RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

MCA, Third -Semester

MCA 301 Data Mining

UNIT – I Motivation, importance, Data type for Data Mining : relation Databases, Data Warehouses, Transactional databases, advanced database system and its applications, Data mining Functionalities: Concept/Class description, Association Analysis classification & Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Classification of Data Mining Systems, Major Issues in Data Mining.

UNIT – II Data Warehouse and OLAP Technology for Data Mining: Differences between Operational Database Systems and Data Warehouses, a multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology.

UNIT- III Data Preprocessing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Data Mining Primitives, Languages, and System Architectures, Concept Description: Characterization and Comparison, Analytical Characterization.

UNIT – IV Mining Association Rules in Large Databases: Association Rule Mining: Market Basket Analysis, Basic Concepts, Mining Single-Dimensional Boolean Association Rules from Transactional Databases: the Apriori algorithm, Generating Association rules from Frequent items, Improving the efficiency of Apriory, Mining Multilevel Association Rules, Multidimensional Association Rules, Constraint-Based Association Mining.

UNIT – V Classification & Prediction and Cluster Analysis: Issues regarding classification & prediction, Different Classification Methods, Prediction, Cluster Analysis, Major Clustering Methods, Applications & Trends in Data Mining: Data Mining Applications, currently available tools.

BOOKS

1. J. Han and M. Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Pub. 2. Berson "Dataware housing, Data Mining & DLAP, @004, TMH. 3. W.H. Inmon " Building the Datawarehouse, 3ed, Wiley India. 4. Anahory, "Data Warehousing in Real World", Pearson Education. 5. Adriaans, "Data Mining", Pearson Education. 6. S.K. Pujari, "Data Mining Techniques", University Press, Hyderabad

MCA 302 Artificial Intelligence

UNIT I General Issues and Overview of AI The AI problems, what is an AI technique, Characteristics of AI applications. Introduction to LISP programming: Syntax and numeric functions, Basic list manipulation functions, predicates and conditionals, input output and local variables, iteraction and recursion, property lists and arrays.

UNIT II Problem Solving, Search and Control Strategies General problem solving, production systems, control strategies forward and backward chaining, exhausive searches depth first breadth first search. Heuristic Search Techniques Hill climbing, branch and bound technique, best first search & A* algorithm, AND / OR graphs, problem reduction & AO* algorithm, constraint satisfaction problems.

UNIT III Knowledge Representations First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.

UNIT IV Natural Language processing Parsing techniques, context free grammer, recursive transitions nets (RNT), augmented transition nets (ATN), case and logic grammers, symantic analysis. Game playing Minimax search procedure, alpha-beta cutoffs, additional refinments. Planning Overview an example domain the block word, component of planning systems, goal stack planning, non linear planning.

UNIT V Probabilistic Reasoning and Uncertainty Probability theory, bayes theorem and bayesian networks, certainty factor.
Expert Systems Introduction to expert system and application of expert systems, various expert system shells, vidwan frame work, knowledge acquisition, case studies, MYCIN.
Learning Rote learning, learning by induction, explanation based learning

BOOKS

1. Elaine Rich and Kevin Knight “Artifical Intelligence” - Tata McGraw Hill.
2. “Artifical Intelligence” 4 ed. Pearson
. 3. Dan W. Patterson “Introduction to Artifical Intelligence and Expert Systems”, Prentice India.
4. Nils J. Nilson “Principles of Artifical Intelligence”, Narosa Publishing House.
5. Clocksin & C.S.Melish “Programming in PROLOG”, Narosa Publishing House.
6. M.Sasikumar,S.Ramani etc. “Rule based Expert System”, Narosa Publishing House

Elective –I MCA 303 (1) PYTHON PROGRAMMING

UNIT I INTRODUCTION TO PYTHON:
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT II CONTROL FLOW, FUNCTIONS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT III LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: Sorting and Searching
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UNIT IV
Classes and Inheritance: Object Oriented Programming, Class Instances, Methods Classes Examples, Why OOP, Hierarchies, Your Own Types – An Extended Example: Building a Class, Visualizing the Hierarchy, Adding another Class, Using Inherited Methods

UNIT V FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

BOOKS

1. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", SecondEdition, Shroff O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
3. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised andUpdated forPython 3.2, Network Theory Ltd., Edition2011

