

PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

MASTER OF COMPUTER APPLICATIONS

REGULATIONS 2015

CURRICULUM

SEMESTER III

Course	Course Title	L	T	P	C
PMA15301	Resource Management Techniques	3	2	0	4
CA15301	Computer Communication Networks	3	0	0	3
CA15302	Object Oriented Analysis and Design	3	0	0	3
CA15303	Software Engineering	3	0	0	3
CA15304	Web Programming	3	0	0	3
CA15305	Software Development- Case Tools Laboratory	0	0	4	2
CA15306	Web Programming Laboratory	0	0	4	2
EN15302	Communication and Soft Skills Laboratory	0	0	2	1

SEMESTER IV

Course	Course Title	L	T	P	C
CA15401	C# and .NET Framework	3	0	0	3
CA15402	Free Open Source Software	3	0	0	3
CA15403	Data Mining and Data Warehousing	3	2	0	4
CA15404	Big Data Analytics	3	0	0	3
CA1515*	Elective I	3	0	0	3
CA15405	Free Open Source Software Laboratory	0	0	4	2
CA15406	C# and .NET Programming Laboratory	0	0	4	2
CA15407	Technical Seminar and Report Writing	0	0	4	2
CA15408	Career Development Lab	0	0	2	1

LIST OF ELECTIVES

ELECTIVE I

Course	Course Title	L	T	P	C
CA15151	Energy Aware Computing	3	0	0	3
CA15152	Information Security	3	0	0	3
CA15153	Distributed Computing	3	0	0	3
CA15154	Enterprise Application Integration	3	0	0	3
CA15155	Game Programming	3	0	0	3
CA15156	Soft Computing	3	0	0	3

COURSE OBJECTIVES

- To provide the concept and understanding of basic concepts in Operations Research.
- To understand the Techniques for Analysis and Modeling in Computer Applications.
- To develop and solve mathematical model of linear programming problems.
- To understand, develop and solve the Transport and assignment problems.
- To learn network modeling for planning and scheduling the project activities.

UNIT I LINEAR PROGRAMMING MODELS 15

Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques- Variants of Simplex method

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 15

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem

UNIT III INTEGER PROGRAMMING MODELS 15

Formulation – Gomory’s IPP method – Gomory’s mixed integer method – Branch and Bound technique.

UNIT IV SCHEDULING BY PERT AND CPM 15

Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling

UNIT V QUEUEING MODELS 15

Characteristics of Queuing Models – Poisson Queues - $(M / M / 1) : (FIFO / \infty / \infty)$, $(M / M / 1) : (FIFO / N / \infty)$, $(M / M / C) : (FIFO / \infty / \infty)$, $(M / M / C) : (FIFO / N / \infty)$ models.

TOTAL: 75 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- apply linear, integer programming to solve operational problem with constraints
- apply transportation and assignment models to find optimal solution in warehousing
- prepare project scheduling using PERT and CPM
- identify and analyze appropriate queuing model to reduce the waiting time in queue
- able to use optimization concepts in real world problems

REFERENCES

1. Taha H.A., “Operations Research: An Introduction“8th Edition, Pearson Education, 2011.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, “Operations Research”, Pearson Education, Asia, 2013.
3. Prem Kumar Gupta, D.S. Hira, “Operations Research”, S.Chand& Company Ltd, New Delhi, 3rdEdition,2013.
4. John W. Chinneck “Feasibility and Infeasibility in Optimization Algorithms and ComputationalMethods’ Springer, 2013
5. Ravindran, Phillips, Solberg,”Operations Research: Principles and Practice”, 2ndEdition, JohnWiley& Sons, 01-Jul-2012

WEB LINKS

1. https://en.wikipedia.org/wiki/Resource_management
2. <https://www.wiziq.com/tutorial/211315-RESOURCE-MANAGEMENT-TECHNIQUE>
3. blog.mavenlink.com/resource-management-techniques

COURSE OBJECTIVES

- To understand networking concepts and basic communication model.
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer.
- To acquire knowledge of various application protocol standard developed for internet.
- To analyze the trace for the flow of information from one node to another node in the network.

