

## **Faculty of Engineering**

### **Syllabus**

**M.E. (Information Technology) 2013 course**

**(with effect from Academic Year 2013 - 14)**

**UNIVERSITY OF PUNE**

**THE SYLLABUS IS PREPARED BY:**

**B.O.S. in Information Technology, University of Pune**

# M.E. (Information Technology) 2013 syllabus to be implemented from

July-2013

## Semester – I

Subject Code	Subject Title	Teaching Scheme	Examination Scheme					
		Lecture / Practical	Paper		TW	Oral / Presentation	Marks	Credits
			In-Sem. Assessment	End-Sem. Assessment				
514401	Mathematical Foundation of Information Technology	04	50	50	-	-	100	04
514402	Applied Algorithms	04	50	50	-	-	100	04
514403	Advance Operating System	04	50	50			100	04
514404	Research Methodology	04	50	50	-	-	100	04
514405	Elective – I	05	50	50#	-	-	100	05
514406	Laboratory Practice - I	04 (PR)	-	-	50	50	100	04
	<b>Total</b>	<b>25</b>	<b>250</b>	<b>250</b>	<b>50</b>	<b>50</b>	<b>600</b>	<b>25</b>

## Semester – II

Subject Code	Subject Title	Teaching Scheme	Examination Scheme					
		Lecture / Practical	Paper		TW	Oral / Presentation	Marks	Credits
			In-Sem. Assessment	End-Sem. Assessment				
514407	Wireless Communication Technologies	04	50	50	--	--	100	04
514408	Advanced Database Systems	04	50	50	--	--	100	04
514409	Advance Computer Architecture	04	50	50			100	04
514410	Elective-II	05	50	50#	--	--	100	04
514411	Lab. Practice-II	04(PR)	--	--	50	50	100	05
514412	Seminar-I	04(PR)	--	--	50	50	100	04
	<b>Total</b>	<b>25</b>	<b>200</b>	<b>200</b>	<b>100</b>	<b>100</b>	<b>600</b>	<b>25</b>

### Semester – III

Subject Code	Subject Title	Teaching Scheme	Examination Scheme					
		Lecture / Practical	Paper		TW	Oral / Presentation	Marks	Credits
			In-Sem. Assessment	End-Sem. Assessment				
514413	Information Assurance and Security	04	50	50	-	-	100	04
514414	Network Programming	04	50	50	-	-	100	04
514415	Open Elective	05	50	50#	-	-	100	05
514416	Seminar-II	04 (PR)	-	-	50	50	100	04
514417	Project Stage-I	08 (PR)	-	-	50	50	100	08
<b>Total</b>		<b>25</b>	<b>150</b>	<b>150</b>	<b>100</b>	<b>100</b>	<b>500</b>	<b>25</b>

### Semester – IV

Subject Code	Subject Title	Teaching Scheme	Examination Scheme					
		Lecture / Practical	Paper		TW	Oral / Presentation	Marks	Credits
			In-Sem. Assessment	End-Sem. Assessment				
514418	Seminar-III	05 (PR)	-	-	50	50	100	05
514419	Project Stage-II	20 (PR)	-	-	150	50	200	20
<b>Total</b>		<b>25</b>	<b>-</b>	<b>-</b>	<b>200</b>	<b>100</b>	<b>300</b>	<b>25</b>

#: Ref. Rule R-1.3 for Examination Rules of “Rules and Regulations for M.E. Programs under faculty of Engineering effective from June 2013”.

**Note: Students have to choose any one subject from the list of major subjects and any one subject from the list of minor subjects for 4 credits and 1 credit respectively**

#### List of Electives: Major Subjects ( 4 Credits)

Subject Code	Elective – I (for Semester – I)	Subject Code	Elective – II (for Semester – II)
514405 A	Software Architecture	514410 A	Internet and Web Technologies
514405 B	Real Time and Embedded Systems	514410 B	Software Engineering Methodologies
514405 C	Information Storage and Retrieval	514410 C	Natural Language Processing
514405 D	Internet Routing Design	514410 D	Soft Computing
Subject Code	**Open Elective (for Semester – III)	Subject Code	
514415 A	Service Oriented Architecture	514415 D	User Interface Design
514415 B	Business Intelligence	514415 E	Grid and Cloud Computing
514415 C	Mobile Computing and M-Commerce	514415 F	Any interdisciplinary sub from other branch

**List of Electives: Minor Subjects (1 Credit)**

<b>Elective-I</b>	<b>Elective-II</b>	<b>Elective-III (open)</b>
1. Wireless Sensor Networks	1. Parallel algorithms and design	1. Bioinformatics
2. Information security policies in industries	2. Image classification & virtual reality	2. Trust management in e-commerce
3. Ethical hacking & computer forensics	3. Game Theory	3. Multimedia image storage and retrieval
4. Security assessment and verification	4. Secure software engineering	4. Cloud Development

## 514201: Mathematical Foundations for Information Technology

### Teaching Scheme

Lectures: 04 Hrs. / Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Graph Theory:** Undirected and Directed Graphs, Bipartite Graphs, Connectivity, Traversability, Trees, Spanning Trees, Rooted and Binary Trees, Algorithms – Kruskal's and Prim's Minimal Spanning Tree, Dijkstra's Algorithm, Max-flow Min-cut theorem. Algorithms for computing maximum s-t flows in graphs.

**Probability Theory:** Non-deterministic models, Finite Probability Space and related concepts, Conditional Probability, Independent and mutually exclusive events, Bayes' Theorem, Random Variables – One and Two dimensional, Mathematical Expectation, Variance, Correlation, Distributions – Binomial, Poisson, Normal, Gamma, Chi-Square

**Fuzzy Theory :** Introduction to Fuzzy Sets – Basic Definition and Terminology – Set-theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning - Extension principle and Fuzzy Relations – Fuzzy If-Then Rules – Fuzzy Reasoning.

Uncertainty, Information and Entropy Information Measures Characteristics on information measure, Shannon's concept of information, Shannon's measure of information, Model for source coding theorem communication system: Source coding and line / channel coding, channel mutual information capacity (Bandwidth).

**Channel Coding:** Theorem for discrete memory less channel, Information Capacity theorem: Error detecting & error correcting codes, types of codes: Block codes, Tree codes, Hamming and Lee Metrics, Description of linear block codes by matrices, Description of linear tree codes by matrices, Parity check codes, and Parity check polynomials.

**Sampling Theory:** Purpose and nature of sampling, its uses and applications, Mean Median, Mode, Variance, and Standard Deviation.

**Hypothesis Testing:** Formulation of hypotheses – null and alternate hypothesis, Parametric and non-parametric tests and their applicability, Criteria for acceptance of hypothesis, Level of Significance, t-test, z-test and Chi-Square Tests with simple applications.