Elective –I MCA **303 (2) Web Technology**

UNIT I

Concept of Internet : Client / Server model,Internet and WWW, IP, URL, ISP, DNS; Web Design : Principals of effective Web Design, Page layout and linking, designing effective navigation for your website, planning and publishing websites, Responsive web design : Responsive vs adaptive web design

UNIT II

HTML and Style Sheets : Working with HTML - Formatting and Fonts, Basic Tags, Hyperlinks, Tables, Images, Forms, XHTML, Meta tags. Style Sheets (CSS): Introduction, Need, basic syntax and structure, class, id, background Images, Colors and Properties, Manipulating Texts, Margins, Positioning.

UNIT III

Javascript : Client side scripting with JavaScript, Data Types and Variables, Expressions, Operators and Statements, Objects and Arrays, Functions, loops, Classes, Modules, DOM, Forms and Validations.

UNIT IV

XML : Introduction, Features, Anatomy, Declaration, Uses, Key Components, DTD and Schema, Markup Elements and Attributes, XML Objects, XML Scripting, Using XML with application, Transforming XML using XSL and XSLT, XPATH - Template Based Transformations.

UNIT V

Introduction to AJAX: AJAX Components, The XMLHttpRequest Object, Using XSLT with AJAX; Webservices : Web Service architecture, introduction to webservices, Web Services VS other technologies, Web Services Benefits

Books

1.Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2.Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
3.Web Technologies, Black Book, dreamtech Press
4.Web Design, Joel Sklar, Cengage Learning
5.Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson.
6.Steven Holzner,"HTML Black Book", Dremtech press.
7.Kogent Learning Web Technologies: HTML, Javascript Wiley India

Elective –I MCA 303 (3) Introduction to Data Science and Big Data

UNIT I INTRODUCTION TO DATA SCIENCE AND BIG DATA

Introduction to Data Science – Data Science Process – Exploratory Data analysis – Big data: Definition, Risks of Big Data, Structure of Big Data – Web Data: The Original Big Data – Evolution Of Analytic Scalability – Analytic Processes and Tools – Analysis versus Reporting – Core Analytics versus Advanced Analytics– Modern Data Analytic Tools – Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Introduction to Data Visualization.

UNIT II DATA ANALYSIS USING R

Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis – Bivariate Analysis: Correlation – Regression Modeling: Linear and Logistic Regression – Multivariate Analysis – Graphical representation of Univariate, Bivariate and Multivariate Analysis in R: Bar Plot, Histogram, Box Plot, Line Plot, Scatter Plot, Lattice Plot, Regression Line, Two-Way cross Tabulation.

UNIT III DATA MODELING

Bayesian Modeling – Support Vector and Kernel Methods – Neuro – Fuzzy Modeling – Principal Component Analysis – Introduction to NoSQL: CAP Theorem, MongoDB: RDBMS VsMongoDB, Mongo DB Database Model, Data Types and Sharding – Data Modeling in HBase: Defining Schema – CRUD Operations

UNIT IV DATA ANALYTICAL FRAMEWORKS

Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce – Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.

UNIT V STREAM ANALYTICS

Introduction To Streams Concepts – Stream Data Model and Architecture – Stream Computing – Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window.

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons
2. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly

Elective –II MCA 304(1) Elective –II Machine Learning

UNIT I Introduction to machine learning, scope and limitations, regression, probability, statistics and linear algebra for machine learning, convex optimization, data visualization, hypothesis function and testing, data distributions, data preprocessing, data augmentation, normalizing data sets, machine learning models, supervised and unsupervised learning.

UNIT II Linearity vs non linearity, activation functions like sigmoid, ReLU, etc., weights and bias, loss function, gradient descent, multilayer network, backpropagation, weight initialization, training, testing, unstable gradient problem, auto encoders, batch normalization, dropout, L1 and L2 regularization, momentum, tuning hyper parameters.

UNIT III Convolutional neural network, flattening, subsampling, padding, stride, convolution layer, pooling layer, loss layer, dance layer 1x1 convolution, inception network, input channels, transfer learning, one shot learning, dimension reductions, implementation of CNN like tensor flow, keras etc.