UNIT I INTRODUCTION**9**

Data Communications – Networks – Protocols and Standards. Network Models – OSI Model – Layers – TCP/IP Protocol Suite – Addressing. Digital Transmission – Digital-to-Digital Conversion – Analog-to-Digital Conversion – Transmission Modes. Analog Transmission – Digital-to-Analog Conversion – Analog-to-analog Conversion. Transmission Media – Guided and Unguided Media.

UNIT II DATA LINK LAYER**9**

Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC. - LAN - Ethernet IEEE 802.3 - IEEE 802.4 – IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

UNIT III NETWORK LAYER**9**

Internetworks – Circuit Switching - Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – BGP -Routers.

UNIT IV TRANSPORT LAYER**9**

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT V APPLICATIONS**9**

Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- identify the components required to build different types of networks
- understand the functionalities needed for data communication into layers
- choose the required functionality at each layer for given application
- understand the working principles of various application protocols
- acquire knowledge about security issues and services available

REFERENCES

1. Larry L. Peterson & Bruce S. Davie, “Computer Networks – A systems Approach”, Fourth Edition, Harcourt Asia / Morgan Kaufmann, 2013.
2. William Stallings, “Data and Computer Communications”, Ninth Edition, Prentice Hall, 2013.
3. Forouzan, “ Data Communication and Networking”, Fifth Edition , 2013.
4. Andrew S.Tannenbaum David J. Wetherall, “Computer Networks” Fifth Edition , Pearson Education, 2013.

5. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition,2013.

WEB LINKS

1. www.networking-basics.net
2. www.lantronix.com › Resources › Networking Tutorials
3. www3.nd.edu/~cpoellab/teaching/cse40814_fall14/networks.pdf

COURSE OBJECTIVES

- To understand the basic concept of OOPs concept.
- To provide a brief, hands-on overview of object-oriented analysis in software process.
- To discuss Case studies based project specifications to develop object-oriented models and identify implementation strategies.
- To demonstrate and apply basic object oriented techniques to create and modify object oriented analysis and design models.
- To understand and apply testing techniques for object oriented software.

UNIT I INTRODUCTION 9

An overview – Object basics – Object state and properties – Behavior – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Metaclasses – Object oriented system development life cycle.

UNITII METHODOLOGY AND UML 9

Introduction – Survey – Rumbaugh, Booch, Jacobson methods – Patterns – Creational - Abstract Factory – Factory Method – Behavioral – Momento – Mediator - Structural – Decorator - Facade - Concurrency Patterns –Lock – Reactor – Scheduler - Frameworks – Unified approach – Unified modeling language – Static and Dynamic models – UML diagrams – Class diagram – Usecase diagrams – Dynamic modeling – Model organization – Extensibility.

UNIT III OBJECT ORIENTED ANALYSIS 9

Identifying Usecase – Business object analysis – Usecase driven object oriented analysis – Usecase model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility

UNITIV OBJECT ORIENTED DESIGN 9

Design process and benchmarking – Axioms – Corollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface-OOUI - MVC Architectural Pattern and Design – Designing the system.

UNIT V QUALITY AND TESTING 9

Quality assurance – Testing strategies – Test cases – Automated Testing Tools – Case Study - Cryptanalysis – Health Care Systems- Inventory Control System - Rational Rose Suite.

TOTAL 45: PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- understand the basic concepts to identify state & behavior of real world objects
- learn the various object oriented methodologies and choose the appropriate one for solving the problem with the help of various case studies
- understand the concept of analysis, design & testing to develop a document for the project

- implement analysis, design & testing phases in developing a software project
- understand the testing strategies and know about automated testing tools

REFERENCES

1. Ali Bahrami, “Object Oriented System Development”, McGraw Hill International Edition, 2012.
2. Craig Larman, Applying UML and Patterns, 2nd Edition, Pearson, 2013.
3. Brahma Dathan, SarnathRamnath, “Object-Oriented Analysis, Design and Implementation”, Universities Press, 2013.
4. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Addison Wesley Long man, 2013.
5. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson 2012

WEB LINKS

1. www.tutorialspoint.com/object_oriented_analysis_design
2. www.matincor.com/documents/intro_ooad.pdf
3. www.utdallas.edu/~chung/OOAD/M01_OO_Intro.ppt

COURSE OBJECTIVES

- To understand the software life cycle.
- To provide an insight into the processes of software development.
- To understand and practice the various fields such as analysis, design, development testing of Software Engineering.
- To develop skills to construct software of high quality with high reliability.
- To apply metrics and testing techniques to evaluate the software.