### Reference Books:

1. Judith L. Gersting, "Mathematical Structures for Computer Science", Freeman Co.
2. Kishor S. Trivedi, "Probability and Statistics with Reliability, Querying and Computer Science Applications", PHI
3. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TMH
4. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Fifth Edition, TMH
5. R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Edition, New Delhi
6. Scheinerman, Mathematics: A discrete Introduction, Cengage Learn (Thomson)
7. S. M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, John Wiley.
8. R. V. Hogg and A. T. Craig, Introduction to Mathematical Statistics, Macmillan NY, 4th Edition.
9. D. B. West, Introduction to Graph Theory, Pearson Education, ISBN 0-13-014400-2

**Teaching Scheme**

Lectures: 04 Hrs. / Week

**Examination Scheme**

Theory : 100 Marks  
(In-Sem.Assessment:50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**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.

**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.

**Advanced Data Structures:** Self-adjustment, persistence and multi-dimensional trees.

**Geometric Algorithms:** Point location, convex hulls and Voronoi diagrams, Arrangements applications using examples.

**Approximation Algorithms:** Use of Linear programming and primal dual, local search heuristics.

**Randomized Algorithms:** Solving closest pair problem, pattern matching minimum spanning tree

**Online Algorithms:** Euclidean spanning tree problem solved by greedy method, k-server problem, obstacle traversal algorithm, bipartite matching problem, m machine problem, spanning tree algorithm

**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 Lakshmivarahan S., Dhall S., "Analysis and Design of Parallel Algorithms", McGraw Hill
- 2 R.C.T. Lee, S S Tseng, R C Chang, Y T Tsai, "Introduction to Design and Analysis of Algorithms – a strategic approach", TMH, ISBN:978-1-25-902582-2
- 3 Rajiv Motwani and Prabhakar Raghavan, Randomized Algorithms, Cambridge University Press
- 4 S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley, 2000
- 5 Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley
- 6 Horowitz, Sahni, "Fundamentals of Computer Algorithm", Galgotia
- 7 Dan Gusfield, "Algorithms on Strings, Trees and Sequences", ISBN: 978-0-521-67035-7, Cambridge University Press
- 8 Knuth, "Art of Programming", Addison Wesley
- 9 C Papadimitriou and K Steiglitz, "Combinatorial Optimization", PHI Bressard, "Fundamentals of Algorithms", PHI

**Teaching Scheme**

Lectures: 04 Hrs. / Week

**Examination Scheme**

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Introduction:** A simple OS – structure, processes, address spaces and threads, managing processes, loading programs into processes, files, Beyond a simple OS – extensions, new functionality. Basic concepts: context switching – procedures, threads and coroutines, system calls, interrupts, Input-output architectures, Dynamic storage allocation – Buddy system, slab allocation, Operating System Design – a framework for devices, low-level kernel, processes and threads, storage management. Rethinking OS structure – Virtual machines, microkernel, exokernel.

**Process Management:** Multithreaded Programming- Programming with threads (creation and termination of threads), synchronization, thread safety. Thread implementations- strategies, simple thread implementations, and multiple processors. Scheduling – Strategy, tactics

**Memory management:** Hardware support for virtual memory – forward mapped page tables, linear page tables, hashed page tables, TLBs, 64-bit issues, virtualization. Operating System issues – general concerns, representative systems, copy on write and fork, backing storage issues

**File Systems:** Basics of File systems, Crash resiliency, Directories and naming, multiple disks, Flash memory, Features of DFS, File models, File Accessing models. File-Sharing Semantics, File-Caching schemes, File Replication, Fault Tolerance, Automatic Transactions, Design Principles, Case studies: Ext3/4/5, NTFS, WAFL, , NFS version 4, CIFS.

**Distributed computing systems fundamentals:** Introduction to Distributed computing systems, Models, Popularity. Distributed computing system, Design issues of Distributed operating system, distributed computing environment.

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

**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.

**Resource Management:** Features of global scheduling algorithm, Task assignment approach, Load-Balancing and Load approach.

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

**Reference Books:**

- 1 Thomas W. Doeppner, "Operating Systems in Depth", Wiley India edition, 2011
- 2 P.K. Sinha, "Distributed Operating Systems concepts and design", PHI
- 3 Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill, 2000
- 4 G. Coulouris, J. Dollimore , T. Kindberg, "Distributed Systems concepts and design", 5<sup>th</sup> edition, 2011 Addison Wesley
- 5 A.S. Tanenbaum, "Modern Operating Systems", 3<sup>rd</sup> edition, PHI.

**Teaching Scheme**

Lectures: 04 Hrs. / Week

**Examination Scheme**

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Introduction:** Definition, Research Characteristics, Research Need, Objectives and types of research: Motivation and objectives – Research methods vs Methodology, Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

**Research Formulation** – Defining and formulating the research problem -Selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem, Literature review, Primary and secondary sources, reviews, treatise, monographs, patents, web as a source, searching the web, Critical literature review, Identifying gap areas from literature review, Development of working hypothesis.

Summarizing a Technical Paper - summary template

**Online tools** - Google, CiteSeer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Searching patents

**Research design and methods** – Research design, Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models, Developing a research plan - Exploration, Description, Diagnosis, and Experimentation, Determining experimental and sample designs.

**Data Collection and analysis:** Execution of the research - Observation and Collection of data, Methods of data collection, Sampling Methods, Data Processing and Analysis strategies, Data Analysis with Statistical Packages, Hypothesis-testing -Generalization and Interpretation.

**Reporting and thesis writing** – Structure and components of scientific reports, Types of report, Technical reports and thesis, Significance, Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes, Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication - Documentation and presentation tools: LATEX, Microsoft Office, PowerPoint and SLIDESHOW, Adobe Flash, Slide Rocket, Zoho Show

**Types of technical papers** - Journal papers, Conference papers, Survey papers, Poster papers, Review papers Comparison, Structure of a survey, conference and journal paper, when to go for what type of technical paper in the research process

**How to read a scientific paper** - The three pass approach, comparing the approaches to find the holes

**How to write scientific paper** - Paper Design Process, Readers, Concept Sheet, Embodiment, General advice about writing technical papers in English – Grammar, Punctuation, Tips for writing correct English, How to organize thesis/ Project report.



Present scientific paper and proposal writing – how to write a research proposal, how research is funded, budgeting etc.

**Application of results and ethics** - Environmental impacts - Ethical issues - ethical committees - Commercialization – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

## References

1. Kothari, C.R., Research Methodology: Methods and Techniques. New Age International
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., An introduction to Research Methodology, RBSA Publishers
3. Suresh Sinha, Anil K. Dhiman, “Research Methodology”, ESS Publications, Volumes 2
4. Day R.A., “How to Write and Publish a Scientific Paper”, Cambridge University Press
5. Wadehra, B.L. Law relating to patents, Trade Marks, copyright designs and geographical indications. Universal Law Publishing

## References

1. Louis Cohen, Lawrence Manion and Keith Morrison, Research Methods in Education, 7<sup>th</sup> Edition, Cambridge University Press, ISBN – 978-0415-58336-7
2. Anthony, M., Graziano, A.M. and Raulin, M.L., Research Methods: A Process of Inquiry, Allyn and Bacon
3. Ranjit Kumar, Research Methodology: A Step by Step Guide for Beginners, 2<sup>nd</sup> Edition, APH Publishing Corporation
4. Leedy, P.D. and Ormrod, J.E., Practical Research: Planning and Design, Prentice Hall
5. Fink, A., Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Satarkar, S.V., Intellectual Property Rights and Copy Right. ESS Publications.

