

Design of Objects, Design and Factoring , Design of Software Objects ,Features and Methods, Cohesion of Objects , Coupling between Objects , Coupling and Visibility, Inheritance, Establishing The Object Model, Refining classes and associations, Analysis model vs. design model classes, Categorizing classes: entity, boundary and control, Modeling associations and collections, Achieving reusability, Reuse through delegation , Identifying and using service packages

## **8. Principles of Testing :**

Testing Concepts: Purpose of Software Testing, Testing aspects: Requirements, Test Scenarios, Test cases, Test scripts/procedures, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Testing, Debugging & Root Cause Analysis, Software Items, Component & Units, Verification & Validation, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Benefits of Formal Test Documentation

**White-Box Testing:** Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing

**Black-Box Testing:** Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning, State Based Testing, Compatibility Testing, User Documentation Testing, Domain Testing

## **9. Project Planning and Estimation :**

Project Activities, Structures and Frameworks, Developing Realistic Estimates Integrating the Schedule and Critical Path, Introduction to Complex Projects, Assessing Project Viability, Managing Stakeholders, Introduction to Function Points, Empirical Estimation, COCOMO II model, Software Measurement Framework, Ishikawa's Seven tools, Process Assessment and patterns, CMMI –IPPD, Product and Process attributes

## **Reference Books:**

1. Ian Sommerville, Software Engineering, 7<sup>th</sup> Edition, Addison-Wesley, 2004,ISBN 81- 7758-530-4
2. Grady Booch, James Rumbaugh, Ivar Jacobson, “Unified Modeling Language Users Guide”, 2<sup>nd</sup> Edition, Addison- Wesley, ISBN – 0321267974.
3. Jim Arlow, Ila Neustadt, “UML 2 and Unified Process: Practical Object Oriented Analysis and Design. ”, 2<sup>nd</sup> Edition, Addison- Wesley, ISBN – 0321321278.
4. Tom Pender, “UML Bible”, John Wiley & sons, ISBN – 0764526049.
5. Desikan, Ramesh, ‘ Software Testing: principles and Practices”, Pearson Education, ISBN 81-7758-121-X.
6. Burnstein, “Practical Software Testing”, Springer International Edition, ISBN 81-8128-089-X
7. William E. Perry, “ Effective Methods for Software Testing”, John Wiley and Sons, ISBN 9971-51-345-5
8. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education, ISBN 81-297-0175-8



## 514403 : Advanced Operating System

### **Teaching Scheme**

Lectures: 3 Hrs/week

### **Examination Scheme**

Theory: 100 Marks

Total Credits : 03

#### **1. Distributed computing systems fundamentals:**

Introduction to Distributed computing systems, Models, Popularity.  
Distributed computing system. Design issues of Distributed operating system.  
Distributed computing environment.

#### **2. Message Passing:**

Features of a good Message Passing System. Issues in IPC by Message Passing  
Synchronization, Buffering, Multidatagram Messages, Encoding and Decoding of  
Message Data, Process Addressing, Failure handling,

#### **3. Remote Procedure Calls:**

RPC Model, Implementing RPC Mechanism. Stub Generation. RPC  
Messages, Marshaling Arguments and Results. Server Management, Parameter-  
Passing semantics, call semantics, Communication protocols for RPC's, Client-  
Server Building, Exception handling, Security RPC in Heterogeneous  
Environments, Lightweight RPC.

#### **4. Distributed Shared Memory:**

General Architecture of DSM systems. Design and implementation Issues of  
DSM, Granularity, Structure of Shared Memory Space. Consistency models,  
Replacement strategy, Thrashing. Synchronization: Clock Synchronization. Event  
Ordering, Mutual Exclusion, Deadlock, Election Algorithms.

#### **5. Resource Management:**

Features of global scheduling algorithm. Task assignment approach, Load-  
Balancing and Load approach.

#### **6. Process Management:**

Introduction, Process Migration, Treads.

#### **7. Distributed File Systems:**

Features of good DFS, File models, File Accessing models. File- Sharing  
Semantics, File-Caching schemes, File Replication, Fault Tolerance, Automatic  
Transactions, Design Principles, Case study: DCE Distributed File Service. Sun  
NFS, OSF, DCE.

#### **9. Case Study:**

Case study of Chorus, Mach, Amoeba and OSF distributed Environment,  
Solaris.

**Reference Books:**

1. Distributed Operating Systems concepts and design - P.K.Sinha(PHI).
2. Advanced Operating System - Singhal
3. Distributed Systems concepts and design-G.Coulouris,J.Dollimore & T. Kindberg
4. Modern Operating System - A.S. Tanenbaum(PHI).