UNIT I INTRODUCTION 9

Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model – fourth Generation Techniques – Planning – Software Project Scheduling, – Risk analysis and management – Requirements and Specification – Case Study for Project Plan and SRS

UNIT II SOFTWARE DESIGN 9

Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Jackson System development – Designing for reuse – Programming standards – Case Study for Design of any Application Project.

UNIT III SOFTWARE TESTING AND MAINTENANCE 9

Software Testing Fundamentals – Software testing strategies – Black Box Testing – White Box Testing – System Testing – Object Orientation Testing – State based Testing - Testing Tools – Test Case Management – Software Maintenance Organization – Maintenance Report – Types of Maintenance – Case Study for Testing Techniques

UNIT IV SOFTWARE METRICS 9

Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Cost Estimation - Reliability – Software Quality Assurance – Standards – Case Study for COCOMO model

UNIT V SCM & WEB ENGINEERING 9

Need for SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – CASE Repository – Features – Web Engineering

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- get an insight into the processes of software development
- understand the problem domain for developing SRS and various models of software engineering
- model software projects into high level design using DFD,UML diagrams
- measure the product and process performance using various metrics
- evaluate the system with various testing techniques and strategies

REFERENCES

1. Roger S. Pressman, “Software Engineering: A Practitioner Approach”, Seventh edition, McGrawHill, 2013.
2. Richard Fairley, “ Software Engineering Concepts”, Tata McGraw Hill Edition, 2012

3. Ali Behforroz, Frederick J.Hudson, “Software Engineering Fundamentals”, Oxford Indian Reprint, 2013
4. Sommerville, “Software Engineering”, Sixth Edition, Addison Wesley-Longman, 2013.
5. Kassem A. Saleh, “Software Engineering”, First Edition, J.Ross Publishing, 2012.

WEB LINKS

1. www.tutorialspoint.com/software_engineering
2. <https://www.quora.com/What-are-the-fundamentals-of-software-engineering>
3. <http://sunnyday.mit.edu/16.355/metrics.pdf>

COURSE OBJECTIVES

- To know the concepts and architecture of the World Wide Web.
- To learn and practice mark-up languages.
- To import and practice embedded dynamic scripting on client side Internet Programming.
- To understand and practice of java concept.
- To explore and practice web development techniques on client-side.

UNIT I BASIC NETWORK AND WEB CONCEPT 9

Internet standards – TCP and UDP protocols – URLs – MIME – CGI – Introduction to SGML

UNIT II MARKUP LANGUAGE 9

Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code – Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – Frames - HTML Forms.

UNIT III STYLESHEET 9

The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS.

UNIT IV JAVAPROGRAMMING 9

Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes, Packages and Interfaces – Exception Handling

UNIT V PACKAGES 9

AWT package – Layouts – Containers – Event Package – Event Model – Painting – Garbage Collection – Multithreading – Language Packages.

COURSE OUTCOMES

At the end of the course the students will be able to

- acquire knowledge about functionalities of world wide web
- explore mark-up languages features and create interactive web pages
- learn and design Client side validation using scripting languages
- acquire knowledge about Open source JavaScript libraries
- design front end web page and connect to the back end databases

REFERENCES

1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How to Program”, Fifth Edition, Pearson Education, 2013.
2. Achyut S Godbole and Atul Kahate, “Web Technologies”, 2nd Edition, Tata McGraw Hill, 2012.
3. Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw Hill, 2013.
4. Deitel, Deitel and Nieto, “Internet and World Wide Web – How to program”, Pearson Education Publishers, 2013.
5. R. Krishnamoorthy & S. Prabhu, “Internet and Java Programming”, New Age International Publishers, 2013.