## 514205 A: Software Architecture (Elective - I)

### Teaching Scheme

Lectures: 05 Hrs./Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**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

**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

**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.

**Introduction to Design Patterns:** Design Patterns, Creational Patterns, Patterns for Organization of Work, Access Control Patterns, Service Variation Patterns, Service Extension Patterns

**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

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

**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.

**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

## 514205 B: Real -Time and Embedded Systems (Elective -I)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory : 100 Marks

(In-Sem. Assessment: 50 Marks)

(End-Sem. Assessment: 50 Marks)

Total Credits : 05

**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

**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.

**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.

**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 Online scheduling.

**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)

## 514205 C: Information Storage and Retrieval (Elective -I)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**Introduction to Information Retrieval Systems:** Definition, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses

**Information Retrieval System Capabilities:** Search Capabilities, Browse Capabilities, Miscellaneous Capabilities, Standards

**Cataloging and Indexing :** History and Objectives of Indexing, Indexing Process, Automatic Indexing Information Extraction

**Data Structure:** Introduction to Data Structures, Stemming Algorithms, Inverted File Structure, N-Gram Data Structure, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

**Automatic Indexing:** Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages

**Index Construction:** Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing

**Scoring, term weighting, and the vector space model:** Parametric and zone indexes, Term frequency and weighting, the vector space model for scoring, Variant tf-idf functions

**Document and Term Clustering:** Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

**Flat clustering :** Clustering in information retrieval, Problem statement, Evaluation of clustering, K-means, Model-based

**Hierarchical Clustering:** Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Optimality of hierarchical agglomerative clustering, Divisive clustering, Cluster labeling

**Probabilistic Information Retrieval:** Review of basic probability theory , The probability ranking principle, The binary independence model, An appraisal and some extensions

**Web search basics:** Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling

**Web crawling and indexes :** Overview, Crawling, Distributing indexes, Connectivity servers

### Reference Books

1. Robert R. Korfhage, Information Storage & Retrieval, ISBN, 81-265-0770-5, Wiley India
2. Christopher Manning, Prabhakar Raghavan, Hinrich Schutz, "Introduction to Information Retrieval" ISBN: 0521865719, Cambridge University Press
3. Somasundaram Gnanasundaram, Alok Shrivastava, " Information Storage Management", ISBN : 978-81-265-3750-1, Wiley, India
4. Gerald J. Kowalski, Mark T. Maybury "Information Storage and Retrieval Systems-Theory and Implementation" Kluwer Academic Publisher, New York

## 514205 D: Internet Routing Design (Elective-I)

### Teaching Scheme

Lectures: 05 Hrs./Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**Networking and Network Routing:** 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.

**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

**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.

**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

**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,

**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.

**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)

## 514206: Laboratory Practice – I

### Teaching Scheme

Practical: 04 Hrs/week

### Examination Scheme

Term Work : 50 Marks

Oral : 50 Marks

Total Credits : 04

The concerned faculty member should frame minimum two assignments having sufficient complexity based on the subjects 514401, 514402 and 514403. Students should prepare a journal which will include necessary architecture/design, algorithm and its analysis, test cases, mathematical model etc. The assessment of the assignment should be carried out continuously throughout the semester and the record for the same should be produced at the time of examination. The evaluation will be done by a pair of examiners appointed by university of Pune.

**Teaching Scheme**

Lectures: 04 Hrs/Week

**Examination Scheme**

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Introduction** : Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio Propagation Mechanisms – Characteristics of the Wireless Channel – IEEE 802.11a–b Standard – Origin of Ad hoc Packet Radio Networks – Technical Challenges – Architecture of PRNETs – Components of Packet Radios – Ad hoc Wireless Networks – What is an Ad Hoc Network? Heterogeneity in Mobile Devices – Wireless Sensor Networks – Traffic Profiles – Types of Ad hoc Mobile Communications – Types of Mobile Host Movements – Challenges Facing Ad hoc Mobile Networks – Ad hoc wireless Internet.

**Ad-hoc Routing Protocols** : Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks – Classifications of Routing Protocols – Table-Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source-Initiated On-Demand Approaches – Ad hoc On-Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) – Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) – Location-Aided Routing (LAR) – Power-Aware Routing (PAR) – Zone Routing Protocol (ZRP).

**Multicast routing in Ad-hoc Networks** : Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols – Classifications of Multicast Routing Protocols – Tree-Based Multicast Routing Protocols – Mesh-Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy-Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing – Comparisons of Multicast Routing Protocols.

**Transport Layer Security Protocols** - Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks – Classification of Transport Layer Solutions – TCP over Ad hoc Wireless Networks – Other Transport Layer Protocols for Ad hoc Wireless Networks – Security in Ad Hoc Wireless Networks – Network Security Requirements – Issues and Challenges in Security Provisioning – Network Security Attacks – Key Management – Secure Routing in Ad hoc Wireless Networks.

**QoS and Energy Management** : Issues and Challenges in Providing QoS in Ad hoc Wireless Networks – Classifications of QoS Solutions – MAC Layer Solutions – Network Layer Solutions – QoS Frameworks for Ad hoc Wireless Networks Energy Management in Ad hoc Wireless Networks – Introduction – Need for Energy Management in Ad hoc Wireless Networks – Classification of Energy Management Schemes – Battery Management Schemes – Transmission Power Management Schemes – System Power Management Schemes.

**Reference Books:**

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", ISBN: 978-81-7596-792-2 Cambridge University Press India Pvt. Ltd.
3. C. K. Toh, "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall
4. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000



## 514208: Advanced Database Systems

### Teaching Scheme

Lectures: 04 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Distributed Data :** Introduction, Distributed Data Processing, Distributed Database System, Promises of DDBSs,

**Distributed DBMS Architecture:** Architectural Models for Distributed DBMS, DDMBS Architecture

Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation

**Query Processing and Decomposition:** Query Processing Objectives, Characterization of query processors, layers of query processing, query decomposition, Localization of distributed data.

**Distributed query Optimization:** Query optimization, centralized query optimization, Distributed query optimization algorithms.

**Distributed Concurrency Control:** Serializability, concurrency control Mechanisms & Algorithms, Time stamped & Optimistic concurrency control Algorithms, Deadlock Management

**Distributed DBMS Reliability:** Reliability concepts and Measures, fault-tolerance in Distributed systems, failures in Distributed DBMS, local & Distributed Reliability Protocols, site failures and Network partitioning

**Parallel Database Systems:** Database Series, Parallel Architecture, Parallel DBMS Techniques, Parallel exception problems, Parallel Execution for Hierarchical architecture.

**Distributed Object Database Management Systems:** Fundamental object concepts and Models, Object Distributed Design, Architectural Issues, Object Management, Distributed Object storage, Object query Processing.