## 514404 A : Software Architecture (Elective - I)

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. 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

#### **2. 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, Documenting Software Interfaces, Documenting Behavior, Choosing the Views, Building the Documentation Package

#### **3. 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.

#### **4. Introduction to Design Patterns :**

Design Patterns, Creational Patterns, Patterns for Organization of Work, Access Control Patterns, Service Variation Patterns, Service Extension Patterns

#### **5. Pattern Types :**

Object Management Patterns Adaptation Patterns, Communication Patterns, Architectural Patterns, Structural Patterns, Patterns for Distribution, Patterns for Interactive Systems

Adaptable Systems, Frameworks and Patterns, Analysis Patterns

#### **6. Advanced Patterns :**

Patterns for Concurrent and Networked Objects, Patterns for Resource Management, Pattern Languages, Patterns for Distributed Computing

## **7. Enterprise Architecture Integration :**

Defining EAI, Data-Level EAI, Application Interface-Level EAI, Method-Level EAI, User Interface-Level EAI, The EAI Process—Methodology or Madness, An Introduction to EAI and Middleware, Transactional Middleware and EAI, RPCs, Messaging, and EAI, Distributed Objects and EAI, Database-Oriented Middleware and EAI, Java Middleware and EAI, Implementing and Integrating Packaged Applications—The General Idea, XML and EAI, Message Brokers—The Preferred EAI Engine, Process Automation and EAI.

## **8. Enterprise Architecture Patterns :**

Layering, Organizing Domain Logic, Mapping to Relational Databases, Web Presentation, Domain Logic Patterns, Data Source Architectural Patterns, Object-Relational Behavioral Patterns, Object-Relational Structural Patterns, Object-Relational Metadata Mapping Patterns, Web Presentation Patterns, Distribution Patterns, Offline Concurrency Patterns.

## **Reference Books:**

1. Applied Software Architecture ,Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional; 1st edition (November 4, 1999) ,ISBN-10: 0201325713 , ISBN-13: 978-0201325713
2. Essential Software Architecture, Ian Gorton Springer; 1 edition (2006) ISBN-10: 3540287132 ISBN-13: 978-3540287131
3. Documenting Software Architectures: Views and Beyond Paul 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
4. Pattern-Oriented Software Architecture Volume 1, 2, 3, 4, 5 by Frank Buschmann, Hans Rohnert, Kevin Henney, Douglas C. Schmidt, Publisher: Wiley; 1 edition (August 8, 1996-2004) ISBN-10: 0471958697 ISBN-13: 978-0471958697
5. Design Patterns: Elements of Reusable Object-Oriented Software (Addison-Wesley Professional Computing Series) by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides Publisher: Addison-Wesley Professional; 1st edition (January 15, 1995) ISBN-10: 0201633612 ISBN-13: 978-0201633610
6. Patterns of Enterprise Application Architecture, Martin Fowler, Addison-Wesley Professional, 2003, ISBN-10: 0321127420 ISBN-13: 9780321127426
7. Enterprise Integration: An Architecture for Enterprise Application and Systems Integration, Fred A. Cummins, Wiley; 2002 ISBN-10: 0471400106 ISBN-13: 978-0471400103

## **514404 B : Real - Time and Embedded Systems (Elective - I)**

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Embedded Architecture :**

Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioral Description, Design Example: Model Train Controller

#### **2. Embedded Processor And Computing Platform :**

ARM processor- processor and memory organization, Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

#### **3. Networks :**

Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link ports, ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

#### **4. Real-Time Characteristics :**

Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus On-line scheduling.

#### **5. System Design Techniques :**

Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example: Telephone PBX- System Architecture, Ink jet printer- Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes.

#### **Reference Books :**

1. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
2. Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000

- 3 C. M. Krishna and K. G. Shin , Real-Time Systems, ,McGraw-Hill, 1997 Frank  
Vahid and Tony Givargi, Embedded System Design: A Unified  
Hardware/Software Introduction, John Wiley & Sons, 2000.Networking)

## 514422 C : Bioinformatics (Elective II)

### Teaching Scheme

Lectures: 3 Hrs/week

### Examination Scheme

Theory: 100 Marks

Total Credits : 03

#### 1. Introduction and Information Retrieval :

Introduction, Historical overview, Bioinformatics Applications, major databases, data management, data analysis, molecular biology, Tools for Web Search, Data Retrieval tools, Data mining of biological databases.

#### 2. Molecular Biology and Bioinformatics :

Introduction to Genes and Proteins Genome Sequences Genome rearrangement, block alignment, global sequence alignment, ORFs, Genes, Introns, Exons, Splice Variants DNA/ RNA Secondary Structure, Triplet Coding Protein Sequences, bioinformatics algorithms.

##### Information molecule and information flow :

Central dogma of molecular biology, Problem in molecular and bioinformatics approach, Basic component, Chemistry of DNA and RNA, Basics of DNA replication ,

Introduction to protein ,Amino acid and Protein Structure: Secondary, Tertiary, Quaternary , protein Folding protein function , protein purification and characterization, Data integration and Data Analysis, Multiplicity of Data and redundancy.