WEB LINKS

1. www.webbasedprogramming.com
2. www.programmingsimplified.com/java-source-codes
3. <https://www.tcl.tk/doc/scripting.html>

COURSE OBJECTIVES

- To understand and the various fields such as analysis, design, development testing of Software Engineering.
- To Design the various fields such as analysis, development testing of Software Engineering.
- To develop skills to construct software of high quality with high reliability.

LIST OF EXPERIMENTS

1. Practicing the different types of case tools such as Rational Rose / other Open Source to be used for all the phases of Software development life cycle.
2. Data modeling
3. Source code generators
4. Apply the following to typical application problems:
 - a. Project Planning
 - b. Software Requirement Analysis
 - c. Software Design
 - d. DataModeling& Implementation
5. Software Estimation
6. Software Testing
7. A possible set of applications may be the following:
 - a. Library System
 - b. Student Marks Analyzing System
 - c. Text Editor.
 - d. Create a dictionary.
 - e. Telephone directory.
 - f. Inventory System.

TOTAL: 60 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- model software projects into high level design using DFD,UML diagrams
- practice the high level design using case tools diagrams
- measure the product and process performance using various metrics

COURSE OBJECTIVES

- To understand and practice embedded dynamic scripting on client side Internet Programming.
- To understand and practice of java concept.
- To analyze and understand the JDK development kit.

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML5
 - a. To embed an image map in a web page
 - b. To fix the hot spots
 - c. Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Writing Java programs by making use of class, interface, package, etc for the following
 - a. Different types of inheritance study
 - b. Uses of 'this' keyword
 - c. Polymorphism
 - d. Creation of user specific packages
 - e. Creation of jar files and using them
 - f. User specific exception handling

TOTAL: 60 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- explore mark-up languages features and create interactive web pages using them
- acquire knowledge about Open source JavaScript libraries
- practice various programs using JDK kit

COURSE OBJECTIVES

- To enhance the performance of students at Placement Interviews.
- To enhance the performance of students at Group Discussions.
- To enhance the performance of recruitment exercises.
- To enhance the basic communication concepts.
- To enhance the students communication skills through various practice sessions.

UNIT I	FORMAL AND INFORMAL CONVERSATION PRACTICE	6
Role Play 1- with family members, neighbours, friends, relatives etc., Simple Expressions – agreeing / disagreeing, persuading, wishing, consoling, advising, arguing, expressing opinions etc.- Professional dialogues with the superiors -Conversation with different professionals- Situations like - Government and Corporate Offices, Official Meetings, Educational Institutions, (At the railway junction, malls, post office, bank) etc.		
UNIT II	ORAL REVIEW, RADIO SHOW & NARRATIVE TECHNIQUES	6
Oral review of movies and discussion or sharing the view on various concepts of the movie, Presentation of various radio programs like news, announcements, advertisements, entertainment programs etc. as a team activity, Understanding the basic narrative techniques-Narrating short stories with message, Narrating real life experiences.		
UNIT III	RÉSUMÉ / LETTER WRITING	6
Preparation of résumé – structure – use of words and language style – Types of letter – structure of a letter – format for writing letters – use of language in letters		
UNIT IV	PRESENTATION SKILLS & GROUP DISCUSSION	6
Elements of effective presentation – Structure of presentation - Presentation tools –Voice modulation – effective use to presentation tools - Audience analysis - Body language – Video samples- Importance of GD – GD in selection process - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples		
UNIT V	INTERVIEW SKILLS	9
Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.		
		TOTAL: 30 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- speak effectively in English in all occasions
- face the interview process with confidence and perform better
- practice the Placement Interviews
- practice the Group Discussions
- practice the Communication skills

REFERENCES

1. Kalpana. V & Co., “Communication Skills Laboratory Manual”, Vijay Nicole Imprints Pvt. Limited, Chennai. 2013
2. Anderson, P.V. “Technical Communication”, Thomson Edition, New Delhi, 2012.

3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi, 2012
4. Kumar Sanjay, Pushpalatha, “Communication Skills (With CD)”, Oxford University Press, New Delhi. 2011
5. Dutt, Kiranmai P and GeethaRajeevan, “BasicCommunication Skills”, Foundation Books, New Delhi. 2012.