**Object Oriented Data Model:** Inheritance, Object identity, persistent programming languages, persistence of objects, comparing OODBMS and ORDBMS

**Overview of Data warehousing:** Data preprocessing, Warehouse DBMS, Multidimensional data warehouses, Data Warehouse Architectures

**Overview Data Mining :** KDD process, Data mining applications, Data mining Techniques

### Reference Books

1. Avi Silberschatz Henry F. Korth S. Sudarshan "Database System Concepts" , Fifth Edition McGraw-Hill
2. M.Tamer OZSU and Patuck Valduriez, "Principles of Distributed Database Systems", Pearson Edn. Asia,
3. Stefano Ceri and Willipse Pelagatti, "Distributed Databases", McGraw Hill.

**Teaching Scheme**

Lectures: 04 Hrs/Week

**Examination Scheme**

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Introduction to parallel processing:** Basic concepts, Types and levels of parallelism, classification of parallel architectures, basic parallel techniques.

**Pipelining and ILP :** Fundamentals of Computer Design - Measuring and Reporting Performance – Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Overcoming Data Hazards with Dynamic Scheduling – Dynamic Branch Prediction - Speculation – Multiple Issue Processors – Case Studies.

**Advanced Techniques for Exploiting ILP:** Compiler Techniques for Exposing ILP - Limitations on ILP for Realizable Processors - Hardware versus Software Speculation - Multithreading: Using ILP Support to Exploit Thread-level Parallelism - Performance and Efficiency in Advanced Multiple Issue Processors - Case Studies.

**Multiprocessors:** Symmetric and distributed shared memory architectures – Cache coherence issues - Performance Issues – Synchronization issues – Models of Memory Consistency - Interconnection networks – Buses, crossbar and multi-stage switches.

**Multi-Core Architectures :** Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture – IBM cell architecture.- hp architecture.

**Memory Hierarchy Design :** Introduction - Optimizations of Cache Performance - Memory Technology and Optimizations - Protection: Virtual Memory and Virtual Machines - Design of Memory Hierarchies Case Studies.

**Data Parallel architecture:** Introduction, connectivity, SIMD architectures: Fine grained SIMD, Coarse grained architectures, Multithreaded architectures: Computational models, Data flow architectures.

**Recent architectural trends:** Multi-core system organization, multi core memory issues.

**Reference Books:**

1. John L. Hennessey and David A. Patterson, “ Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier, 4th. edition.
2. David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture : A hardware/ software approach” , Morgan Kaufmann / Elsevier.
3. William Stallings, “ Computer Organization and Architecture – Designing for Performance”, Pearson Education, Seventh Edition.
4. Dezso Sima, Terence Fountain, Peter Kacsuk “Advanced Computer Architectures” A Design space approach, Pearson Education
5. Advanced Computer Architecture Parallelism, Scalability – Kai Hwang:, Programability, Tata Mc Grawhill.

## 514210 A: Internet and Web Technologies (Elective -II)

### Teaching Scheme

Lectures: 04 Hrs/Week

### Examination Scheme

Theory : 100 Marks

(In-Sem. Assessment: 50 Marks)

(End-Sem. Assessment: 50 Marks)

Total Credits : 04

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

**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.

**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.

**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

**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.

**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

## 514210 B: Software Engineering Methodologies (Elective – II)

### Teaching Scheme

Lectures: 04 Hrs/Week

### Examination Scheme

Theory : 100 Marks

(In-Sem. Assessment: 50 Marks)

(End-Sem. Assessment: 50 Marks)

Total Credits : 04

**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

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

**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

**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

**Principles of Testing :** Test Scenarios, Test cases, Test scripts/procedures, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Debugging & Root Cause Analysis, Verification & Validation, Traceability and Testability,

**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

**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, Edition, Addison-Wesley, 2004,ISBN 81-7758-530-4
- 2 Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language Users Guide", 2nd Edition, Addison-Wesley, ISBN – 0321267974.
- 3 Jim Arlow, Ila Neustadt, "UML 2 and Unified Process: Practical Object Oriented Analysis and Design. ", 2nd Edition, Addison-Wesley, ISBN – 0321321278.
- 4 Desikan, Ramesh, ' Software Testing: principles and Practices", Pearson Education, ISBN 81-7758-121-X.
- 5 William E. Perry, " Effective Methods for Software Testing", John Wiley, ISBN 9971-51-345-5
- 6 Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, ISBN 81-297-0175-8

## 514210 C: Natural Language Processing (Elective -II)

### Teaching Scheme

Lectures: 04 Hrs/Week

### Examination Scheme

Theory : 100 Marks

(In-Sem. Assessment: 50 Marks)

(End-Sem. Assessment: 50 Marks)

Total Credits : 04

**Introduction to Natural Language Understanding** The Study of Language Applications of Natural Language Understanding Evaluating Language Understanding Systems The Different Levels of Language Analysis Representations and Understanding The Organization of Natural Language Understanding Systems

**Linguistic Background:** An Outline of English Syntax Words- The Elements of Simple Noun Phrases Verb Phrases and Simple Sentences Noun Phrases Revisited Adjective Phrases Adverbial Phrases

**Grammars and Parsing:** Grammars and Sentence Structure What Makes a Good Grammar A Top-Down Parser A Bottom-Up Chart Parser Top-Down Chart Parsing Finite State Models and Morphological Processing Grammars and Logic Programming

**Features and Augmented Grammars:** Feature Systems and Augmented Grammars Some Basic Feature Systems for English Morphological Analysis and the Lexicon A Simple Grammar Using Features Parsing with Features Augmented Transition Networks Definite Clause Grammars Generalized Feature Systems and Unification Grammars

**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases Movement Phenomena in Language Handling Questions in Context-Free Grammars Noun Phrases and Relative Clauses The Hold Mechanism in ATN Gap Threading

**Toward Efficient Parsing:** Human Preferences in Parsing Encoding Uncertainty: Shift-Reduce Parsers A Deterministic Parser Techniques for Efficient Encoding of Ambiguity Partial Parsing

**Ambiguity Resolution:** Statistical Methods-Basic Probability Theory Estimating Probabilities Part-of-Speech Tagging Obtaining Lexical Probabilities Probabilistic Context-Free Grammars Best-First Parsing A Simple Context-Dependent Best-First Parser

**Semantics and Logical Form:** Semantics and Logical Form Word Senses and Ambiguity The Basic Logical Form Language Encoding Ambiguity in Logical Form Verbs and States in Logical Form Case Relations Speech Acts and Embedded Sentences Defining Semantic Structure: Model Theory

**Linking Syntax and Semantics:** Semantic Interpretation and Compositionality A Simple Grammar and Lexicon with Semantic Interpretation Prepositional Phrases and Verb Phrases Lexicalized Semantic Interpretation and Semantic Roles Handling Simple Questions Semantic Interpretation Using Feature Unification Generating Sentences from Logical Form