#### 3. Genome Analysis and Gene Mapping :

Pairwise Sequence Alignment, Database Similarity Searching :- BLAST, FASTA, Multiple Sequence Alignment, Profiles and Hidden Markov Models

4. Structure prediction methods for gene, Gene expression and Microarray.

5. Protein classification and Structure Visualization, Protein structure Prediction, Proteomics, Protein folding

#### 6. Application : Drug Discovery :

Introduction, Technology, Cell Cycle, G-Protein coupled Receptor as drug target

#### Text Books :

- 1 S.C. Rastogi, Namita Mendirata, Parag Rastogi "Bioinformatics concepts Skills and application, CBS publisher
- 2 S.C. Rastogi, Namita Mendirata, Parag Rastogi "Bioinformatics Methods and application, PHI
- 3.
4. D. Baxevanis and F. Ouellet, (2002), "Bioinformatics: A practical guide to the analysis of genes and proteins", Wiley
5. Arthur M. Lesk, (2002), "Introduction to Bioinformatics" Oxford University

## **514405 A : Information Assurance And Security (Elective - II)**

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Fundamental Concepts:**

Motivation for security, Basics of computer networks, Internet, Network tools and utilities.

#### **2. Introduction to Security Concepts:**

Threats and vulnerabilities in today's digital world; Security terminology, Common attacks.

#### **3. Hacker techniques:**

Gathering information, becoming part of a network, launching attacks, hacker tools.

#### **4. Securing a system:**

Firewalls, Safe web surfing

#### **5. Securing a transaction:**

Encryption, digital signatures, virtual private networks

#### **6. Cyber Crime:**

Internet fraud, Identity theft, Industrial espionage, Cyber terrorism

#### **7. Tools and Techniques for Security:**

Security hardware and software, intrusion detection systems, security standards.

#### **8. Emerging Areas:**

Wireless security, anti-virus and anti-phishing tools, computer forensics, biometrics, establishing security plans and risk mitigation.



## 514422 : Network Programming (Elective II)

### **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", 3<sup>rd</sup> edition.

2. W. Richard Stevens, “Advanced Programming in the Unix Environment”, Addison Wesley.
3. UNIX Internals – “A new Frontier” , PHI

**514405 C : Geographical Information Systems (Elective - II)**

**Teaching Scheme**

Lectures: 3 Hrs/Week

**Examination Scheme**

Theory: 100 Marks

Total Credits: 03

**Aims:** To understand fundamental concepts and principles of Geographical Information Systems.

**1. Fundamentals of GIS and Cartography :**

Roots of GIS, Four M’s, Definition, GIS Architecture, Models of GIS, Framework for GIS, GIS Categories, Map as a Model, Spatial Referencing

System, Map Projections, Commonly Used Map Projections, Grid Systems, Cartographic Symbolization, Types of Maps, Typography, Map Design, Map Productions, Map Applications.

**2. Data Management, Models and Quality Issues :**

Conceptual Models, Geographical Data Models, Data Primitives, Data Types - Raster and Vector Approach, Data Modeling and Spatial Analysis, Sources of Geographical Data, Data Collectors and Providers, Creating Digital Data Sets, Data Presentation, Data Updating, Data Storage, Spatial Data Costs, Quality of GIS Output, Sources of Errors in Spatial Data, Factors affecting Reliability of Spatial Data, Faults from Assumptions.

**3. Remote Sensing Fundamentals :**

Remote Sensing - Basic Principles, Electromagnetic Remote Sensing, Energy Sources, Energy Interactions with Earth's Surface Materials, Microwave Remote Sensing, The Radar Principle, Factors Affecting Microwave Measurements, Radar Wavebands, SLAR Systems, Sar, Interpreting Sar Images, Geometrical Characteristics, Remote Sensing Platform and Sensors, Satellite System Parameters, Sensor Parameters, Imaging Sensor Systems, Earth Resources Satellites, Meteorological Satellites.

**4. Image Processing :**

Digital Image Processing, Basic Character of Digital Images, Preprocessing, Registration, Enhancement, Spatial Filtering, Transformations, Classification, Image Classification and GIS, Visual Image Interpretation, Types of Pictorial Data Products, Image Interpretation Strategy, Image Interpretation Process, Overview of Image Interpretation Equipments.

**5. Terrain Mapping, Geocoding and Segmentation :**

Interpolation, Visualization of Continuous Surfaces, Data Sources for Interpolations, Methods for Interpolations, Global Interpolation, Local Deterministic Methods, Comparison of Global and Local Method, Optimal Interpolation Using Geo Statistics – Kriging, Variogram, Geocoding, Applications of Geocoding, Dynamic Segmentation, Applications of Dynamic Segmentation.

