

**BHARATHIAR UNIVERSITY: COIMBATORE 641046**

**M. Phil. / Ph.D. – COMPUTER SCIENCE**

**Part I – Syllabus**

**[From October 2011 batch onwards]**

**PAPER I - RESEARCH METHODOLOGY**

**PAPER II - ADVANCED TECHNOLOGIES IN COMPUTER SCIENCE**

- PAPER III**
1. Data Warehousing and Mining.
  2. Digital Image Processing.
  3. Advanced Networking.
  4. Natural Language Processing.
  5. Data Compression.
  6. Agent Based Computing.
  7. Soft Computing.
  8. Software Testing and Quality Assurance.
  9. Knowledge Management and Business Intelligence.
  10. Grid and Cloud Computing.
  11. Mobile Computing.
  12. Bioinspired Computing.
  13. Concurrent Engineering Information System.
  14. Speech Processing.
  15. Information Security.

## **PAPER I - RESEARCH METHODOLOGY**

### **UNIT – I RESEARCH METHODS**

Meaning of Research- Objectives of Research- Motivation in Research- Types of Research- Research Approaches- Significance of Research-research methods versus Methodology- Research and Scientific Method- Importance of Knowing How Research is done- Research Process –Criteria of good Research –Problem Encountered by Researchers in India- What is Research Problem? Selecting the Problem- Necessity of Defining the Problem- Technique involved in Defining the Problem- Meaning of Research Design- Need for Research Design- Features of a Good Design- Important Concepts Relating to Research Design- Different research design- Basic principles of Experimental Designs- Significance of Report Writing- Different Steps in writing Report- Layout of the Research Report- Types of Reports- Oral Presentation Mechanics of Writing a Research Report- Precautions for Writing Research Reports.

### **UNIT – II ALGORITHMS AND ANALYSIS**

Elementary data Structures, Greedy method: Knapsack problem-job sequencing with deadlines- Optimal merge patterns, Dynamic Programming: Multistage graphs-Optimal binary search trees- 0/1 knapsack- Reliability design- The traveling salesperson problem- Flow shop scheduling, Basics search and traversal techniques: The techniques Code Optimization- Biconnected components and depth- first search. Backtracking: The 8 – Queer s problem- Sum of subsets – Hamiltonian cycles-Knapsack Problem.

### **UNIT – III COMPILER DESIGN**

Introduction to compiling- The Phases o f a Compiler- Lexical Analysis- The role of the lexical analyser-Specification &Recognition of tokens- Finite Automata-Conversion of Regular Expression to NFA – Syntax Analysis- The Role of the Parser-Context Free Grammar- Top-flown Parsing: Predictive Parser- Bottom- Up Parsing: SLR Parser Syntax- Directed Translation Construction of Syntax trees- Bottom-Up evaluation of S- attributed definition and inherited attributes- L- attributed definition-Type Checking- Specification of a simple type checker -Type Conversion- An algorithm for Unification- Symbol tables- Intermediate Code Generation-Code Generation- Issues in the design of code generator- Basic Blocks and Flow Graphs- A simple code generator- Register allocation and assignment-Dynamic programming code generation algorithm- Code Optimization- The Principal sources of optimization-optimization of basic blocks-Loops in flow graphs.

### **UNIT – IV OBJECT ORIENTED ANALYSIS, DESIGN AND DEVELOPMENT**

Object Oriented Design Fundamentals: The Object Model - Classes and Objects - Complexity - Classification - Notation - Process - Pragmatics – binary and entity relationship - object types - object state - OOSD life cycle. Object Oriented Analysis: Overview of object analysis - Shatter/Mellor, Coad/Yourdon, Rumbaugh, Booch - UML – Use case model– Conceptual model - behavior - class - analysis patterns - overview - diagrams - aggregation. Object Oriented Design Methods: UML - diagrams - collaboration - sequence - class - design patterns and frameworks - comparison with other design methods. Managing Object Oriented Development: Managing analysis and design - Evaluation testing - coding - Maintenance - Metrics. Object Oriented Development: Design of Foundation class libraries - Object Oriented Databases - Client/Server Computing - Middleware.

**UNIT – V SOFTWARE ENGINEERING**

Software Engineering Process paradigms - Project management - Process and Project Metrics – software estimation - Empirical estimation models - planning - Risk analysis - Software project scheduling. Requirements Analysis and Design: Prototyping - Specification - Analysis modeling - Software design - Abstraction - Modularity - Software Architecture - Effective modular design -Cohesion and Coupling - Architecture design and Procedural design - Data flow oriented design- design patterns. User interface design - Human Computer Interface design - Interface design - Interface standards. Programming languages and coding - Language classes - Code documentation – Code efficiency - Software Configuration Management – real time systems-Reverse Engineering and Re-engineering-CASE tools - Projects management, tools - analysis and design tools - Programming tools - integration and testing tools – clean room software engineering.

**TEXT BOOKS:****UNIT - I**

1. C.R.Kothari,"Research Methodology Methods & Techniques" 2<sup>nd</sup> Edition, Wishwa Prakashan Publishers.
2. Dr.Rajammal P. Devadas,"A. Handbook on Methodology of Research-Sri Ramakrishna Mission Vidyalyaya College of Rural Higher Education".

**UNIT - II**

1. Alfre V. Aho, John E. Hcpcroft, Jeffrey D. Ullman," Data structures and Algorithms", Addison- Wesley Publishing Company, 1987.
2. Ellis Harowitz, Sartaj Sahini, "Compute Algorithms", Galgotia Publications (P) Ltd., 1993.