**Ambiguity Resolution:** Selectional Restrictions, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Statistical Word Sense Disambiguation, Statistical Semantic Preferences Combining Approaches to Disambiguation

**Other Strategies for Semantic Interpretation:** Grammatical Relations Semantic Grammars Template Matching Semantically-Directed Parsing Techniques

**Scoping and the Interpretation of Noun Phrases:** Scoping Phenomena Definite Descriptions and Scoping A Method for Scoping While Parsing Co-Reference and Binding Constraints Adjective Phrases Relational Nouns and Nominalizations Other Problems in Semantics

**Knowledge Representation and Reasoning:** Knowledge Representation A Representation Based on FOPC Frames: Representing Stereotypical Information Handling Natural Language Quantification Time and Aspectual Classes of Verbs Automating Deduction in Logic-Based Representations Procedural Semantics and Question Answering Hybrid Knowledge Representations

**Local Discourse Context and Reference:** Defining Local Discourse Context and Discourse Entities A Simple Model of Anaphora Based on History Lists Pronouns and Centering Definite Descriptions Definite Reference and Sets Ellipsis Surface Anaphora

**Using World Knowledge:** Using World Knowledge: Establishing Coherence Matching Against Expectations Reference and Matching Expectations Using Knowledge About Action and Casualty Scripts: Understanding Stereotypical Situations Using Hierarchical Plans Action-Effect-Based Reasoning Using Knowledge About Rational Behavior

**Discourse Structure:** The Need for Discourse Structure Segmentation and Cue Phrases Discourse Structure and Reference Relating Discourse Structure and Inference Discourse Structure, Tense, and Aspect Managing the Attentional Stack an Example

**Defining a Conversational Agent:** What's Necessary to Build a Conversational Agent? Language as Multi-Agent Activity Representing Cognitive State: Beliefs Representing Cognitive State: Desires, Intentions, and Plans Speech Acts and Communicative Acts Planning Communicative Acts Communicative Acts and the Recognition of Intention The Source of Intention in Dialogue Recognizing Illocutionary Acts Discourse and Level Planning

#### **Reference Books:**

1. James Allen, "Natural Language Understanding", Pearson Publication, ISBN: 978-81-317-0895-8 2<sup>nd</sup> Edition
2. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson Education, 2002.
3. Christopher D. Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, Massachusetts.1999.

## 514210 D: Soft Computing (Elective -II)

### Teaching Scheme

Lectures: 04 Hrs/Week

### Examination Scheme

Theory : 100 Marks

(In-Sem. Assessment: 50 Marks)

(End-Sem. Assessment: 50 Marks)

Total Credits : 04

**Fuzzy Set Theory:** Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement.

**Fuzzy Rules and Fuzzy Reasoning:** Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning.

**Fuzzy inference systems:** Mamdani model- Sugeno model. Tsukamoto model -Fuzzy decision making- Multiobjective Decision Making--Fuzzy classification-Fuzzy control methods – Application

**Neuro-Fuzzy Modeling:** Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress- CART algorithm – Data clustering algorithms: K means clustering- Fuzzy C means clustering- Mountain clustering- Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems- Expert Control- Inverse Learning- Specialized Learning- Back propagation through Real Time Recurrent Learning.

**Fundamentals of Genetic Algorithms:** Basic Concepts Creation, Offspring's Encoding, Fitness functions, Reproduction,

**Genetic Modeling:** Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

**Genetic Algorithm:** Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest - crossover- Inversion and Deletion-mutation-reproduction- Generational cycle-rank method-rank space method- Other derivative free optimization simulated annealing- Random search- Downhill simplex search- Application

**Applications of Computational Intelligence:** Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

### Reference Books:

1. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education
2. S. Rajasekaran & G.A. Vijayalakshmi Pai, PHI
3. T. J. Ross, "Fuzzy Logic with Engineering Applications." TMH
4. Laurene Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications ", Pearson Education India, 2006
5. S.N. Sivanandam, S.N. Deepa, "Introduction to Genetic Algorithm", Springer 2008

### 514211: Laboratory Practice – II

#### Teaching Scheme

Practical: 05 Hrs/Week

#### Examination Scheme

Term Work : 50 Marks

Oral : 50 Marks

Total Credits : 05

The concerned faculty member should frame minimum two assignments having sufficient complexity based on the subjects 514407, 514408 and 514409. Students should prepare a journal which will include necessary architecture/design, algorithm and its analysis, test cases, mathematical model etc. The assessment of the assignment should be carried out continuously throughout the semester and the record for the same should be produced at the time of examination. The evaluation will be done by a pair of examiners appointed by university of Pune.

### 514212: Seminar – I

#### Teaching Scheme

Practical: 04 Hrs/Week/Student

#### Examination Scheme

Term Work : 50 Marks

Presentation : 50 Marks

Total Credits : 04

The students will deliver a seminar on state-of-art topic of current interest in Information Technology, Computer Science and Engineering field. The student is expected to study and review at least five research papers from IEEE, ACM, Springer journals/transactions, reviewed international conferences related to a topic he/she has chosen for seminar. The seminar guide shall maintain a progressive record of seminar such as discussion agenda, weekly outcomes achieved, corrective actions and comments on the progress report as per the plan submitted by the student etc and should be produced at the time of examination/presentation. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned guide and head of the Department/Institute during practical sessions. The evaluation of the seminar would be carried out as per the ***Rules and Regulations for M.E. Programs under faculty of Engineering effective from June 2013***



## 514213: Information Assurance and Security

### Teaching Scheme

Lectures: 04 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**Introduction to Information Security:** Basic Terms and Definitions, the Three Pillars of Information Security, Security Model, Components of an Information System, Approaches to Information Security Implementation, The system Development Life Cycle, The Security Systems Development Life Cycle.

**The Need for Security:** Business Needs First, Threats, Attacks, And Secure Software Development.

**Legal, Ethical, and Professional Issues in Information Security:** Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data

**Risk Management:** Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management.

**Planning for Security:** Information Security Planning and Governance, Information Security Policy Standards, and Practices, The Information Security Blueprint, Security education, Training, and Awareness program, Continuity Strategies

**Security Technology:** Firewalls and VPNs: Access Control, Firewalls, protecting remote Connections, Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems, Honey pots

**Cyber Crime:** Introduction, Definition, Cyber Crime and Information Security, Classification of crime, Tools and Methods used in Cyber Crime, Internet fraud, Identity theft, Industrial espionage, Cyber terrorism

**Security Policies :** Introduction of Security Policy, standards and Practices, Design of Security Architecture .

**Information Security Maintenance:** Security Management Maintenance Models. Digital Forensics

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

### Reference Books:

1. Michael E. Whitman & Herbert J. Mattord, "Principle of Information Security", 4<sup>th</sup> edition, Thomson
2. Charles P. Pfleeger, Shari Lawrence Pfleege, Deven Shah, Security in Computing, Fourth Edition, ISBN:978-81-317-2725-6, Pearson Publication,
3. Nina Godbole, Information System Security, Security Management, Metrics , Frameworks and Best Practices, ISBN : 978-81-265-1692-6 Wiley, India
4. C K Shamala, N Hirani, Dr. T R Padmanabhan, " Cryptography and Security", ISBN : 978-81-265-2285-9 Wiley, Indiaa
5. William Stallings, Cryptography and Network Security, Pearson Education, 2000