WEB LINKS

1. <http://writing-program.uchicago.edu/resources/grammar.htm>
2. <http://www.grammarbook.com/>
3. <http://www.myenglishteacher.eu/blog/english-grammar-9-websites-to-learn-and-practice-english-grammar/>

COURSE OBJECTIVES

- To learn the .NET frame work concept and understand he syntax of basic C# Programs.
- To learn C# elements and OOPS concepts.
- To learn fundamentals of window application programming and how to create a window applications.
- To develop web based applications and learn advanced features of C#.
- To understand the foundation of CLR execution.

UNIT I INTRODUCTION TO C# 8

Introducing C#, Understanding .NET, Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations.

UNIT II OBJECT ORIENTED ASPECTS OF C# 9

Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading, Delegates, Events, Errors and Exceptions.

UNIT III APPLICATION DEVELOPMENT ON .NET 8

Building Windows Applications, Accessing Data with ADO.NET.

UNIT IV WEB BASED APPLICATION DEVELOPMENT ON .NET 8

Programming Web Applications with Web Forms, Programming Web Services.

UNIT V THE CLR AND THE .NET FRAMEWORK 12

Assemblies, Versioning, Attributes, Reflection, Viewing MetaData, Type Discovery, Reflecting on a Type, Marshaling, Remoting, Understanding Server Object Types, Specifying a Server with an Interface, Building a Server, Building the Client, Using SingleCall, Threads.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- use Visual Studio .NET to implementing the .NET application and to know the basic C# elements.
- know the C# OOPS concepts.
- know the basic ADO.NET structures and understand the ADO.NET database connectivity.
- understand the ASP.NET programming model and able to create ASP pages for web applications
- understand the internal function of CLR and develop web based applications on .NET CLR.

REFERENCES

1. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2014.
2. J. Liberty, "Programming C#", 2nd ed., O'Reilly, 2013.
3. Herbert Schildt, "The Complete Reference: C#", Tata McGraw-Hill, 2014.
4. Robinson et al, "Professional C#", 2nd ed., Wrox Press, 2013.
5. Andrew Troelsen, "C# and the .NET Platform", A1 Press, 2014.

WEB LINKS

1. www.tutorialspoint.com/csharp
2. <https://mva.microsoft.com/en-us/.../c-fundamentals-for-absolute-beginners-16169>
3. <http://csharp.net-tutorials.com/>

COURSE OBJECTIVES

- To know of how to do project for the open source software process.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software.
- To learn the Database concept.
- To understand various open source software.

UNIT I INTRODUCTION 9

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources. Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux.

UNIT II OPEN SOURCE DATABASE 9

MySQL: Introduction – Setting up account – Starting, terminating and writing your ownSQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata – Usingsequences – MySQL and Web.

UNIT III OPEN SOURCE PROGRAMMING LANGUAGES 9

PHP: Introduction – Programming in web environment – variables – constants – datatypes – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates.

UNITIV PYTHON 9

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

UNIT V PERL 9

Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures – Subroutines, Packages, and Modules- Working with Files –Data Manipulation.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- prepare and do project for the open source software process
- understand the cost estimation techniques during the analysis of the project
- learn the quality concepts for ensuring the functionality of the software
- learn the Database concept
- practice and demonstrate various open source software

REFERENCES

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2013.
2. Steve Suchring, “MySQL Bible”, John Wiley, 2012.
3. RasmusLerdorf and Levin Tatroe, “Programming PHP”, O’Reilly, 2012.

4. Wesley J. Chun, “Core Python Programming”, Prentice Hall, 2012.
5. Martin C. Brown, “Perl: The Complete Reference”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2012.

WEB LINKS

1. <https://www.php.net>
2. <https://www.mysql.com>
3. <https://www.python.org>

COURSE OBJECTIVES

- To expose the students to the concepts of Data warehousing Architecture and Implementation.
- To understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence.
- To understand the concept of classification for the retrieval purposes.
- To know the clustering techniques in details for better organization and retrieval of data.
- To identify Business applications and Trends of Data mining.

