

BHARATHIAR UNIVERSITY : COIMBATORE 641 046

M.Phil. / Ph.D. - COMPUTER SCIENCE

Part I – Syllabus (Effective from Academic year 2008-2009 onwards)

- PAPER III -
1. Data Warehousing and Mining
 2. Digital Image Processing
 3. Advance Networking
 4. Natural Language Processing
 5. Data Compression
 6. Agent based Computing
 7. Soft Computing
 8. Embedded and Real Time Operating Systems
 9. Software Testing and Quality Assurance
 10. Knowledge Management.

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Part I – Syllabus (Effective from Academic year 2008-2009)

Paper III : 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.

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 “,Prentice Hall of India, 2nd edition , 2002.

REFERENCE BOOKS :

1. David Hand, Heikki Mannila , Padhraic smyth, “Principles of Data Mining”, the MIT Press, Massachusetts Institute of Technology , Cambridge.
2. Usama M Fayyad, Gregory Piatskey Sharpio, Padhr Smyth, Ramasamy Uthurusamy , “Advances in Knowledge discovery and data mining”.
3. Mehmed Kantardzix, ”Data Mining : Concepts Models,methods and algorithms”.
4. Mark Humphries , Michal W Hawkins & Michelle C dy, “Data warehousing architecture and implementation”, Prentice hall of India,1999.
5. Margaret H.Dunham ,”Data Mining :Introductory and advanced topics”.
6. Sumathi, S.N. Sivanandam, “Introduction to Data Mining and its Applications “,Springer.

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Paper III : Digital Image Processing

UNIT - I

Digital image processing – fundamental steps in image processing – elements of image processing systems. Digital image fundamentals: A simple image model – sampling and quantization – some basic relationships between pixels. Introduction to Fourier transform – the discrete Fourier transform – properties of the two-dimensional Fourier transform. Image Enhancement: Enhancement by point processing – spatial filtering – enhancement in the frequency domain – generation of spatial masks from frequency domain specifications – color image processing

UNIT - II

Image restoration: Degradation model – diagonalisation of circulant and block circulant matrices – Algebraic approach to restoration – inverse filtering. Image compression: Fundamentals – image compression models – error-free compression – lossy compression – image compression standards.

UNIT - III

Image segmentation: Detection of discontinuities – edge linking and boundary detection – thresholding - region oriented segmentation. Representation and description: representation schemes – boundary descriptors – regional descriptors. Elements of image analysis – Patterns and Pattern classes – decision theoretic methods – structural methods – interpretation

UNIT - IV

Image processing – pattern recognition – relationship between image processing and pattern recognition. Object detection: introduction. Shape analysis: introduction – convex hull – convex hull based representation – fractals – fractals based image shape representation.

UNIT - V

Wavelets: introduction – properties of wavelets – fast wavelet transform – wavelet decomposition structures and coefficients – inverse fast wavelet transform – application of wavelets in image processing

TEXT BOOKS :

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image processing using MATLAB”, Pearson Education, 2004
2. Rafael C. Gonzalez, Richard E. Woods, “Digital Image processing”, 2nd ed., Prentice Hall, NJ., 2002
3. Russ J. C., “The image processing handbook”, 3rd ed., CRC Press, 1999

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Paper – III : Advanced Networking

Unit – I : Circuit Switching Networks

AT & T's Dynamic Routing Network, Routing in Telephone Network – Dynamic Non Hierarchical Routing – Trunk Status Map Routing – Real Time Network Routing, Dynamic Alternative Routing – Distributed Adaptive Dynamic Routing – Optimized Dynamic Routing.

Unit – II : Packet Switching Networks

Distance Vector Routing-Link State Routing-Inter Domain Routing – Classless Interdomain Routing (CIDR), Interior Gateway Routing Protocols(IGRP) – Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol(EGRP)–Border Gateway Protocol(BGP), Apple Talk Routing and SNA Routing

UNIT – III : High Speed Networks

Routing in optical networks- The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks – ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol, Routing in the PLANET network and Deflection Routing.

Unit – IV : Security and Cryptography

Introduction to Security - Security Attacks, services and Mechanisms – Data Encryption Standard - Advanced Encryption Standard–Public–Key Cryptography and RSA – Message Authentication and Hash Functions – Hash and MAC algorithms – Digital Signatures and Authentication Protocols

Unit – V : Network Security

Authentication Applications – Electronic Mail security – IP Security – Web security – Intruders – Malicious Software – Firewalls.