**UNIT - III**

1. Alfre V. Aho, Ravi Sethi and Jeffrey D. Ullman," Compiler Principles, Techniques and Tools", Addison Wesley Publishing Co,1986.
2. Jean Paul, Tremblay, Paul G. Sorenson, "The Theory and Practices of Compiler Writing" Mc. GrawHill Inc, International Student Edition, 1985.

**UNIT - IV**

1. Craig Larman, "Applying UML and patterns ", Addison Wesley, 2000.
2. Grady Booch, James Rumbaugh, Ivar Jacobson," The Unified Modeling Language User Guide ", Addison-Wesley Long man, 1999.
3. Ali Bahrami, "Object Oriented System Development ", McGraw Hill International Edition, 1999.
4. Erich Gamma, "Design Patterns ", Addison Wesley, 1994.

**UNIT - V**

1. Roger Pressman.S., " Software Engineering : A Practitioner's Approach ", 3<sup>rd</sup> Edition, McGraw Hill, 1997.
2. I.Sommerville, " Software Engineerin",5<sup>th</sup> Edition, Addison Wesley, 1996.
3. P Fleege, "Software Engineering ", Prentice Hall, 1999.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli "Fundamental of Software Engineering ", Prentice Hall of India 1991.

## **PAPER II - ADVANCED TECHNOLOGIES IN COMPUTER SCIENCE**

### **UNIT – I MULTIMEDIA & ITS APPLICATIONS**

Multimedia - An Overview – Text – Image – Audio – Video – Animation – Multimedia Architecture – Multimedia Documents – Multimedia Application Development.

### **UNIT – II TCP/IP**

TCP/IP Protocol suite – Addressing – Classful addressing – Addressing issues – Subnetting and Supernetting – Variable length blocks – Packet delivery – Forwarding – Routing – ARP and RARP – Internet Protocol – ICMP – IGMP – UDP – TCP – Flow Control – Error Control – Congestion Control – Intra and Inter Domain Routing – Distance Vector Routing – Link State Routing- Path Vector Routing – Multicast Routing – BOOTP – DHCP – DNS – Remote Login and Telnet – FTP and TFTP – Electronic Mail – Network Management – IPV6.

### **UNIT – III CLIENT/SERVER TECHNOLOGY**

Client/Server Computing-What is Client/Server-Types of Servers-SQL Database server-The fundamentals of SQL and relational databases -What does a database server do-Stored Procedures, Triggers and rules- SQL Middleware and federated databases-SQL middleware-Will the real SQL API Please stand up? Open SQL gateways-data warehouses-Distributed Objects and components-From Distributed Objects to components-3Tier Client Server, Object Style-CORBA-Distributed Objects, CORBA style-OMG's object management architecture-CORBA 2.0-CORBA.Object Services-CORBA common facilities –CORBA business objects.

### **UNIT – IV ADAPTIVE WEB TECHNOLOGY**

J2EE: Overview-Multi-tier Architecture-The Enterprise Application-Clients-Sessions management-Web Tier-EJB Tier-J2EE Web Services. .NET Framework -Common Language Runtime- Base Class Libraries-Interoperability-Networking- Remoting- Security, Building Web applications- Web Services, Overview of XML.

### **UNIT – V DISTRIBUTED COMPUTING**

Distributed Systems: Fully distributed processing systems – Networks and Interconnection structures – Designing a distributed processing system – Distributed databases- challenge of distributed data – loading factors – managing the distributed resources – division of responsibilities.

### **TEXT BOOKS:**

#### **UNIT - I**

Ranjan Parekh, “Principles of Multimedia”, Fourth Reprint, Tata McGraw-Hill Publishing Company Limited, New Delhi, , 2008.

#### **UNIT - II**

Behrouz A. Forouzan, “TCP/IP Protocol Suite”, 3rd Edition, Tata McGraw –Hill, 2008

#### **UNIT - III**

Robert Orfali, Dan Harkey, Jerry, Edwards, “The Essential Client/Server Survival Guide”, Galgotia Publications.

**UNIT - IV**

1. Jim Keogh, " The Complete Reference J2EE", Tata McGraw-Hill Edition, 2002.
2. James McGovern et al., "J2EE1 .4 Bible", Wiley Publishing Inc, 2003.
3. Visual studio .Net Walkthroughs- Microsoft Manual.
4. [www.msdn.microsoft.com/netframework](http://www.msdn.microsoft.com/netframework).

**UNIT - V**

1. John A. Sharp, "An Introduction to Distributed and Parallel Processing", Blackwell Scientific Publications, 1987.
2. Uyles D. Black, "Data Communications & Distributed Networks", Prentice Hall, 1997.
3. Joel M. Crichlow, "Introduction to Distributed & Parallel Computing", Prentice Hall, 1988.
4. Stefans Ceri, Ginseppe Pelagatti, "Distributed Databases Principles and systems", McGraw Hill Book Co., New York, 1985.

## **PAPER III – 1. DATA WAREHOUSING AND MINING**

### **UNIT - I**

Data Warehousing Introduction – Definition-Architecture-Warehouse Schema-Warehouse server-OLAP operations. Data Warehouse technology – Hardware and operating system-Warehousing Software – Extraction tools – Transformation tools – Data quality tools – Data loaders – Data Access and retrieval tools – Data Modelling tools – Fact tables and dimensions Data warehousing case studies : Data warehousing in Government , Tourism, Industry , Genomics data.