UNIT I DATA WAREHOUSE 14

Data Warehousing - Operational Database Systems vs. Data Warehouses - Multidimensional Data Model - Schemas for Multidimensional Databases – OLAP Operations – Data Warehouse Architecture – Indexing – OLAP queries & Tools.

UNIT II DATA MINING & DATA PREPROCESSING 15

Introduction to KDD process – Knowledge Discovery from Databases - Need for Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

UNIT III ASSOCIATION RULE MINING 14

Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Item Sets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint-Based Association Mining.

UNIT IV CLASSIFICATION & PREDICTION 16

Classification vs. Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT V CLUSTERING 16

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

TOTAL: 75 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- understanding the Store voluminous data for online processing
- prepare the Pre-process the data for mining applications
- learn the association rules for mining the data
- practice and deploy appropriate classification techniques
- understand the high dimensional data for better organization of the data

REFERENCES

1. Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques” Second Edition, Elsevier, Reprinted 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2012.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2013.
4. BERSON, ALEX & SMITH, STEPHEN J, Data Warehousing, Data Mining, and OLAP, TMH Pub. Co. Ltd, New Delhi, 2012
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2012

WEB LINKS

1. http://www.tutorialspoint.com/dwh/dwh_overview.htm
2. <http://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf>
3. <http://www.careerride.com/Data-warehousing-data-mining.aspx>

COURSE OBJECTIVES

- To know of how to understand the BigData concept.
- To learn the mining data stream system.
- To understand the Hadoop concept.
- To learn the usage of file systems.
- To understand how to build up framework.

UNIT I INTRODUCTION TO BIG DATA 8

Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II MINING DATA STREAMS 9

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 - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT III HADOOP 10

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

UNIT IV HADOOP ENVIRONMENT 9

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance-Hadoop benchmarks- Hadoop in the cloud

UNIT V FRAMEWORKS 9

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- write the API interface based programs
- design and implement the data stream systems
- analyze the mining data streams
- design the Hadoop concept
- understand the Framework applications

REFERENCES

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2012.
2. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.

3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
4. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.

WEB LINKS

1. <http://www-01.ibm.com/software/in/data/bigdata/>
2. <https://www.oracle.com/big-data/index.html>
3. <http://www.uncc.edu/sites/cci.uncc.edu/files/media/files/Stonebreaker-charlotte.ppt>

COURSE OBJECTIVES

- To know of how to do project for the open source software process.
- To learn the Unix operating systems.
- To learn the cost estimation techniques during the analysis of the project.

LIST OF EXPERIMENTS

1. Basic Linux Commands
2. Students Details using Shell Program
3. Develop PHP program using Arrays, control structures, looping structures and Form Handling Develop a web application for Airline Reservation System using PHP.
4. Running Python: some simple exercise – e.g. Connecting with MySql database
5. Text processing with Perl: simple programs, connecting with database e.g., MYSQL

TOTAL: 60 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able

- to prepare and do project for the open source software process
- to practice basic command in Unix operating systems
- to understand the cost estimation techniques during the analysis of the project

COURSE OBJECTIVES

- To learn the .NET framework concept.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software.

LIST OF EXPERIMENTS

1. Programs using Branching, Looping.
2. Programs using Methods, Arrays, Strings.
3. Programs using Structures, Enumerations.
4. Programs using Inheritance.
5. Programs using Polymorphism.
6. Programs using Interfaces.
7. Programs using Operator overloading.
8. Programs using Delegates, Events, Errors and Exceptions.
9. Program to Build a Calculator widget
10. Programs Using Multi Module Assembly.
11. Programs using application development on .NET.
12. Programs using Web applications.

TOTAL: 60 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able

- to practice the .NET framework concept
- to learn the risk management activities and the resource allocation for the projects
- to apply the software estimation and recent quality standards for evaluation of the software projects

COURSE OBJECTIVES

- To evaluate a well-defined set of research subjects.
- To summarize the findings concisely in a paper of scientific quality.
- To evaluate based on the ability to understand a topic.