UNIT IV Recurrent neural network, Long short-term memory, gated recurrent unit, translation, beam search and width, Bleu score, attention model, Reinforcement Learning, RL-framework, MDP, Bellman equations, Value Iteration and Policy Iteration, , Actor-critic model, Q-learning, SARSA

UNIT V Support Vector Machines, Bayesian learning, application of machine learning in computer vision, speech processing, natural language processing etc, Case Study: ImageNet Competition

TEXT BOOKS RECOMMENDED:

1. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer-Verlag New York Inc., 2nd Edition, 2011.
2. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education, First edition, 2017. 3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2016

REFERENCE BOOKS:

1. Aurelien Geon, “Hands-On Machine Learning with Scikit-Learn and Tensorflow: Concepts, Tools, and Techniques to Build Intelligent Systems”, Shroff/O'Reilly; First edition (2017).
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 1 edition (10 January 2018).
3. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly; First edition (2016).
4. Russell, S. and Norvig, N. “Artificial Intelligence: A Modern Approach”, Prentice Hall Series in Artificial Intelligence. 2003.

Elective –II MCA **304(2) SOFT COMPUTING**

UNIT I Overview of Soft Computing, Difference between Soft and Hard computing, Brief descriptions of different components of soft computing including Artificial intelligence systems Neural networks, fuzzy logic, genetic algorithms. Artificial neural networks Vs Biological neural networks, ANN architecture, Basic building block of an artificial neuron, Activation functions, Introduction to Early ANN architectures (basics only)-McCulloch & Pitts model, Perceptron, ADALINE, MADALINE

UNIT II Artificial Neural Networks: Supervised Learning: Introduction and how brain works, Neuron as a simple computing element, The perceptron, Backpropagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, accelerated learning in multilayer perceptron, The Hopfield network, Bidirectional associative memories (BAM), RBF Neural Network.

UNIT III Artificial Neural Networks: Unsupervised Learning: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self- Organizing Computational Maps: Kohonen Network.

UNIT IV Fuzzy Logic Crisp & fuzzy sets fuzzy relations fuzzy conditional statements fuzzy rules fuzzy algorithm. Fuzzy logic controller.

UNIT V Genetic algorithms basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Convergence of GA, Applications of GA case studies. Introduction to genetic programming- basic concepts.

BOOK

1. R. Rajasekaran and G. A and Vijayalakshmi Pa, *Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications*, Prentice Hall of India
2. D. E. Goldberg, *Genetic Algorithms in Search, Optimisation, and Machine Learning*, Addison-Wesley

SUPPLEMENTARY READING

1. . L. Fausett, *Fundamentals of Neural Networks*, Prentice Hall
2. T. Ross, *Fuzzy Logic with Engineering Applications*, Tata McGraw Hill

Elective –II MCA **304(3) Internet of Things**

UNIT I

Introduction: Definition, Characteristics of IOT, IOT Conceptual framework, IOT Architectural view, Physical design of IOT, Logical design of IOT, Application of IOT.

UNIT II

Machine-to-machine (M2M), SDN (software defined networking) and NFV (network function virtualization) for IOT, data storage in IOT, IOT Cloud Based Services.

UNIT III

Design Principles for Web Connectivity: Web Communication Protocols for connected devices, Message Communication Protocols for connected devices, SOAP, REST, HTTP Restful and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet based communication, IP addressing in IOT, Media Accesscontrol.

UNIT IV

Sensor Technology , Participatory Sensing, Industrial IOT and Automotive IOT , Actuator, Sensor data Communication Protocols ,Radio Frequency Identification Technology, Wireless Sensor NetworkTechnology.

UNIT V

IOT Design methodology: Specification -Requirement, process, model, service, functional & operational view.IOT Privacy and security solutions, Raspberry Pi &arduino devices. IOT Case studies: smart city streetlights control & monitoring.

Reference Book:

1. Rajkamal,"Internet of Things", Tata McGraw Hill publication
2. Vijay Madisetti and ArshdeepBahga, "Internet of things(A-Hand-on-Approach)" 1st Edition ,UniversalPress
3. HakimaChaouchi "The Internet of Things: Connecting Objects", Wiley publication.
4. Charless Bell "MySQL for the Internet of things", Apresspublications.
5. Francis dacosta "Rethinking the Internet of things:A scalable Approach to connecting everything", 1st edition, Apress publications2013.
6. Donald Norris"The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", McGraw Hillpublication.