**Teaching Scheme**

Lectures: 04 Hrs/Week

**Examination Scheme**

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 04

**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.

**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.

**Routing Sockets :** Datalink Socket Address Structure, Reading and Writing, Interface Name and Index Functions

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

**IPv4 and IPv6 Interoperability :** IPv4 Client, IPv6 Server, IPv6 Client, IPv4 Server, IPv6 Address Testing Macros, IPV6\_ADDRFORM Socket Option

**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.

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

**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

## 514215 A: Service Oriented Architecture (Open Elective)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**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

**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)

**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

**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. Shankar Kambhampaty, Service-Oriented Architecture for Enterprise and Cloud Applications, ISBN13: 978-81-265-1989-7, Wiley, India
3. Norbert Bieberstein, Sanjay Bose, Marc Fiammante, Keith Jones, Rawn
4. Shah, "Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap", IBM Press Publication, 2005.
5. Sandy Carter, "The New Language of Business: SOA & Web 2.0", IBM Press, 2007.
6. Thomas Erl, "Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services", Prentice Hall Publication, 2004
7. Dave Chappell, "Enterprise Service Bus", O'Reilly Publications, 2004
8. 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
10. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Addison Wesley Publication, 2004

## 514215 B: Business Intelligence (Open Elective)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**Important concepts:** Design and implementation aspect of OLTP, Design and implementation aspect of Warehouse, Comparison of Analytical queries with Transactional Queries, Components of Warehouse Architectures.

**Dimensional Modeling and DW design :** Star schema and snow flake schema, Grain of dimensional model, transactions, Recurring Snapshots, Accumulating Snapshots, Dimensions (SCD types, conformed dimensions), Facts (additive, semi-additive, non-additive), Hierarchy in dimensions, parent child relationships, Many-Many Dimensional relationship, Multi Valued Dimensions and Dimension Attributes.

**ETL :** Data Quality, Data profiling, Data enrichment, data duplication, ETL Architecture and what is ETL, Extraction concept and Change data capture Transformation concept, lookups, time lag, formats, consistency, Loading concept, Initial and Incremental loading, late arriving facts, What is Staging, Data marts, Cubes, Scheduling and dependency matrix.

**Reporting :** Metadata Layer, Presentation Layer, Data Layer, Use of different layers and overall Reporting architecture, Basic Report authoring, Various report elements such as Charts, Tables, prompts Data aggregation: Table based, Materialized views, Query rewrite, OLAP, MOLAP, Dashboards, Ad-hoc reports, interactivity in analysis (drill down, drill up), Security: report level, data level (row, column), Scheduling.

**Analytics :** Analytics concepts and use in Business Intelligence, Exploratory and statistical techniques:- Cluster analysis, Data visualization, Predictive analysis :- Regression, Time series, Data Mining :- Hierarchical clustering, Decision tree Text analytics :- Text mining.

**Recent trends :** Big data like HIVE, PIG and DW appliances like Netezza, Teradata, Smart Change data capture using log based techniques, Real time BI, Operational BI, Embedded BI, Agile BI, BI on cloud.

### Reference Books:

1. Ralph Kimball, Margy Ross, "The complete Guide to dimensional modeling 2<sup>nd</sup> edition, Publisher: Wiley publication ISBN- 0-471-20024-7
2. Ralph Kimball, Joe Caserta, "The data warehouse ETL toolkit: practical techniques for extracting, cleaning, conforming, and delivering data", Publisher: Wiley. ISBN: 0-7645-6757-8
3. Jiawei Han, Micheline Kamber, Jian Pei "Data Mining: concepts and techniques", 2nd edition Publisher: Elsevier/Morgan Kaufmann
4. Efram G. Mallach "Decision Support And Data Warehouse Systems", 1st Edition Publisher: Tata McGraw-Hill Education,. ISBN-10: 0072899816.
5. Efraim Turban, Ramesh Sharda, Dursun Delen, David King "Business Intelligence, 2/E" ISBN-10: 013610066X Publisher: Prentice Hall. ISBN-13: 9780136100669

## 514215 C: Mobile Computing and M Commerce (Open Elective)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory: 100 Marks

(In-Sem. Assessment: 50 Marks)

(End-Sem. Assessment: 50 Marks)

Total Credits: 05

**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

**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

**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

**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

**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

**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

### Reference Books:

1. 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
2. Paul May, Mobile Commerce Opportunities, Applications, and Technologies of Wireless Business, ISBN:9780521797566, Cambridge University Press
3. Mobile Computing (Technology, Applications and Service Creation) Asoke. K Talukder and Roopa R. Yavagal. Tata Mc-graw Hill
4. Mobile Communication : Jachan Schiller, Adison-Wesley.

## 514215 D: User Interface Design (Open Elective)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**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

**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.

**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,

**User Research:** Interviews, questionnaires, social interaction & emotional design,

**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

**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

Evaluation criteria for UI Testing: Usability Testing, Suitability Testing, Accessibility Testing methods -Think Aloud, Videotaping, Customer Satisfaction questionnaires Advantages & disadvantages of user centered design Case studies in UCD

**Usable Web -Web Site Usability:** Web User Interfaces , Rich web experience design Navigations , Links , Searching , Comparisons , Readability , Collaborative systems, groupware & coordination technology

**Object Oriented User Interfaces (OOUI):** Identifying needs and establishing requirement, Object Oriented User Interface, Migrating GUI to Object Oriented User Interfaces.

**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. Wilbert O. Galitz , “The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques”, 3rd Edition, ISBN: 978-0-470-05342-3, Wiley
4. Human Computer Interaction by Alan Dix

## 514215 E: Cloud Computing (Open Elective)

### Teaching Scheme

Lectures: 05 Hrs/Week

### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**Fundamentals of Grid and Cloud Computing :** Fundamentals – Scope of Grid Computing – Merging the Grid sources – Architecture with the Web Devices Architecture – Cloud computing – Definition, Characteristics, Components, History of Cloud Computing , Cloud Architecture, Cloud Storage, Advantages and, Disadvantages of Cloud Computing .

**Cloud Security Fundamentals:** Cloud computing security architecture, Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security

**Cloud computing security challenges:** Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.

**Cloud Services :** Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing – Collaborating on Databases – Storing and Sharing Files – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

**Cloud Computing Platforms :** Installing cloud platforms and performance evaluation

**Features and functions of cloud platforms:** Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform,

**Grid Computing :** OGSA – Sample Use Cases – OGSA Platform Components – OGSI – OGSA Basic Services. Globus Toolkit – Architecture – Programming Model – High Level Services – OGSI.Net. Middleware Solutions.