### **UNIT - II**

Data Mining definition – DM Techniques – current trends in data mining - Different forms of Knowledge – Data selection, cleaning, Integration, Transformation, Reduction and Enrichment. Data: Types of data - Data Quality - Data Preprocessing - Measures of similarity and dissimilarity. Exploration: Summary statistics – Visualization.

### **UNIT – III**

Association rules: Introduction – Methods to discover association rule – Apriori algorithm Partition Algorithm – Pincher search algorithm – Dynamic Item set algorithm – FP Tree growth algorithm. Classification: Decision Tree classification – Bayesian Classification – Classification by Back Propagation.

### **UNIT - IV**

Clustering Techniques: Introduction – Clustering Paradigms – Partitioning Algorithms – K means & K Mediod algorithms – CLARA – CLARANS – Hierarchical clustering – DBSCAN – BIRCH – Categorical Clustering algorithms – STIRR – ROCK – CACTUS. Introduction to machine learning – Supervised learning – Unsupervised learning – Machine learning and data mining. Neural Networks: Introduction – Use of NN – Working of NN Genetic Algorithm: Introduction –Working of GA.

### **UNIT - V**

Web Mining: Introduction –Web content mining – Web structure mining –Web usage mining – Text mining –Text clustering, Temporal mining -Spatial mining –Visual data mining – Knowledge mining – Various tools and techniques for implementation using (weka, Rapidminer and Matlab).

### **TEXT BOOKS:**

1. Arun K Pujari , “Data Mining Techniques”, University press , Edition 2001.
2. Jaiwei Han, Michelinne Kamber , “Data Mining : Concepts and Techniques”
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining”, 2007.
4. T.Sushmita mitra, Tir ku Acharaya , “Data Mining Multimedia,Softcomputing & Bioinformatics”, Wiley Interscience publications , 2004.
5. Michal J A Berry, Gordon Linoff, “Mastering Data Mining”, John Wiley & Sons, 2000.
6. Alex Berson , Stephen J.Smith , “Data Warehousing , Data Mining & OLAP “, Tata McGrawhill
7. C S R Prabhu, “Data Warehousing – concepts, techniques and applications “, 2<sup>nd</sup> Edition, Prentice Hall of India, 2002.

**PAPER III – 2. DIGITAL IMAGE PROCESSING****UNIT – I**

Digital Image Processing: Origins of Digital Image Processing, Steps in Digital Image Processing, Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships between Pixels, Mathematical Tools used in Digital Image Processing.

**UNIT – II**

Image Transformation & Filters: Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filter, Sharpening Spatial Filters, Combining Spatial Enhancement methods, Fuzzy techniques for Intensity Transformation and Spatial Filtering. Filtering in the Frequency Domain: Preliminary Concepts, Sampling and the Fourier Transforms of Sampled Functions, The Discrete Fourier Transform (DFT), Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Sharpening using Frequency Domain Filters, Selective Filtering.

**UNIT – III**

Image Restoration, Reconstruction and Image Segmentation: Image Degradation/Restoration process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Functions, Inverse Filtering, Wiener Square Error Filtering, Constrained Least Square Filtering, Geometric Mean Filter, Image Reconstruction from Projections. Image Segmentation: Point, Line and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds, Use of Motion in Segmentation.

**UNIT - IV**

Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Full Color Image Processing, Color Transformation, Smoothing and Sharpening, Image Segmentation Based on Color, Noise in Color Images. Wavelets and Multiresolution Processing: Multiresolution Expansion, Wavelet Transforms in One Dimension, The Fast Wavelet Transforms, Wavelet Transforms in Two Dimensions, Wavelet Packets. Image Compression: Fundamentals, Basic Compression Methods, Digital Image Watermarking.

**UNIT - V**

Morphological Image Processing: Erosion and Dilation, Opening and Closing, The Hit-Or-Miss Transformation, Basic Morphological Algorithms, Gray-Scale Morphology. Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

**TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 3<sup>rd</sup> Edition, Pearson Education, 2008.
2. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing using MATLAB”, 2<sup>nd</sup> Edition, Prentice Hall of India, 2002.
3. A.Jain, ”Fundamentals of Digital Image Processing”, Prentice Hall of India.

### **PAPER III – 3. ADVANCED NETWORKING**

#### **UNIT - I**

Interconnections: Digital Data Communication Techniques – Data Link control protocol – Multiplexing – Spread spectrum – Circuit switching and packet switching – routing in switched networks. Data Link Layer issues – Transparent and Source routing bridges – Network interface – generic connectionless service – network layer address – connectionless data packet formats – routing algorithm concepts – Fast packet forwarding.

#### **UNIT - II**

Framerelay – ATM – High- speed LANs - Congestion control in data networks and Internets – Link-level flow and error control – TCP traffic control – Integrated and differential services – protocols for Qos support.

#### **UNIT - III**

VPN - SDH and SONET networks – Operational aspects – evolution of the optical network – optical transport network – MPLS traffic engineering. Network Management: SNMP Basic Foundation – SNMPv2 – SNMPv3 –RMON.

#### **UNIT - IV**

Mobile Communication: Wireless Transmission – Medium Access Control – Telecommunication Systems – Broadcast Systems - Wireless LAN – Mobile IP. Adhoc Wireless Networks: Adhoc Wireless Networks – MAC Protocol – Routing Protocols – Multicast Routing - QOS – Wireless Sensor Networks – Energy Management.

#### **UNIT - V**

Network Security and System Security: Introduction to Network Security – Symmetric Encryption and Message Confidentiality – Public-key Cryptography and Message Authentication – Authentication Application – Electronic Mail Security – IP Security – Web Security – Network Management Security - Intruders – Malicious Software – Firewalls.