**6. Issues and Applications in GIS :**

Changes in Technology, Data Supply and Users, Role of Satellite Imagery and Data Sets, Urban and Municipal Applications, Other Applications.

**Reference Books:**

1. Peter A Burrough and McDonell, "Principles of Geographical Information Systems", Oxford University Press, 1998.
2. M. Anji Reddi, "Remote Sensing and Geographical Information Systems", B. S. Publications, Second Edition, 2001.

3. George B Korte, "The GIS Book", Onword press, Thomson Learning, 5<sup>th</sup> Edition, 2003.
4. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Third Edition, 2003.

### **514424 : Laboratory Practice – I**

#### **Teaching Scheme**

Practicals: 6 Hrs/week

#### **Examination Scheme**

Term Work: 50 Marks

Total Credits : 03

Experiments/Assignments based on 514401,514403 and Elective Subjects and/or small project. The lab in charge should frame minimum of five assignments.

### **514425 : Seminar – I**

#### **Teaching Scheme**

Practicals: 4 Hrs/week/student

#### **Examination Scheme**

Term Work: 50 Marks

Total Credits : 02

The students will deliver a talk on their experience during the semester referring to at least two research papers and will deliver a seminar on topic of current interest in Information technology, computer science , and Engineering field. The student is expected to review and study at least four research papers from IEEE transactions based on the theory subjects

## 514426 : Net-Centric Computing

### **Teaching Scheme**

Lectures: 3 Hrs/week

### **Examination Scheme**

Theory: 100 Marks

Total Credits : 03

#### **1. Network Technology :**

Introduction, Media Issues, Data Link Protocols, The OSI Model, Networking topologies, Types of Networks, protocols capabilities, NetBIOS, IPX, TCP/IP, CSMA/CD, token passing, frame relay, networking devices, Repeaters, Bridges, Routers, switches, gateways, Network design issues, Data in support of Network Design, Network design tools, protocols and architecture.

#### **2. Network Performance, Modeling and Estimation :**

Issues related with optimizing network performance, probability, stochastic processes, modeling and performance evaluation. Queuing theory, queuing models, estimating model parameters, throughput utilization, modeling network as graph external and internal representation, complexity issues, network traffic controls.

#### **3. Network Administration :**

Function and responsibilities, network issues:-planning, implementation, fault diagnosis and recovery.

#### **4. Network Design :**

Problem definition, multipoint line layout heuristics, CMST algorithms, ESAU-William's algorithm, Sharma's algorithm, unified algorithm, Bin packing algorithm, Terminal assignments and concentrator location.

#### **5. High Speed Networks :**

Need, characteristics, challenges, applications, frame relay, ATM, ISDN, High speed LANs: Ethernet, fiber channel, DQDB, SMDS, B\_ISDN, STM, DSL, and DWDM, Architecture Transport, Switching and Routing in optical domain, optical network management, Internetworking.

#### **6. Network security :**

Basic cryptographic techniques, security in OSI architecture, internet and networked computing, Kerberos, firewalls, proxy, etc. Security applications in commerce and banking.

#### **7. IP Telephony :**

VOIP system architecture, protocol hierarchy, structure of a voice endpoint, Protocols for the transport of voice media over IP networks, Providing IP quality of service for voice, signaling protocols for VOIP, PSTN gateways, VOIP applications.

## **8. Storage Networks :**

Introduction, challenges, SCSI protocols and architecture: RAID, Backup and mirroring, Fiber channel attached storage. Network attached storage including NFS, CIFS, and DAFS, Management of network storage architectures. New storage protocols, architectures and enabling technologies.

## **9. Compression :**

Overview of Information Theory, Lossless Compression: Run-Length Encoding, Facsimile compression, String Matching algorithms. Lossy compression: DCT, Wavelet compression.

## **Reference Books :**

- 1) Stallings. W.-“High Speed Networks and Internets:Performance and Quality of service”,Prentice Hall 2002
- 2) Kershenbaum A.-“Telecommunications Network Design Algorithms” Tata McGraw Hill.
- 3) Ramaswami R. ,Shivrajan K-“Optical Networks”,Morgan Kaufmann.
- 4) Douskalis B.-“IP Telephony:The Integration of Robust VOIP service”,Perason Education Asia .
- 5) Douglas E.Comer-“Computer NetWorks and Internet”,Pearson Education Asia.
- 6) Stallings W.-“High Speed Networks :TCP/IP and ATM Design principles”,Prentice Hall,1998.
- 7) Andrew Tanenbaum- “computer Network”,PHI.

## 514409 : Advance Trends in Database Systems

### Teaching Scheme

Lectures: 3 Hrs/week

### Examination Scheme

Theory: 100 Marks

Total Credits : 03

#### 1. Distributed databases :

Schemas, Architectures, Queries, Transactions, implementation aspects.