Elective –III MCA 305(1) Computer Ethics

UNIT-1 An Overview of Ethics: Ethics: Definition of Ethics, The Importance of Integrity, The Difference between Morals, Ethics, and Laws. Ethics in the Business World: Why Fostering Good Business Ethics Is Important, Improving Corporate Ethics, Creating an Ethical Work Environment, Including Ethical Considerations in Decision Making. Ethics in Information Technology Ethics for IT Workers and IT Users: IT Technicians, IT Professionals: Are IT Workers Professionals, The Changing Professional Services Industry, Professional Relationships That Must Be Managed, Professional Codes of Ethics, Professional Organizations, Certification, Government Licensing, IT Professional Malpractice. IT Users, Common Ethical Issues for IT Users, Supporting the Ethical Practices of IT Users.

UNIT II Computer and Internet Crime, IT Security Incidents: A Major Concern, Why Computer Incidents Are So Prevalent, Types of Exploits, Types of Perpetrators, Federal Laws for Prosecuting Computer Attacks, Implementing Trustworthy Computing: Risk Assessment, Establishing a Security Policy, Educating Employees, Contractors, and Part-Time Workers, Prevention, Detection, Response. Privacy: Privacy Concerns Abound with New IRS Systems, Privacy Protection and the Law: Information Privacy, Privacy Laws, Applications, and Court Rulings. Key Privacy and Anonymity Issues: Identity Theft, Consumer Profiling, Treating Consumer Data Responsibly, Workplace Monitoring, Advanced Surveillance Technology.

UNIT III Freedom of Expression: First Amendment Rights, Obscene Speech, Defamation, Freedom of Expression: Key Issues, Controlling Access to Information on the Internet, Anonymity on the Internet, Defamation and Hate Speech, Corporate Blogging, Pornography. Intellectual Property: What Is Intellectual Property? Copyrights: Copyright Term, Eligible Works, Fair Use Doctrine, Software Copyright Protection, The Prioritizing Resources and Organization for Intellectual Property (PRO-IP) Act of 2008, General Agreement on Tariffs and Trade (GATT), The WTO and the WTO TRIPS Agreement (1994), The World Intellectual Property Organization (WIPO) Copyright Treaty (1996), The Digital Millennium Copyright Act (1998), Patents: Software Patents, Software Cross-Licensing Agreements, Defensive Publishing and Patent Trolls, Submarine Patents and Patent Farming. Trade Secrets: Trade Secret Laws, Employees and Trade Secrets, Key Intellectual Property Issues: Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence, Cybersquatting

UNIT IV Software Development: Strategies for Engineering Quality Software,:The Importance of Software Quality, Software Product Liability, Software Development Process, Capability Maturity Model Integration. Key Issues in Software Development, Development of Safety-Critical Systems, Quality Management Standards The Impact of Information Technology on Productivity and Quality of Life: The Impact of IT on the Standard of Living and Worker Productivity, IT Investment and Productivity, The Digital Divide, The Impact of IT on Healthcare Costs, Electronic Health Records, Use of Mobile and Wireless Technology in the Healthcare Industry, Telemedicine, Medical Information Web Sites for Laypeople

UNIT V Social Networking: What Is a Social Networking Web Site? Business Applications of Online Social Networking, Social Network Advertising, The Use of Social Networks in the Hiring Process, Social Shopping Web Sites, Social Networking Ethical Issues, Cyberbullying, Cyberstalking, Encounters with Sexual Predators, Uploading of Inappropriate Material, Online Virtual Worlds, Crime in Virtual Worlds, Educational and Business Uses of Virtual Worlds. Ethics of IT Organizations: Key Ethical Issues for Organizations, The Need for Nontraditional Workers, Contingent Workers, Advantages of Using Contingent Workers, Disadvantages of Using Contingent Workers, Deciding When to Use Contingent, Outsourcing, Offshore Outsourcing, Pros and Cons of Offshore Outsourcing, Strategies for Successful Offshore Outsourcing, Whistle-Blowing, Protection for Whistle-Blowers, Whistle-Blowing Protection for Private-Sector Workers, Dealing with a Whistle-Blowing Situation, Green Computing, ICT Industry Code of Conduct.