#### **TEXT BOOKS:**

1. Jochen Schiller, Mobile Communication, Pearson, 2<sup>nd</sup> Edition, 2009.
2. C.Siva Ram Murthy, B.S. Manoj, “Adhoc Wireless Networks”, Pearson, 2005.
3. Radia Perlman, “Interconnections”, Pearsons, 2000.
4. William Stallings, “High Speed Networks and Internets”, Pearson, 2010.
5. Jon C.Snader,” VPNs Illustrated Tunnels, VPNs and Ipsec”, Pearson, 2006.
6. Jean Pjilippe Vasseur, Mario Pickavet, Demeester, “Network Recovery”, Elsevier, 2004.
7. Mani Subramanian, “Network Management”, Pearson, 2006.
8. William Stallings, “Data and Computer Communications”, Pearson, 2007.



### **PAPER III – 4. NATURAL LANGUAGE PROCESSING**

#### **UNIT - I**

Natural Language Processing (NLP) – open problems – major goal – language structure – language analyzer – morphological analyzer – local world grouper (LWG) – core parser – requirements of computational grammars – computational aspect – system aspect – large system aspect – morphological analysis – morphological generation using paradigms – morphological analysis using paradigms – speeding up morphological analysis by compilation – morphological analyzer – additional issues – local word grouping – verb groups – noun groups – strategy for grammar development – semantics in stages.

#### **UNIT - II**

Paninian grammar – semantic model – free word order and vibhakti – paninian theory – karaka relations – active passive – control – karaka to vibhakti mapping – karaka sharing.

#### **UNIT - III**

Machine translation – survey – is MT possible? – Possible approaches – current status – anusaraka or language accessor – cutting the Gordian knot – structure of anusaraka systems – user interface – linguistic area – anusaraka output – language bridges.

#### **UNIT - IV**

Lexical functional grammar – active passive and dative constructions – WH movements in questions – LFG formalism – well formedness conditions – handling WH movements in questions – computational aspects – features and feature structures – unification – other constraints – CFG and Indian languages – functional specification – lexicalized grammars and locality – lexicalized tree substitution grammar – lexicalized tree adjoining grammar – feature structures – mathematical aspects.

#### **UNIT - V**

Comparing TAG with PG – similarities between TAG and PG – differences between TAG and PG – Government and binding – GB modules – X-bar theory – theta theory – Government – Case theory – bounding theory – empty category principle (ECP) – binding theory – constraints on movement – GB parsing – comparing GB with PG.

#### **TEXT BOOKS:**

1. Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, “Natural Language Processing – A Paninian Prespective”, Prentice Hall of India, 2000.
2. James Allen, Natural Language Understanding, 3<sup>rd</sup> Edition, Pearson Education, 2005.

**PAPER III – 5. DATA COMPRESSION****UNIT - I**

Compression Techniques – Lossy compression & Lossless compression, modeling and compression Mathematical modeling for Lossless compression- Physical models, probability models, Markov Models and composite source models. Mathematical modeling for Lossy compression – physical models, Probability and linear systems models.

**UNIT - II**

Basic Techniques: Run length encoding, RLE Text compression, RLE image compression and scalar quantization. Statistical Methods : Information theory concepts, Huffman coding, Adaptive Huffman coding facsimile, compression Arithmetic coding and Adaptive, Arithmetic coding and Text compression. Dictionary methods: String compression, LZ 77, LZSS, LZ78,LZW, Unix compression, GIF image, ARC and PKZIP, Data compression patterns. Wavelet methods: Fourier Image compression, Multi Resolution decomposition and JPEG 2000.

**UNIT - III**

Intuitive Methods, Image Transforms, JPEG, Progressive Image compression, Vector quantization, Adaptive Vector Quantization, Block Matching, Block Truncation coding. Context Tree weighting, Block Decomposition, Binary Tree predictive coding, Quad Trees and Finite Automata Methods.

**UNIT - IV**

Analog Video, Composite and Components Video, Digital Video, Video compression, MPEG and H.261.

**UNIT - V**

Sound, Digital Audio, The Human Auditory System,  $\mu$ -Law and A-Law companding, ADPCM Audio compression and MPEPG-1 Audio Layers.

**TEXT BOOKS:**

1. David salomon ,”Data compression – The complete Reference”,2<sup>nd</sup> Edition, Springer publications.
2. Mark Nelson and Jean-Loup Gailly,” The Data compression Book”, 2<sup>nd</sup> Edition, BPB publications.
3. Khalid Sayood, “Introduction to Data Compression”, Harcout India(P) Ltd, New Delhi.

## **PAPER III – 6. AGENT BASED COMPUTING**

### **UNIT - I**

Introduction to Software Agents: What is a software agent? - Why software agents? - Applications of Intelligent software agents-Practical design of intelligent agent systems.

### **UNIT - II**

Intelligent Agent Learning- Approaches to Knowledge base development-Disciple approach for building intelligent agents- Knowledge representation-Generalization-Problem solving methods-Knowledge elicitation.

### **UNIT - III**

Rule learning: Rule learning problem- Rule learning method- Learned rule characterization. Rule refinement: Rule refinement problem- Rule refinement method- Rule experimentation and verification-Refined rule characterization-Agent interactions.

### **UNIT - IV**

Disciple shell: Architecture of Disciple shell- Methodology for building Intelligent Agents-Expert-Agent interactions during knowledge elicitation process- Expert-Agent interactions during rule learning process- Expert-Agent interactions during rule refinement process.