TEXT BOOKS :

1. M Steen Strub,“Routing in Communication Networks”,PH International,NY 1995.
2. William Stallings,“ISDN & Broadband ISDN with Frame Relay and ATM”, PHI, ND, 2004.
3. William Stallings, “Cryptography and Network Security”, PHI, 2006

REFERENCE BOOKS :

1. “Internetworking Technologies Hand Book”, Fouth Edition, Inc. (CISCO System , ILSG Cisco System 2003)
2. William Stallings, “High Speed Networks TCP/IP and ATM Design Principles”, PH International, NY, 1998.
3. “Behrouy A Ferouzan”, Data Communications and Networking (3/e) TMH, 2004
4. Charlie Kaufman, Radia Rerlman Mike Specines, “Network Security – Private Communication in a Public World”, PHI (2/e) 2002.

Paper - III : 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

REFERENCE BOOKS :

1. Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, “Natural Language Processing – A Paninian Perspective”, Prentice Hall of India, 2000
2. James Allen, Natural Language Understanding, Pearson Education, 3rd ed., 2005

Paper - III : Data Compression

UNIT-I : Introduction

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 models and linear systems models.

UNIT – II : Different Methods of Compression

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 : Image Compression

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 : Video Compression

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

UNIT – V : Audio Compression

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

TEXT BOOKS :

1. David salomon, “Data compression – The complete Reference”, Springer Publications(2nd Edition)
 2. Mark Nelson and Jean-Loup Gailly, “The Data compression Book”, Mark Nelson and Jean-Loup Gailly, BPB publications (2nd Edition)
 3. Khalid Sayood, “Introduction to Data Compression”,Harcout India(P) Ltd,New Delhi
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Paper - III : 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- Statistical Analysis assessment and support agent- Design assistant for configuring computer systems.

REFERENCE BOOKS :

1. Jeffrey M Bradshaw, “Software Agents”, AAI Press/ The MIT Press, Standard Edition.
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.

Paper - III : 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.

REFERENCE BOOKS :

1. Satish Kumar, Neural Networks – A Classroom approach, Tata McGraw-Hill, New Delhi, 2007.
2. Martin T. Hagan, Howard B. Demuth, Mark Beale, Neural Network Design, Thomson Learning, India, 2002.
3. B. Kosko, Neural Network and fuzzy systems, PHI, 1996.
4. Klir & Yuan, “Fuzzy sets and fuzzy logic – theory and applications, PHI, 1996.
5. Melanie Mitchell, An introduction to genetic algorithm, PHI, India, 1996.

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Paper - III : Embedded and Real Time Operating Systems

UNIT - I

Introduction to Embedded Systems-Categories of embedded Systems-specialties of embedded systems- requirements of embedded systems –challenges and issues in embedded software development – recent trends in embedded systems-Architecture of embedded systems: Hardware architecture – software architecture-application software – communication software –Embedded systems on a Chip (SoC) and the use of VLSI designed circuits.

UNIT - II

Hardware Fundamentals- Terminology-Gates-Timing Diagrams-Memory- Advanced Hardware Fundamentals- Microprocessors-Microprocessor Architecture-Direct Memory Access - Interrupts and Software Architecture- Interrupts Basics – Interrupt Service Routines- Survey of Software Architectures- Round Robin with interrupts-Function-Queue-Scheduling Architecture-Real Time Operating Systems Architecture.

UNIT - III

Applications of Embedded Systems-Application market segments-consumer electronics-control system and industrial automation – biomedical systems- field instrumentation – handheld computers – data communication – networked information appliances – telecommunications – wireless communication.

UNIT - IV

Introduction to real time theory-Scheduling theory-rate monotonic scheduling-utilization bound theorem-Introduction to Real time Operating System –Desktop OS vs. RTOS – need for BSP in embedded systems – Issues in Real time computing –Structure of a real time system – task management – race condition – priority inversion – RTOS under the hood – ISRs and scheduling – Inter task communication – timers – programming language and tools.

UNIT - V

Case Study-QNX Neutrino, VxWorks, MicroC/OS-II, RTLinux, POSIX, Embedded NT, and Windows XP embedded.

TEXT BOOKS :

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First Reprint 2003
2. David E.Simon, an Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
3. Dreamtech Software Team, Programming for Embedded Systems, Wiley Publishing Inc., 2003
Ahmed M Ibrahim , Fuzzy logic for Embedded Systems Applications, Newness an imprint of Elsevier, 2004
4. Dr.K.V.K.K Prasad, Embedded/Real Time Systems: Concepts, Design and Programming – The Ultimate Reference, Dreamtech Press, 2003
5. Sriram Iyer, Pankaj Gupta, Embedded Real time Systems Programming , Tata McGraw Hill Publishing Company Limited, 2004

REFERENCE BOOKS :

1. Lewin A.R.W.Edwards, “Embedded System Design on a Shoestring, Newness an imprint of Elsevier
2. C.M. Krishna, Kang G.Shin, Real Time Systems, The McGraw Hill International Editions Computer Science Series.