Books :

1. George W. Reynolds, ETHICS IN INFORMATION TECHNOLOGY, Third Edition, Course Technology, ISBN-13: 978-0-538-74622-9, Cengage Learning.

2. Deborah Johnson, Computer Ethics, Fourth Edition

3. Richard Spinello and Herman Tavani, CyberEthics, 2nd Edition

Elective –III MCA 305(2) Advanced DBMS

UNIT-I Objected Oriented and Object Relational Databases Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity and its implementation, Clustering, Equality and Object Reference, Architecture of Object Oriented and Object Relational databases, Persistent Programming Languages, Cache Coherence. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2.

UNIT-II Deductive Databases Data log and Recursion, Evaluation of Data log program, Recursive queries with negation. Parallel and Distributed Databases Parallel architectures, shared nothing / shared disk / shared memory based architectures, Data partitioning, Intra-operator parallelism, pipelining.

Distributed Data Storage – Fragmentation & Replication, Location and Fragment Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, and Parallel Query Evaluation.

UNIT-III Advanced Transaction Processing Advanced transaction models: Savepoints, Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors, Shared disk systems.

UNIT-IV Active Database and Real Time Databases Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Recursive query processing, Compensation and Databases Recovery, multi-level recovery.

UNIT-V Image and Multimedia Databases Modeling and Storage of Image and Multimedia Data, Data Structures – R-tree, k-d tree, Quad trees, Content Based Retrieval: Color Histograms, Textures, etc., Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio & Handwritten Data, Geographic Information Systems (GIS). WEB Database Accessing Databases through WEB, WEB Servers, XML Databases, Commercial Systems – Oracle xxi, DB2.

BOOKS

1. Elmarsi, "Fundamentals of Database Systems", 4 th Edition, Pearson Education
2. R. Ramakrishnan, "Database Management Systems", 1998, McGraw Hill International Editions
3. Elmagarmid.A.K. "Database transaction models for advanced applications", Morgan Kaufman.
4. Transaction Processing, Concepts and Techniques, J. Gray and A. Reuter, Morgan Kauffman..
5. S. Abiteboul, R. hull and V. Vianu, "Foundations of Databases", 1995, Addison – Wesley Publishing Co., Reading Massachusetts.
6. W. Kim, "Modern Database Systems", 1995, ACM Press, Addison – Wesley.
7. D. Maier, "The Theory of Relational Databases", 1993, Computer Science Press, Rockville, Maryland

Elective –III MCA 305(3) Distributed Systems

UNIT-I Introduction to Distributed Systems : Goals of Distributed Systems, Hardware and Software concepts, the client server model, Remote procedure call, remote object invocation, message and stream oriented communications.

UNIT-II Process and synchronization in Distributed Systems : Threads, clients, servers, code migration, clock synchronization, mutual exclusion, Bully and Ring Algorithm, Distributed transactions.

UNIT-III Consistency, Replication, fault tolerance and security: Object replication, Data centric consistency model, client-centric consistency models, Introduction to fault tolerence, process resilience, recovery, distributed security architecture, security management, KERBEROS, secure socket layer, cryptography.

UNIT-IV Distributed Object Based and File Systems : CORBA, Distributed COM, Goals and Design Issues of Distributed file system, types of distributed file system, sun network file system,.

UNIT-V Distributed shared memory, DSM servers, shared memory consistency model, distributed document based systems : the world wide web, distributed co-ordination based systems: JINI Implementation: JAVA RMI, OLE, ActiveX, Orbix, Visbrokes, Object oriented programming with SOM

BOOKS

1. Andrew S. Tanenbaum, Maarten Van Steen "Distributed Systems Principles and Paradigms" Pearson Education Inc. 2002.

2. Lui "Distributed Computing Principles and Applications".

3. Harry Singh "Progressing to Distributed Multiprocessing" Prentice-Hall Inc.

4. B.W. Lampson "Distributed Systems Architecture Design & Implementation", 1985 Springer Varlag.

5. Parker Y. Verjies J. P. "Distributed computing Systems, Synchronization, control & Communications" PHI.

6. Robert J. & Thieranf "Distributed Processing Systems" 1978, Prentice Hall.

7. George Coulios, "Distribute System: Design and Concepts", Pearson Education