### **UNIT - V**

Case studies in building intelligent agents: Intelligent Agents in portfolio management-Intelligent Agents in financial services. Java Agent Development framework [JADE]: Creating multi-agent systems with JADE- Agent platform- Agent Tasks and behaviors-Agent Communication Language - Interaction protocols- Using JADE from Java.

### **TEXT BOOKS:**

1. Jeffrey M Bradshaw, “Software Agents”, AAAI Press/ The MIT Press, 2000.
2. Nicholas R Jennings, Michael J Wooldridge (Eds.), “Agent Technology – Foundations, Applications and Markets”, Springer, 1997.
3. Gheorghe Tecuci et al., “Building Intelligent Agents”, Academic Press, 2003.
4. Eduardo Alanso, Daniel Kudenko, Dimitar Kazakov (Eds.), “Adaptive Agents and Multi-Agent Systems”, Springer Publications, 2003.
5. [jade.tilab.com/doc/programmersguide.pdf](http://jade.tilab.com/doc/programmersguide.pdf).

## **PAPER III – 7. SOFT COMPUTING**

### **UNIT - I**

Fundamentals of ANN: The Biological Neural Network, Artificial Neural Networks - Building Blocks of ANN and ANN terminologies: architecture, setting of weights, activation functions - McCulloch-pitts Neuron Model, Hebbian Learning rule, Perception learning rule, Delta learning rule.

### **UNIT - II**

Models of ANN: Single layer perception, Architecture, Algorithm, application procedure - Feedback Networks: Hopfield Net and BAM - Feed Forward Networks: Back Propagation Network (BPN) and Radial Basis Function Network (RBFN) - Self Organizing Feature Maps: SOM and LVQ.

### **UNIT - III**

Fuzzy Sets, properties and operations - Fuzzy relations, cardinality, operations and properties of fuzzy relations, fuzzy composition.

### **UNIT - IV**

Fuzzy variables - Types of membership functions - fuzzy rules: Takagi and Mamdani – fuzzy inference systems: fuzzification, inference, rulebase, defuzzification.

### **UNIT - V**

Genetic Algorithm (GA): Biological terminology – elements of GA: encoding, types of selection, types of crossover, mutation, reinsertion – a simple genetic algorithm – Theoretical foundation: schema, fundamental theorem of GA, building block hypothesis.

### **TEXT BOOKS:**

1. S. N. Sivanandam, S. Sumathi, S.N. Deepa, “Introduction to Neural Networks using MATLAB 6.0 “, Tata McGraw-Hill, New Delhi, 2006.
2. S. N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Wiley-India, 2008.
3. D.E. Goldberg,” Genetic algorithms, optimization and machine learning”, Addison Wesley 2000.

## **PAPER III – 8. SOFTWARE TESTING AND QUALITY ASSURANCE**

### **UNIT - I**

Testing Objectives and principles - Purpose of Software testing – SDLC and testing – Verification and validation - Weyuker's adequacy axioms – model for testing and consulting oracles – Is complete testing possible – The Consequence of bugs – Taxonomy of Bugs– Test case Design – Black Box Testing and White Box testing – Testing strategies - Unit testing – Integration Testing – Validation testing – System testing – The art of Debugging and debugging approaches.

### **UNIT - II**

Basis Path testing - Data flow testing - Control flow and structure testing– Strategies – Applications, Tools and effectiveness – Condition Testing -Transaction Flow testing, Syntax Testing – Grammar for formats – Implementation. Loop and Logic Based Testing – Decision tables – Path Expressions – KV Charts – Specifications – State transition Testing – identifying good & bad states – state testing Metrics and Complexity.

### **UNIT - III**

Graph based testing methods –Orthogonal Array testing –Performance Testing -Testing for Real-time Systems– issues – Testing in web applications – Testing in object oriented software - Differences from testing non-OO Software – Testing OOA and OOD models -Class testing strategies - Class Modality - State-based Testing - Message Sequence Specification.

### **UNIT - IV**

Automated Tools for Testing - Static code analyzers - Test case generators - GUI Testing - Capture/Playback – Stress Testing - Testing Client -server applications - Testing compilers and language processors - Testing web enabled applications. Design for Testability - Observability & Controllability - Built-in Test - Design by Contract - Precondition, Post condition and Invariant - Impact on inheritance – polymorphism.

### **UNIT - V**

Regression Testing - Challenges – Test optimization- Mutation testing – Fault based testing – Scenario based testing-penetration testing-Testing Approaches in Software Industry – testing metrics – function based metrics –Bang metrics – software quality metrics.

### **TEXT BOOKS:**

1. Boris Beizer, "Software Testing Techniques", 2<sup>nd</sup> Edition, Dreamtech Press, 2003.
2. Myers, Glenford.J., "The Art of Software Testing", John-Wiley & Sons, 1979.
3. Roger.S.Pressman, "Software Engineering – A Practitioner's Approach", 5<sup>th</sup> Edition, Mc- Graw Hill, 2001.
4. Marnie.L. Hutcheson, "Software Testing Fundamentals", Wiley, 2007.
5. William E.Perry, "Effective Methods for Software Testing ", 2nd Edition, John Wiley & Sons, 2000.
6. Robert V.Binder, "Testing Object-Oriented Systems: Models Patterns and Tools ", Addison Wesley, 2000.

## **PAPER III – 9. KNOWLEDGE MANAGEMENT AND BUSINESS INTELLIGENCE**

### **UNIT - I**

Basics - What is Knowledge Management? - Key Challenges - KM Life Cycle - Understanding Knowledge – Definitions - Cognition and Knowledge Management - Data, Information, and Knowledge - Types of Knowledge - Expert Knowledge.