#### 2. Data warehousing :

Data preprocessing, Data Warehousing; Warehouse DBMS, multidimensional data warehouses, data warehouse architectures. Data cubes, Dashboards, BI

#### 3. Data Mining :

KDD process, Data mining applications, Data mining Techniques and Algorithms , frequent Patterns, association rules , correlation, classification, prediction

#### 4. Introduction to Active databases syntax, semantics and applications.

#### 5. Introduction to Object Databases .OR mapping classes and inheritance, TP Monitors and architecture of TP systems

#### 6. Web mining introduction, crawling the web, web search and information retrieval

### Reference Books :

1. Avi Silberschatz Henry F. Korth S. Sudarshan Database System Concepts Fifth Edition McGraw-Hill
2. Jiawei Han and Micheline Kamber Data Mining: Concepts and Techniques, 2<sup>nd</sup> ed.
3. Chakrabarti, S. (2002). Mining the Web: Discovering knowledge from hypertext data. Morgan-Kaufman.
4. M. Jarke, M. Lenzerini, Y. Vassiliou, P. Vassiliadis (ed.), Fundamentals of Data Warehouses, Springer-Verlag, 1999
5. Advanced Database Systems (The Morgan Kaufmann Series in Data Management Systems) (Hardcover) by Carlo Zaniolo (Author), Stefano Ceri (Author), Christos Faloutsos (Author), Richard T. Snodgrass (Author), V.S. Subrahmanian (Author), Roberto Zicari (Author)
6. Database Systems: An Application Oriented Approach, Complete Version, 2/E Michael Kifer, Arthur Bernstein, Philip M. Lewis
7. Java Persistence with Hibernate  
Second Edition of Hibernate in Action, Christian Bauer and Gavin King



## 514427 : Management Trends in Information Technology

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Managing with IT :**

Applications of IT in Functions Like Finance, Accounting, Stores, Purchase, Product Design, Quality Control, Logistics, Marketing, Customer Relationship, ERP. Health Care, Insurance, Banking, Agriculture, Railways, Defense, Road transport, Utilities, shipping, airlines. Social service organizations. Case Studies.

#### **2. Information Resources Management :**

Building information model of the organization, Infrastructure status assessment Aligning IT strategy with business strategy, Developing IT strategy for the organization, Managing information resources function, Developing information systems, Database administration and housekeeping, Developing disaster recovery strategy, Auditing IT/IS systems.

#### **3. IT project management :**

Defining Project Goals, Gathering Project Information, Establishing Project Priorities, Requirements Analysis, Risk Management, Project Budgeting, Creating a Work Breakdown Structure, Cost Estimation.  
Organizing a Project Team, Assessing Internal Scales, Creating a Team, Managing Team Issues, Resources Procurement, Preparing and Implementing 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. Software Quality Management :**

Concept of Knowledge Management, Change Management, Technology Management, Supply Chain Management, Process and Project Quality Standards -  
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. Quality Assurance and Testing, Planning, Quality Control, Accepted Test Plan. Impact of IT on Quality Management Systems, Learning Organizations.

**5. Group Dynamics and Team Management :**

Theory of Group Formation - Formal and Informal Groups and Their Interaction, Importance of Teams, Formation Of Teams, Team Work, Leading 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.

**6. Laws related with IT :**

Intellectual Property Rights (IPR) - Copyrights, Patents, Trade Secrets, Piracy, Cyber Law - IT Bill, Relevance of The Companies Act, The Consumer Protection Act, Indian Copyright Act. Case Studies on IT- related Legal Issues.

**7. Ethics and Corporate Social Responsibility :**

Importance of Ethics and Corporate Social Responsibility, Four Forces that shape Ethical Conduct, Three Approaches to making Ethical Judgments, Managing Corporate Social Responsibility, Encouraging Ethical Conduct.

**Reference Books:**

1. IT Project Management by Joseph Phillips 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.
8. Cyber Law Simplified by Vivek Sood, Tata McGraw Hill.
9. Information Technology Project Management - S. A. Kelkar, PHI, 2005.

## **514411 A : Internet and Web Technologies (Elective - III)**

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Name Services and Configuration :**

DNS,DHCP,X500 Directory Services,LDAP, Internet Security, Authentication and Encryption, Watermarks, Firewall, SSL, Digital Signatures, Kerberos,

#### **2. Network Management :**

Infrastructure for Network Management, Intranet Standard Management framework, SMI, MIB, SNMP,CGI Scripts, Scripting Language, Perl, PHP, Java Script and VB Script, Internet Servers, Proxy Server, Search Engine.

#### **3. Web Services :**

Web services, Evolution and differences with Distributed computing, XML, 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. Web 2.0 technologies Introduction to Ajax, Ajax Design Basics, JavaScript, Blogs, Wikis, RSS feeds.