### Reference Books

1. Joshy Joseph & Criag Fellenstein, “Grid Computing”, PHI
2. Michael Miller, Cloud Computing : Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008
3. Gautam Shroff , Enterprise Cloud Computing, Cambridge
4. Ronald Krutz and Russell Dean Vines , Cloud Security, Wiley India
5. Barrie Sosinsky , Cloud Computing Bible, Wiley India
6. Haley Bear, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs.

### 514215 F: Any interdisciplinary subject from other branch/Industry (Open Elective)\*\*

#### Teaching Scheme

Lectures: 05 Hrs/Week

#### Examination Scheme

Theory : 100 Marks  
(In-Sem. Assessment: 50 Marks)  
(End-Sem. Assessment: 50 Marks)  
Total Credits : 05

**\*\* Open Elective** – Institute / department will interact with Industry or vice a versa to offer a need based topic and will prepare tentative contents of the syllabus and will get it approved from the BOS (Information Tech.)

Students of ME (Information Technology) can also select any subject from the list of open electives of other branches (Elective III only) provided that the concerned college has informed it to the BOS Chairman of IT and examination section of University of Pune well in time.

BOS (Information Technology) will declare the syllabus of such subject(s) before commencement of the Semester/Academic Year.

### 514216: Seminar – II

#### Teaching Scheme

Practical: 4 Hrs./Week/Student

#### Examination Scheme

Term Work: 50 Marks  
Presentation: 50 Marks  
Total Credits: 04

The students will deliver a seminar on state-of-art topic of current interest in Information Technology, Computer Science and Engineering field preferably on elective subject. The student is expected to study and review at least five research papers from IEEE, ACM, Springer journals/transactions, reviewed international conferences related to a topic he/she has chosen for seminar. The seminar guide shall maintain a progressive record of seminar such as discussion agenda, weekly outcomes achieved, corrective actions and comments on the progress report as per the plan submitted by the student etc and should be produced at the time of examination/presentation. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned guide and head of the Department/Institute during practical sessions. The evaluation of the seminar would be carried out as per the **Rules and Regulations for M.E. Programs under faculty of Engineering effective from June 2013**



### 514217: Project Stage – I

#### Teaching Scheme

Practical: 08 Hrs/Week

#### Examination Scheme

Term Work : 50 Marks

Oral/Presentation: 50 Marks

Total Credits : 08

The project stage-I should include Motivation, Problem statement, survey of reputed journal and/or reviewed international conference papers (adequate in number) related to the problem selected (problem modeling and design using set theory, NP-Hard analysis, SRS, UML, Classes, Signals, Test scenarios and other necessary, problem specific UML, software engineering documents, project plan).

Student should publish at least one paper in reviewed International Journal having ISSN Number and preferably with Citation Index II or International Journal recommended by the guide of the project or reputed reviewed conferences. The term work should include the paper published, reviewer's comments and certificate of presenting the paper in the conference organized/sponsored by the Board of Studies in Information Technology. The guides should maintain a progressive record of the project work such as discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students etc and should be produced at time of examination

### 514218: Seminar – III

#### Teaching Scheme

Practical: 05 Hrs/Week/Student

#### Examination Scheme

Term Work : 50 Marks

Oral/Presentation: 50 Marks

Total Credits : 05

The students will deliver a seminar which could be extension of seminar-II or current topic of interest in Information Technology, Computer Science and Engineering field. The student is expected to study and review at least five research papers from IEEE, ACM, Springer journals/transactions, reviewed international conferences related to a topic he/she has chosen for seminar. The seminar guide shall maintain a progressive record of seminar such as discussion agenda, weekly outcomes achieved, corrective actions and comments on the progress report as per the plan submitted by the student etc and should be produced at the time of examination/presentation. The student shall submit the seminar report in standard format, duly certified for satisfactory completion of the work by the concerned guide and head of the Department/Institute during practical sessions. The evaluation of the seminar would be carried out as per the **Rules and Regulations for M.E. Programs under faculty of Engineering effective from June 2013**

## 514419: Project stage – II

### Teaching Scheme

Practical: 20 Hrs/week

### Examination Scheme

Term Work : 150 Marks  
Oral : 50 Marks  
Total Credits : 20

The student will select an appropriate Technology, implant a detailed design prepared in project stage-I, test it manually and/or using tools, obtain desired results, discuss performance in terms of improvement with existing known algorithms and comparative graphs to support the conclusions drawn. Student should publish at least one paper in reviewed International Journal having ISSN Number and preferably with Citation Index II or reviewed International Journal recommended by the guide of the Dissertation or reviewed reputed international conference. The term work shall include the paper published, reviewer's comments and certificate of presenting the paper in the conference organized/sponsored by the Board of Studies in Information Technology. The guides should maintain a progressive record of the project work such as discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students etc and should be produced at time of examination. A maximum number of students assigned to a guide should not be more than **Eight (8)**.

### Syllabus for Elective (Minor Subjects)

#### WIRELESS SENSOR NETWORKS

**Introduction to adhoc/sensor networks:** Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering. (6)

**MAC Protocols:** Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4. (7)

**Routing Protocols:** Issues in designing a routing protocol, classification of routing

protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols. (6)

**QoS and Energy Management:** Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

#### IMAGE CLASSIFICATION & VIRTUAL REALITY

**Image Analysis and Computer Vision:** Spatial feature Extraction – Transform feature Edge detection-Boundary Representation-Region Representation-Moment Representation-Structure-Shape Features-Texture-Scene Matching and Detection-Image Segmentation-Classification techniques-Morphology-Interpolation.

**Sensing 3D shape:** how the 3rd dimension changes the problem. Stereo 3D description, 3D model, matching, TINA, Direct 3D sensing-structured light, range finders, range image segmentation Emerging IT applications: Recognition of characters, Fingerprints and faces-Image databases.

## BIOINFORMATICS

Biology in the computer age, computing changes in biology, Bioinformatics just about building database, Meaning of informatics to biologists, challenges offered by biology to computer scientists, skills required for this field, Available information & software for this domain, use web information, understand sequence alignment data, writing programs to align two biological sequences, predict protein structure from sequence, questions bioinformatics can answer, Watson's Definition, Information Flow, Human Genome project.

Biological Research on the web, Using search engines, finding scientific articles. Public biological databases, Searching biological databases, Depositing data into the public databases, finding software, Judging the quality of information

**Sequence Analysis, Pair-wise alignment& Database searching:** Chemical composition of bio-molecules, Composition of DNA & RNA, Watson & Crick Solve structure of DNA, Development of DNA sequencing methods, Gene finders & feature detection in DNA, DNA translation, Pair wise sequence comparison, Sequence queries against biological databases, Multifunctional tools for sequence analysis.

## PARALLEL ALGORITHMS AND DESIGN

**Introduction :** Introduction, Why Parallel Architecture, Application Trends .., Technology Trends, Architectural Trends, Supercomputers, Convergence of Parallel Architectures, Communication Architecture, Shared Memory, Message-Passing, Convergence, Data Parallel Processing, Other Parallel Architectures, A Generic Parallel Architecture, Fundamental Design Issues, Communication Abstraction, Programming Model Requirements, Naming, Ordering, Communication and Replication, Performance.