### **UNIT - II**

Knowledge Management System Life Cycle - Challenges in Building KM Systems - Conventional Versus KM System Life Cycle - KM System Life Cycle - System Justification - Role of Rapid Prototyping - Role of Knowledge Developer – User Training.

### **UNIT - III**

Knowledge Creation - Nonaka's Model of Knowledge Creation and Transformation - Knowledge Architecture - Capturing Tacit Knowledge – Evaluating the Expert – Developing a relationship with Expert – Interview as a tool – Brainstorming – Repertory Grid - Nominal-Group Techniques(NGT) – Delphi method – Concept mapping Knowledge Codification - Codification Tools and Procedures - Knowledge Developers Skill Set - Knowledge Transfer - Transfer Methods - Portals Basics - Business Challenge - Knowledge Portal Technologies - Ethical and Legal Issues - Knowledge Owners - Legal Issues.

### **UNIT - IV**

Changing Business Environments and Computerized Decision Support - A Framework for Business Intelligence - Intelligence Creation and Use and BI Governance - Transaction Processing versus Analytic Processing - Successful BI Implementation - Major Tools and Techniques of Business Intelligence.

### **UNIT - V**

Implementing BI: An Overview - BI and Integration Implementation - Connecting BI Systems to Databases and Other Enterprise Systems - On-Demand BI - Issues of Legality, Privacy, and Ethics - Emerging Topics in BI: An Overview - The Web 2.0 Revolution - Online Social Networking: Basics and Examples - Virtual Worlds - Social Networks and BI: Collaborative Decision Making - RFID and New BI Application Opportunities - Reality Mining.

### **TEXT BOOKS:**

1. Elias M.Awad, Hassan M.Ghaziri,"Knowledge Management", Pearson Education, 2004, (For Units I, II and III).
2. Efraim Turban, Ramesh Sharda, Dursun Delen and David King, "Business Intelligence" 2<sup>nd</sup> Edition, 2010. (For Unit IV – Chapter 1, Unit – V -Chapter 6).

## **PAPER III – 10. GRID AND CLOUD COMPUTING**

### **UNIT - I**

Introduction to Grid Computing- Anatomy and Physiology of Grid – Early Grid Activities – Current Grid Activities– Grid Standards - Grid Business Areas – Grid Challenges and Applications- Grid Computing Organization and their roles.

### **UNIT - II**

Service Oriented Architecture – Web Service Architecture – Grid Architecture – Implementing Grid Architecture- Globus Toolkit – Services - Open Grid Services Architecture - Grid Scheduling and Resource Management– Framework– Grid Resource Management Systems – Principles of Local Schedulers - Grid Scheduling with QoS – Data Management -Grid Security.

### **UNIT - III**

Cloud Computing – Overview – Applications-Intranets and the Cloud – Companies in the Cloud Today- Cloud Computing Services- On Demand Computing – Discovering Cloud Services- Development Services and Tools.

### **UNIT - IV**

Cloud hardware and infrastructure-clients-security-network-services-platforms-cloud storage- Cloud software architecture issues- Classification of Cloud Implementations.

### **UNIT - V**

Operating System for the Cloud - Application Patterns and Architecture – Case Studies-Cloud Computing services available under various platforms.

### **TEXT BOOKS:**

1. Joshy Joseph, Craig Fellenstein, “Grid Computing”, IBM Press, Pearson Education, 2004.
2. Ian Foster, Carl Kesselman (eds.),”The Grid: Blueprint for a New Computing Infrastructure”, Morgan Kaufmann Publishers, 2004.
3. Ahmar Abbas, “Grid Computing: A Practical Guide to Technology and Applications, Firewall Media”, 2009.
4. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, “Cloud Computing –A Practical Approach”, Tata McGraw Hill Education Pvt. Ltd, 2010.
5. Michael Miller,” Cloud Computing: Web based Applications that change the way you work and Collaborate online”, Que Publishing, August 2008.
6. Haley Beard, “Cloud Computing Best Practices for Managing and Measuring Processes for on demand computing, Applications and Data Centers in the Cloud with SLAs”, Emereo Pvt. Ltd, July 2008.
7. Prof (Dr.) Andreas Polze, “A Comparative Analysis of Cloud Computing Environments”.
8. Cloud Economics.

### **PAPER III – 11. MOBILE COMPUTING**

#### **UNIT - I**

Mobile computing: Components of wireless environment- Challenges in Mobile environment- Mobile devices - Middleware and gateways - Wireless Internet - Smart clients - Three-tier Architecture- Design considerations for mobile computing— Mobility and Location based services – Active transactions - Device Technology – Device Connectivity – Voice technology – Personal digital assistant.

#### **UNIT - II**

Mobile computing through Internet- Mobile-enabled Applications - Developing Mobile GUIs – VUIs and Mobile Applications – Multichannel and Multi modal user interfaces – Synchronization and replication of Mobile Data - SMS architecture - Java card – GPRS – Mobile Computing through Telephony - Synchronization protocol - Context-aware applications.

#### **UNIT - III**

Mobile Communication: Wireless Transmission – Medium Access Control – Telecommunication Systems – Satellite Systems – Broadcast system – Wireless LAN – Mobile IP – Mobile TCP.

#### **UNIT - IV**

ADHOC Wireless Network: Ad Hoc Wireless Network –MAC protocol – Routing protocols - Transport Layer Protocol - QOS – Energy Management.