#### **4. Content Delivery and Preparation :**

Introduction to WWW, TCP/IP, HTTP, FTP, UDP, N-Tier, Markup Languages VRML– HTML, DHTML, DNS, URL, Browsers, Platform for Web Services Development

MVC Design Pattern, .NET, J2EE Architecture, J2EE Components & Containers, Specification, Application servers, Struts

#### **5. Dynamic Web Programming :**

Java Applets, Java script, JSP, JSTL, ASP, PHP, Servlets, Servlet Life cycle, C#, Component Technologies, Java beans, CORBA, Introduction to EJBs, JDBC, Secure Electronics Transactions over Web.

#### **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", 2<sup>nd</sup> Edition, Tata McGraw Hill,
6. Herbert Schildt, The Complete Reference – Java 2 , 4<sup>th</sup> 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

## 514411 B : Advance Topics in Operating Systems (Elective - III)

### Teaching Scheme

Lectures: 3 Hrs/Week

### Examination Scheme

Theory: 100 Marks

Total Credits: 03

#### 1. Introduction to Operating Systems Internals :

Study and comparison of different operating system architectures: Windows, Linux, Solaris

#### 2. Process Management :

**Windows:** System Mechanisms, Management Mechanisms, Startup and Shutdown, Process, Threads and Jobs

**Linux:** Process Descriptor and Task Structure, Process Creation, Implementation of threads, Process Termination, Process Scheduling,

#### 3. Memory Management :

**Windows:** Memory manager & its services, System memory pools, Virtual address space layout, address translation, page fault handling.

**Linux:** Pages, Zones, kmalloc, vmalloc, slab layer, slab layer allocator, statically allocating on the stack, High memory mapping.

#### 4. File Management :

**Windows:** Windows file system formats, FS driver architecture, troubleshooting FS problems, NTFS design goal and features, NTFS drivers, NTFS on disk structure.

**Linux:** Common File system Interface, File Abstraction Layer, Unix File System, VFS, Dentry Object, Super block Object, Inode Object, File Object, Data structure associated with File systems.

#### 5. I/O Management :

**Windows:** I/O system components, Device drivers, IO processing, PnP manager.

**Linux:** Anatomy of block device, Buffer & Buffer Heads, the bio structure, Request queue, I/O scheduler.

#### 6. Device driver for printer and network card for linux and windows. :

Study effect of different parameters of setting of TCP/IP for linux and windows OS. Creating device driver for linux and windows

#### Textbooks:

1. Jim Mauro, Richard McDougall: "Solaris Internals: Core Kernel Architecture", 2<sup>nd</sup> Edition, Pearson Education
2. Robert Love: "Linux Kernel Development", 2<sup>nd</sup> edition, Pearson Education.
3. Daniel Bovet: "Understanding the Linux kernel", 3rd edition, O'Reilly Publications
4. Mark Russinovich, David Solomon: "Windows Internals", 4<sup>th</sup> edition, Microsoft Press

## **514411 C : Mobile Computing and M Commerce (Elective - III)**

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

### **Introduction:**

Generations of mobile computing, Spectrum allocation, Standard Bodies, Players in the Wireless Space, three tier architecture of mobile computing, Mobile Computing through Internet, Basic cellular system, concept of frequency reuse channels, hand-off mechanism, cell splitting

### **1. GSM & GPRS :**

GSM features and Architecture , Network Aspects in GSM ,GSM Frequency Allocation, Mobility management, hand-off mechanisms, cell splitting, Security issues used in GSM, GPRS features and architecture, network operations, data services in GPRS, applications and limitations, SMS and MMS services architecture and operation details

### **2. Emerging Telecommunication Technologies :**

Introduction, bluetooth, EDGE, UMTS, Wireless Broadband (WiMAX), Mobile IP, Java Card, WLAN, Ad-hoc Networks, Sensor Networks, Spread Spectrum technology, CDMA, Third generation networks and applications, WAP: Model, architecture & protocol stack

### **3. Security Issues in Mobile Computing :**

Introduction, Information security, Security techniques and Algorithms, security Protocols, Public Key Infrastructure, Trust, Security Models, Security Frameworks for Mobile Environment

### **4. M-Commerce :**

Introduction to m-commerce :Emerging applications, different players in m-commerce, m-commerce life cycle  
Mobile financial services, mobile entertainment services, and proactive service management

### **5. Management of mobile commerce services :**

Content development and distribution to hand-held devices, content caching, pricing of mobile commerce services  
The emerging issues in mobile commerce : The role of emerging wireless LANs and 3G/4G wireless networks, personalized content management, implementation challenges in m-commerce, futuristic m-commerce services