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Paper – III : Software Testing and Quality Assurance

UNIT - I

Introduction to software quality – Software modeling – Scope of the software quality program – Establishing quality goals – Purpose, quality of goals – SQA planning software – Productivity and documentation, Software quality assurance plan – Purpose and Scope, Software quality assurance management - Organization – Quality tasks – Responsibilities – Documentation. Standards, Practices, Conventions and Metrics, Reviews and Audits – Management, Technical review – Software inspection process – Walk through process – Audit process – Test processes – ISO, CMM compatibility – Problem reporting and corrective action.

UNIT - II

Tools, Techniques and methodologies, Code control, Media control, Supplier control, Records collection, Maintenance and retention, Training and risk management. ISO 9000 model, CMM model, Comparisons, ISO 9000 weaknesses, CMM weaknesses, SPICE – Software Process Improvement and Capability determination.

UNIT - III

Purpose of Software testing – Some Dichotomies – a model for testing – Playing pool and consulting oracles – Is complete testing possible – The Consequence of bugs – Taxonomy of Bugs. Software testing Fundamentals – Test case Design – Introduction of Black Box Testing and White Box testing – Flow Graphs and Path testing – Path testing Basics - Predicates, Path Predicates and Achievable Paths - Path Sensitizing – Path Instrumentation –Implementation and Application of Path Testing.

UNIT - IV

Transaction Flow testing – Transaction Flows – techniques – Implementation Comments – Data Flow Testing – Basics – Strategies – Applications, Tools and effectiveness – Syntax Testing – Why, What, How – Grammar for formats – Implementation – Tips. Logic Based Testing – Motivational Overview – Decision tables – Path Expressions – KV Charts – Specifications – States, State Graphs and transition Testing – State Graphs – Good & bad states – state testing Metrics and Complexity.

UNIT - V

Testing GUIs – Testing Client – Server Architecture – Testing for Real-time System – A Strategic Approach to Software testing – issues – unit testing – Integration Testing – Validation testing – System testing – The art of Debugging.

REFERENCE BOOKS :

1. Mordechai Ben – Meachem and Garry S.Marliss, “Software Quality–Producing Practical, Consistent Software”, International Thompson Computer Press, 1997
2. Watt. S. Humphrey, “Managing Software Process”, Addison – Wesley, 1998.
3. Philip.B.Crosby,“Quality is Free:The Art of making quality certain”, Mass Market, 1992
4. Boris Beizer, Software Testing Techniques, Dreamtech Press, Second Edition – 2003.
5. Myers and Glenford.J., The Art of Software Testing, John-Wiley & Sons,1979
6. Roger.S.Pressman, Software Engineering – A Practitioner’s Approach ,Mc-Graw Hill, 5th edition, 2001
7. Marnie.L. Hutcheson, Software Testing Fundamentals, Wiley-India,2007

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Paper – III : Knowledge Management

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 – Fuzzy Reasoning and the Quality of Knowledge Capture – Interview as a tool – Brainstorming – Repertory Grid - Nominal-Group Techniques(NGT) – Delphi method – Concept mapping

UNIT - IV

Knowledge Codification - Codification Tools and Procedures - Knowledge Developers Skill Set - Knowledge Transfer - Transfer Methods - Role of the Internet in Knowledge Transfer - Knowledge Transfer in the E-World - E-Business – KM Tools :- Personal KM Tools, What next – from GUI to CIM, Software – Knowledge Technologies :- State of Technology, KM Gets Unconventional, Application is the Key, Content Mgmt, Technology components of KM, ERP and BPR, Meta-data Architecture.

UNIT - V

Knowledge Management Tools and Knowledge Portals - Portals Basics - Business Challenge - Knowledge Portal Technologies - Ethical and Legal Issues - Knowledge Owners - Legal Issues - The Ethical Factors – Futuristic KM.

TEXT BOOKS :

1. Elias M.Awad, Hassan M.Ghaziri, "Knowledge Management", Pearson Education (Edition 2004).

REFERENCE BOOKS :

1. A Thothathri Raman, Knowledge Management a resource book, EXCEL Books, 2004. ISBN 81-7446-351-8 (PB), 81-7446-352-6 (HB)
 2. Kai Mertins, Peter Heisig , Jens Vorbeck ,” Knowledge Management: Concepts and Best Practices” ,Springer Publications, Second Edition.
 3. Amrit Tiwana, The Essential Guide to Knowledge Management – E-Business and CRM Applications, Pearson Education Asia, ISBN 81-7808-326-4
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