#### **UNIT - V**

Wireless Sensor Network: Architecture and Design – Medium Access Control – Routing – Transport Layer – Energy model.

#### **TEXT BOOKS:**

1. William Stallings, "Wireless Communications & Networks", Pearson Education, 2005.
2. C.Siva Ram Murthy, B.S. Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", 2<sup>nd</sup> Edition, Pearson Education.
3. Ashok K Talukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill, 2005.
4. Jochen Burkhardt Dr.Horst Henn, Klaus Rintdoff,Thomas Schack, "Pervasive Computing", Pearson, 2009.
5. Fei Hu , Xiaojun Cao, " Wireless Sensor Networks Principles and Practice " CRC Press, 2010.



## **PAPER III – 15. BIOINSPIRED COMPUTING**

### **UNIT - I**

Natural to Artificial Systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging - Division of Labor - Task Allocation– Cemetery Organization and Brood Sorting – Nest Building- Cooperative transport.

### **UNIT - II**

Ant Colony Optimization [ACO]: Ant Behavior - Towards Artificial Ants - Combinatorial Optimization - Ant Colony Optimization Metaheuristic – Problem solving using ACO- Extensions of Ant Systems – ACO and Local search methods - ACO theoretical considerations and Convergence.

### **UNIT - III**

Ant Colony Optimization algorithms for NP-hard problems- Routing problems-Assignment problems - Scheduling problems – Subset problems - Machine Learning Problems – ACO for Travelling Salesman problem.

### **UNIT - IV**

Swarm Intelligence: Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Particle Swarms for dynamic optimization problems.

### **UNIT - V**

Biological Inspired computing to Natural Computing – Integration of Evolutionary Computation Components in Ant Colony Optimization – Particle Swarm Optimization based on Socio-cognition.

### **TEXT BOOKS:**

1. Marco Dorigo, Thomas Stutzle, “Ant Colony Optimization”, MIT Press, 2004.
2. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, ”Swarm Intelligence: From Natural to Artificial Systems”, Oxford University press, 2000.
3. Christian Blum, Daniel Merkle (Eds.),”Swarm Intelligence: Introduction and Applications”, Springer Verlag, 2008.
4. Leandro N De Castro, Fernando J Von Zuben,” Recent Developments in Biologically Inspired Computing”, Idea Group Inc., 2005.

**PAPER III – 13. CONCURRENT ENGINEERING INFORMATION SYSTEM****UNIT - I**

New Product Development And Management : Designing and Developing Products More Effectively - Complexity and Centrality - The Value of Operational Perspectives; Structuring the Work: Phases, Gates, and Simultaneous Engineering - Description of the NPI Process - Gate Reviews - The Practice of Simultaneous Engineering - Managing the Phase - Gate Process; Planning and Managing the Projects - The Need for Multiple Targets - Setting the Target Levels under Different Situations - Interactions among the Targets - Managing NPI Projects to Meet Cycle Time Targets - The Role of the Project Manager.

**UNIT - II**

Concurrent Engineering And Information Modeling : Concurrent Engineering: Basic Principles of CE - Components of CE - Concurrency and Simultaneity - Modes of Concurrency - Modes of Cooperation - Benefits of Concurrent Engineering; Information Modeling: Introduction - Information Modeling - Modeling Methodology - Foundation of Information Modeling - Concurrent Engineering Process Invariant - Enterprise Model-Class - Specification Model-Class - Product Model-Class - Process Model- Class - Cognitive Models - Merits and Demerits.

**UNIT - III**

Concurrent Engineering Information System And Process Modeling: Design For Quality, and for Other Objective Functions (DFx); Concurrent Engineering Methods and Tools; Concurrent Engineering Information System and Process Modeling - Concurrent Engineering, Advanced Integrated Product / Process Design Methods, as Part of Collaborative Design in PLM; Integration of Concurrent Engineering and Quality, Collaborative, Networked TQM.

**UNIT - IV**

Software Tools For Concurrent Engineering: Concurrent Engineering Customer Requirements Analysis Modeling, Based on the QFD (Quality Function Deployment) Method, Using CORA (Component Oriented Requirements Analysis) Software Tool for PLM; Concurrent Engineering Process Failure Risk Analysis Modeling (PFRA); a Failure Mode and Effect Analysis (FMEA) Method, and Software Tool.

**UNIT - V**

Case Studies : Collaboration of Parametric Technology's a Failure Mode and Effect Analysis (FMEA) Method; ProEngineer Wildfire and Windchill Software Tools - Rapid Prototyping Methods, Tools - Kaizen, Kanban, JIT (Just-in-Time), and Lean Production Control Methods to Support the Integrated Design Processes and Flexible / Real-time Dynamic Supply Chains in PLM - The Lean Six Sigma Methodology - Continuous Design Improvement Methods.

**TEXT BOOKS:**

1. Stephen R. Rosenthal, "Effective product design and development: how to cut lead time and increase customer satisfaction", Business One, Illinois [Unit 1].
2. Biren Prasad, "Concurrent Engineering Fundamentals: Integrated Product and Process Organization" Volume I, Prentice Hall, 1995 [Unit 2].

3. Paul G Ranky, Richard G Ranky, “Concurrent / Simultaneous Engineering Methods, Tools and Case Studies Within a Quality Green PLM, (Product Lifecycle Management) Framework”, CIMware USA, 1872631045, ISBN-13: 978-1872631042, <http://www.cimwareukandusa.com/CIMwMedia/IntroCE-PLM-eBook-Wobject.html> [Units 3, 4, 5].
4. Bin Wu, “Manufacturing systems design and analysis: context and techniques”, Chapman Hall, London, 2000.
5. Andrew Kusiak, “Concurrent Engineering: Automation, Tools, and Techniques, Wiley-Interscience”, 1992, ISBN-10: 0471554928, ISBN-13: 978-0471554929.