**Text Book:**

1. Mobile Computing (Technology, Applications and Service Creation)  
Asoke. K Talukder and Roopa R. Yavagal.TATA McGRAW HILL
- 2.Mobile Communication : Jachan Schiller, Adison-Wesley.  
Wireless and Mobile Network Architecture : Yi-Bing Lin, Wiley  
Mobile Commerce: Technology, Theory and Applications by Brian  
Mennecke and Troy J. Strader, Idea Group Publishing

**Reference Books :**

1. Mobile Commerce and Applications, Upkar Varshney, A tutorial at IEEE International Conference on Wireless Communications (WCNC)
2. Mobile Commerce: Frameworks, Applications and Networking Support, ACM/Kluwer Journal on Mobile Networks and Applications (MONET), June 2002 (Upkar Varshney and Ron Vetter)
3. Location-based Mobile Commerce Services, ACM Transactions on Internet Technology, August 2003, (Upkar Varshney)
4. Mobile Commerce: An Emerging Frontier, IEEE Computer, Oct 2000 (Varshney and others)
5. Group-oriented Mobile Services, ACM/Kluwer Journal on Mobile Networks and Applications (MONET), 2004 (Upkar Varshney)

## **514411 D : User Interface Design (Elective - III)**

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Introduction to Human-Computer Interaction as an emerging field :**

Disciplines contributing to HCI, Human Information Processing  
Psychology of everyday things, Importance of human factors in design – cultural , emotional , technological, business,Need Satisfaction curve of technology,Levels of human computer interaction

#### **2. Foundations of User Interface Design (U.I.D) :**

Goals of UID, Goal directed Design, User Interface Models, Understanding and Conceptualizing Interface, Psychology of users designing for collaboration and communication, Process of Interaction Design, Standards & Guidelines, Usability Testing, GIU.

#### **3. UCD Models , UCD methodology :**

User centered design life cycle - cooperative , participative , contextual  
Understanding users , user experience levels , human information processing  
- i/o channels ISO 13407,Human memory , user study techniques , user models,User research - Personas, , scenarios , story boarding  
Focus Groups , Card Sorting , Questionnaires , Interviews , On-site observation,Role Playing, Walkthroughs,

#### **4. User research :**

[O,interviews,questionnaires](#),social interaction & emotional design,

#### **5. Interaction Design :**

Goals of interaction design , Interaction design strategies  
Task analysis & design , GOMS model , navigation design , screen design  
Defining interactivity , types of interactions , interaction models  
Interaction models , styles, Advancements in interaction devices  
Ergonomics principles in interaction design

#### **6. Design - Types participatory :**

Scenario/task based , usage centered , user centered,  
User interface models, Interface metaphors and conceptual models  
User support systems – online help, documentation  
Accessibility of User Interfaces  
Heuristics , Principles , patterns in interaction design  
HCI frameworks, Architectural patterns for user interface  
Designing for effectiveness , comprehension , satisfaction



**7. Evaluation criteria for UI testing :**

Usability Testing , Suitability Testing , Accessibility Testing  
Testing methods - Think Aloud , Video taping , Customer Satisfaction  
questionnaires  
Advantages & disadvantages of user centered design  
Case studies in UCD

**8. Usable Web - Web Site Usability :**

Web User Interfaces , Rich web experience design  
Navigations , Links , Searching , Comparisons , Readability ,  
Collaborative systems, groupware & coordination technology

**9. Object Oriented User Interfaces (OOUI) :**

Identifying needs and establishing requirement , Object Oriented User  
Interface, Migrating GUI to Object Oriented User Interfaces.

**10. Advanced UI – Techniques and Technology :**

User Interface design, Toolkit, Help Advise, Wizard Testing and Modeling  
Testing, PC –Internet user Interface.

**Reference Books :**

1. Elements of User Interface Design - Theo Mandel, John Wiley & Sons
2. Interaction Design – Preece, Roger, Sharp, John Wiley & Sons
3. Essentials of User Interface Design – Alan Cooper – Wiley India.
4. Object Modeling & User Interface Design - Mark Hamelen ,
5. Human Computer Interaction by Alan Dix



## **514428 A : Internet Routing Design (Elective IV)**

### **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 Books :**

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)

## **514412 B : Advanced Network Programming (Elective - IV)**

### **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. Richard Stevens, Bill Fenner, "UNIX network programming Volume-1 -The Sockets Networking API", 3<sup>rd</sup> edition.
4. W. Richard Stevens, "Advanced Programming in the Unix Environment", Addison Wesley.
3. UNIX Internals – "A new Frontier", PHI

## **514412 C : High Performance Computer Networks (Elective - IV)**

### **Teaching Scheme**

Lectures: 3 Hrs/Week

### **Examination Scheme**

Theory: 100 Marks

Total Credits: 03

#### **1. Network Performance analysis :**

Objectives and requirements for Quality of Service (QoS) in high performance networks. Architecture of high performance networks (HPN), design issues, protocols for HPN, VHF backbone networks, virtual interface architectures, virtual interface for networking, High-speed switching and routing - internet and PSTN IP switching techniques, SRP protocols, SRP authentication, and key exchange, comparison of TCP/IP, FTP, TELNET, queuing systems, network modeling as a graph