**Parallel Programs :** Introduction, Parallel Application Case Studies, Simulating Ocean Currents, Simulating the Evolution of Galaxies, Visualizing Complex Scenes using Ray Tracing, Mining Data for Associations, The Parallelization Process, Steps in the Process, Parallelizing Computation versus Data, Goals of the Parallelization Process, Parallelization of an Example Program, A Simple Example: The Equation Solver Kernel, Decomposition, Assignment, Orchestration under the Data Parallel Model, Orchestration under the Shared Address Space Model, Orchestration under the Message Passing Model.

## GAME THEORY

Fundamentals: Conflict, Strategy and Games, Game theory, The Prisoner's Dilemma, Scientific metaphor, Business case, Games in normal and extensive forms – Representation, Examination, Examples.

Non Cooperative Equilibria in Normal Games: Dominant Strategies and Social Dilemmas, Nash Equilibrium, Classical Cases in Game theory, Three person games, Introduction to Probability and Game theory, N-Person games.

Cooperative Solutions: Elements of Cooperative Games- Credible commitment, A Real Estate Development, Solution Set, Some Political Coalitions, Applications of the Core to Economics –The Market Game, The Core of a Two Person Exchange Game, The Core with More than Two Pairs of Traders, The core of Public Goods Contribution Game, Monopoly and Regulation .

Sequential Games: Strategic Investment to Deter Entry, The Spanish Rebellion, Again ,Imbedded Games – Planning Doctoral Study, Centipede Solved, Repeated play- Campers Dilemma, Pressing the shirts, Indefinitely Repeated Play – A Repeated Effort Dilemma, The Discount Factor.

## SECURE SOFTWARE ENGINEERING

Problem, Process, and Product - Problems of software practitioners – approach through software

Reliability engineering- experience with SRE – SRE process – defining the product – Testing acquired software – reliability concepts- software and hardware reliability. Implementing Operational Profiles - Developing, identifying, crating, reviewing the operation – concurrence rate – occurrence probabilities- applying operation profiles

Engineering “Just Right” Reliability - Defining “failure” for the product - Choosing a common measure for all associated systems. - Setting system failure intensity objectives –Determining user needs for reliability and availability, overall reliability and availability objectives, common failure intensity objective, developed software failure intensity objectives. – Engineering software reliability strategies. Preparing for Test - Preparing test cases. - Planning number of new test cases for current release. -Allocating new test cases. - Distributing new test cases among new operations - Detailing test cases. - Preparing test procedures

Using UML for Security - UM L diagrams for security requirement -security business process physical security - security critical interaction - security state. Analyzing Model - Notation -formal semantics - security analysis - important security opportunities. Model based security engineering with UML - UML sec profile- Design principles for secure systems – Applying security patterns

## INFORMATION SECURITY POLICIES IN INDUSTRIES

Writing The Security Policies - Computer location and Facility construction – Contingency Planning - Periodic System and Network Configuration Audits - Authentication and Network Security – Addressing and Architecture – Access Control – Login Security – Passwords – User Interface – Telecommuting and Remote Access – Internet Security Policies – Administrative and User Responsibilities – WWW Policies – Application Responsibilities – E-mail Security Policies.

Establishing Type of Viruses Protection - Rules for handling Third Party Software – User Involvement with Viruses - Legal Issues- Managing Encryption and Encrypted data – Key Generation considerations and Management - Software Development policies -Processes -Testing and Documentation- Revision control and Configuration management - Third Party Development - Intellectual Property Issues

Maintaining the Policies - Writing the AUP - User Login Responsibilities - Organization’s responsibilities and Disclosures- Compliance and Enforcement – Testing and Effectiveness of Policies - Publishing and Notification Requirements of the Policies- Monitoring, Controls and Remedies - Administrator Responsibility - Login Considerations - Reporting of security Problems - Policy Review Process - The Review Committee-Sample Corporate Policies –Sample Security Policies

## SECURITY ASSESSMENT AND VERIFICATION

Evolution of information security, information assets, security standards, organizational impacts, security certifications, elements of information security program, need for security assessment, Security assessment process.

Security assessment planning – Business drivers, scope definition, consultant’s perspective, Client’s perspective, Development of project plan. Initial information gathering – Initial preparation, analysis of gathered

information.

Business process evaluation, Technology evaluation, Risk analysis, Risk mitigation.

Security Risk assessment project management, Security risk assessment approaches and methods.

Information security standards, information security Legislation, formal security verification, security verification with SSL.

### **TRUST MANAGEMENT IN E-COMMERCE**

Introduction to E-Commerce – Network and E-Commerce – Types of E-Commerce – E-Commerce

Business Models: B2C, B2B, C2C, P2P and M-commerce business models – Ecommerce Payment systems: Types of payment system – Credit card E-Commerce transactions– B2C E-Commerce Digital payment systems – B2B payment system.

Security and Encryption: E-Commerce Security Environment – Security threats in E-Commerce Environment – Policies, Procedures and Laws.

Inter-organizational trust in E-Commerce: Need – Trading partner trust – Perceived benefits and risks of E-Commerce – Technology trust mechanism in E-Commerce – Perspectives of organizational, economic and political theories of inter-organizational trust – Conceptual model of inter-organizational trust in E-Commerce participation.

Introduction to trusted computing platform: Overview – Usage Scenarios – Key components of trusted platform – Trust mechanisms in a trusted platform

Trusted platforms for organizations and individuals – Trust models and the E-Commerce domain.

### **ETHICAL HACKING & COMPUTER FORENSICS**

Introduction to Computer Forensics & Investigations: Computer Forensics & Investigations as a profession, understanding computer investigations, data acquisition, processing crime and incident scenes, Network forensics, cell phone and mobile device forensics.

Searching and Seizing Computer Related Evidence; Processing Evidence and Report Preparation;

Current Computer Forensics Tools: Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software

### **MULTIMEDIA IMAGE STORAGE AND RETRIEVAL**

Introduction: What is it, why study it and how? The eye and the camera, vision as an information processing task. A geometrical framework for vision. 3D interpretation of 2D images. Applications.

Image Formation Models : Monocular imaging system, Orthographic & Perspective Projection,

Camera model and Camera calibration, Binocular imaging systems

Case study: 3D models from uncelebrated images using Photo Builder

Motion Estimation : Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion

### **CLOUD DEVELOPMENT**

Data in the cloud – Relational databases, Cloud File Systems (GFS & HDFS), Big Table, HBase and Dynamo, Cloud Data Stores (Data Store and Simple DB)

MapReduce and Extensions : Parallel Computing, MapReduce Model, Parallel Efficiency of Map Reduce, Relational Operations using MapReduce, Enterprise Batch Processing using MapReduce.

Dev 2.0 Platform – Salesforce.com's Force.com platform, TCS InstantApps on Amazon Cloud, Advantages, Applicability and limits of Dev 2.0, Custom Enterprise Applications and Dev 2.0

Chairman, BOS (Information Technology), UoP