### **PAPER III – 14. SPEECH PROCESSING**

#### **UNIT - I**

Introduction to speech processing – History – Applications- Speech production: Mechanism of speech production- Acoustic phonetics – Digital models for speech signals – Speech waveform representations- Sampling speech signals- Basics of quantization.

#### **UNIT - II**

Short-time analysis of speech- Short-time energy and Zero crossing rate-Short-time auto correlation method – Short-time Fourier Transform –Speech spectrogram- Homomorphic speech analysis-Cepstrum and Complex Cepstrum-The short-time cepstrum-Computation of Cepstrum - Mel Frequency Cepstrum Co-efficients - Linear predictive analysis.

#### **UNIT - III**

Text to Speech Synthesis: Basic principles - Rule based speech synthesis - Corpus based speech synthesis -Linguistic processing - Prosodic processing

#### **UNIT - IV**

Speech Recognition: Speech recognition architecture- Types of speech recognition-Issues in speech recognition-Speech databases-Performance evaluation of SR systems-Applications - Feature extraction methods- Speech recognition methodologies: Acoustic-phonetic approach- Pattern recognition approach: Template based approach-Dynamic Time Warping- Hidden Markov Model-Vector Quantization – Support Vector Machine - Neural network based approaches.Language Model- Trigram language model –CMU SLM Toolkit.

#### **UNIT - V**

Speaker Identification and Verification: Measuring speaker features- Statistical Vs Dynamic features - Cepstral analysis – Similarity Vs Distance measures - Constructing speaker models – Adaptation - Applications of speaker recognition - Text dependent speaker recognition - Text independent speaker recognition- Generative approaches: Rationale - Gaussian mixture model (GMM)- Neural network approaches - Discriminative approaches: Support Vector Machine(SVM) - Kernels.

#### **TEXT BOOKS:**

1. L. R. Rabiner, R. W. Schaffer, “Digital Processing of Speech signals”, Prentice Hall, 1978.
2. Jacob Benesty, M. Mohan Sondhi, Yiteng Huang “Springer handbook of speech Processing”, Springer, 2007.
3. Douglas O’Shaughnessy, “Speech Communications: Human and Machine”, Wiley-IEEE Press, 1999.
4. L.R. Rabiner, B. H. Juang, “Fundamentals of speech recognition”, Prentice Hall,1993.

### **PAPER III – 15. INFORMATION SECURITY**

#### **UNIT - I**

Conventional Encryption : Classical Technique – Modern technique – Algorithms; Public Key Cryptography : Public Key Cryptography – Introduction to Number Theory – Message Authentication and Hash Function – HASH and MAC Algorithm – Digital Signature and Authentication protocol.

#### **UNIT - II**

Network Security Practice: Authentication Application – Electronic Mail Security – IP Security Program Security and System Security: Secure programs – Nonmalicious program errors – viruses and Worms – Memory and address protection – control access to general objects – File protection mechanism – user authentication – Trusted operating system design and assurance – Intrusion Detection system.

#### **UNIT - III**

System Security and Web Security: Intruders,– Firewall - Managing Access – Password management - Web Security requirements – SSL and TLS – SET; Client Side Security : Using SSL – Active Content – Web Privacy. Database Security: The Database as a Networked Server – Securing database-to-database communication – Reliability and Integrity of database – sensitive data – inference – multilevel databases

#### **UNIT - IV**

Wireless Network Security: Mobile Security – Encryption Schemes in WLANs – Basic approach to WLAN security and Policy Development – WLAN intrusion process – WLAN security solutions. Digital Watermarking and Steganography: Models of Watermarking – Basic Message Coding – Watermark Security – Content Authentication – Steganography.

#### **UNIT - V**

Cyber Crimes: Introduction – computer crime and cyber crimes; Classification of cyber crimes, Cyber crime and Related Concepts: Distinction between cyber crime and conventional crimes, Reasons for commission of cyber crime, Cyber forensic : Cyber criminals and their objectives, Kinds of cyber crimes – cyber stalking; cyber pornography; forgery and fraud; crime related to IPRs; Cyber terrorism; computer vandalism, Regulation of cyber crimes: Issues relating to investigation, Issues relating to Jurisdiction, Issues relating to Evidence , Relevant provisions under Information Technology Act, 2000, Indian Penal Code, Pornography Act and Evidence Act etc.

#### **TEXT BOOKS:**

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Prentice Hall of India, 2007.
2. William Stallings, “Cryptography and Network Security”, 5<sup>th</sup> Edition, Pearson.
3. John W.Rittinghouse, James F.Ransome, “Wireless Operational Security”, Elsevier, 2004.
4. Ron Ben Natan, “Implementing Database Security and Auditing”, Elsevier, 2005.
5. Lincoln D. Stein, “Web Security”, Addison Wesley, 1999.
6. Ingemar J.Cox, Matthew L. Miller Jeffrey A.Bloom, Jessica Fridrich, Ton Kalker, “Digital Watermarking and Steganography”, 2<sup>nd</sup> Edition, Elsevier.
7. Dr.R.K.Tiwari, P.K.Sastri, K.V.Ravikumar, “ Computer Crime and Computer Forensics”, 1<sup>st</sup> Edition, Selective Publishers, 2002.