#### **2. Gigabit Ethernet :**

Architecture, standards, interface, applications, network design

#### **3. High speed networks :**

**A. Frame relay:** Frame relay protocols and services, frame relay congestion control

**B. ATM:** Architecture, protocol, switching, traffic and congestion control, flow control, error detection and control, traffic management, ATM service categories, ATM in LAN environment, classical IP over ATM

**C. ISDN:** ISDN overview, interfaces and functions, physical layer, Network layer, ISDN services

**D. B-ISDN:** Driving forces and need, B-ISDN standards and services, B-ISDN Functional Architecture, B-ISDN Transmission structure, B-ISDN protocol architecture

#### **4. ADSL and DSL Technologies :**

Background and technological capabilities, Standards and associations, Architecture, Conceptual overview of VDSL, Deployment Case study, Market status and future

#### **5. Fiber Optics Communication:**

GPON (Gigabit capable Passive Optical Network), SONET/SDH and comparison with other available standards, SAN (Storage Area Networks) and Fiber Channel, DWDM, and CWDM

#### **6. Wireless Networks:**

Overview of GSM & CDMA, 3G mobile technologies, UMTS, EDGE, WiFi, WiMax

### **Reference Books :**

1. Jochetl Schiller: Mobile Communication: Addison Wesley.
2. Tanenbaum: Computer Networks: PHI
3. M Shwartz: Telecommunication Network Protocol Modeling And Analysis: Addison Wesley
4. Gallangar: Data Networks: Prentice Hall
5. Fred Halsall: Data Communication Computer Networks, And Open Systems: Addison Wesley
6. Kershanbaum : Telecommunication Network Design Algorithms: MGH
7. William Stallings: ISDN And BISDN
8. William Stallings: High Speed Networks
9. Computer Networks And Internet: Comer
10. Johnson: Fast Ethernet



### **514412 D : Open Elective (Self Study)\*\***

#### **Teaching Scheme**

Lectures: 3hrs/week

#### **Examination Scheme**

Theory: 100 Marks

Total Credits : 03

\*\* Open Elective - Institute will Interact with Industry to offer a need based topic.  
–BOS Information Technology will declare the list of subjects which can be taken under open elective.

### **514412 D : Service Oriented Architecture (Open Elective)**

#### **Teaching Scheme**

Lectures: 3 Hrs/week

#### **Examination Scheme**

Theory: 100 Marks

Total Credits : 03

#### **1. 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

#### **2. 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)

#### **3. 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

#### **4. 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

## 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

### **514430 : Laboratory Practice – II**

#### **Teaching Scheme**

Practicals: 6 Hrs/week

#### **Examination Scheme**

Term Work: 50 Marks

Total Credits : 03

Experiments/Assignments based on 514409, 514411 and 514412 and/or small project.  
The lab in charge should frame minimum of five assignments.

### **514431 : Seminar – II**

#### **Teaching Scheme**

Practicals: 4 Hrs/week/student

#### **Examination Scheme**

Term Work: 50 Marks

Total Credits : 02

The students will deliver a talk on their experience during the semester referring to at least two research papers and will deliver a seminar on topic of current interest in Information technology, computer science , and Engineering field. The student is expected to review and study at least four research papers from IEEE transactions based on the theory subjects

### **514432 : Seminar – III**

#### **Teaching Scheme**

Practicals: 4 Hrs/week/student

#### **Examination Scheme**

Term Work: 50 Marks

Total Credits : 02

The Student will deliver a seminar based on the survey made in selection of the topic for project. This will include presentation on papers referred in the topic selected for dissertation.

### **514433 : Project Stage – I**

**Teaching Scheme**

Practicals: 6 Hrs/week

**Examination Scheme**

Term Work: 50 Marks

Total Credits : 06

**Contents.** Research and development projects based on problems of practical and theoretical interest. First part of a two semester long project activity. Problem definition, background research, development of overall project plan (detailed design, milestones, etc.) and meeting the research and development targets set up for the first part. Evaluation will be based on student seminars, written reports, and evaluation of the developed system and/or theories. It is expected that the student will submit at least one paper in journal or conference before submission of project stage II.

**514434 : Project stage – II****Teaching Scheme**

Practicals: 6 Hrs/week

**Examination Scheme**

Term Work: 150 Marks

Oral : 50 Marks

Total Credits : 12

**Contents.** Second part of the two semester project. The primary objective is to meet the milestones formed in the overall project plan. Evaluation will be held periodically, and will be based on written reports, oral presentations and demonstration of results. The project will culminate in the production of a thesis by each individual student. Final evaluation will be according to the M.E., project evaluation guidelines.