LIST OF EXPERIMENTS

1. Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct primary sources.
2. Every student must write a short review of the topic and present it to fellow students and faculty (discuss the topic – expose the flaws – analyze the issues) every week.
3. The faculty should evaluate the short review and award marks with respect to the following.
 - a. Has the student analyzed – not merely quoted – the most significant portions of the primary sources employed?
 - b. Has the student offered original and convincing insights?
 - c. Plagiarism to be checked.
4. Every student should re-submit and present the review article including issues/ comments/ conclusions which had arisen during the previous discussion.
5. Every student should submit a final paper as per project specifications along with all short review reports (at least 4 internal reviews) and corresponding evaluation comments.
6. Every student should appear for a final external review exam to defend themselves.

TOTAL: 60 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- practice the students to critically evaluate a well-defined set of research subjects
- practice the findings concisely in a paper of scientific quality
- practice evaluate based on the ability to understand a topic

COURSE OBJECTIVES

- To expose the Communication media etiquette.
- To understand the Interview skills.
- To understand the concept of Quantitative Aptitude skills.
- To know the Logical Reasoning skills.
- To identify the verbal Reasoning skills.

UNIT I	CORPORATE READINESS	6
Business Communication – Inter & Intra Personal Skills – Business Etiquettes – Corporate Ethics – Communication Media Etiquette		
UNIT II	INTERVIEW SKILLS	6
Resume Building – Group Discussions – Presentation Skills – Entrepreneur Skills – Psychometric Assessment – Mock Interview		
UNIT III	QUANTITATIVE APTITUDE (QA) 2	6
Profit & Loss – Clock – Power & Square Roots – Train – Boats & Streams – Probability – Calendars – Permutations & Combinations - Partnership – Simplification – Pipes & Cisterns – Puzzles		
UNIT IV	LOGICAL REASONING (LR) 2	6
Statements & Assumptions – Matching Definitions – Logical Games – Making Judgments – Statements & Conclusions – Verbal Classifications		
UNIT V	VERBAL REASONING (VR) 2	6
Syllogisms – Data Sufficiency – Dice – Series Completion – Character Puzzles – Cube & Cuboid – Arithmetic Reasoning		
TOTAL: 30 PERIODS		

COURSE OUTCOMES

At the end of the course the students will be able to

- speak effectively in English in all occasions
- face the interview process with confidence and perform better
- practice the Placement Interviews
- practice the Group Discussions
- practice the Communication skills

ELECTIVE I

CAE15401

ENERGY AWARE COMPUTING

3 0 0 3

COURSE OBJECTIVES

- To examine the design of power efficient architecture, power and performance tradeoffs, restructuring of software and applications and standards for energy aware Hardware and Software.
- To know the fundamental principles energy efficient devices.
- To study the concepts of Energy efficient storage.
- To know energy efficient techniques involved to support real-time systems.
- To study Energy aware applications.

UNIT I INTRODUCTION 9

Energy efficient network on chip architecture for multi core system-Energy efficient MIPS CPU core with fine grained run time power gating – Low power design of emerging memory technologies.

UNIT II ENERGY EFFICIENT STORAGE 9

Disk Energy Management-Power efficient strategies for storage system-Dynamic thermal management for high performance storage systems-Energy saving technique for Disk storage systems

UNIT III ENERGY EFFICIENT ALGORITHMS 9

Scheduling of Parallel Tasks – Task level Dynamic voltage scaling – Speed Scaling – Processor optimization-Memetic Algorithms – Online job scheduling Algorithms.

UNIT IV REAL TIME SYSTEMS 9

Multi processor system – Real Time tasks- Energy Minimization – Energy aware scheduling- Dynamic Reconfiguration- Adaptive power management-Energy Harvesting Embedded system..

UNIT V ENERGY AWARE APPLICATIONS 9

On chip network – Video codec Design – Surveillance camera- Low power mobile storage.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- design Power efficient architecture hardware and software
- analyze power and performance tradeoff between various energy aware storage devices
- implement various energy aware algorithms
- restructure the software and Hardware for Energy aware applications
- know the Energy aware applications

REFERENCES

1. Handbook of Energy Aware and Green computing, Ishfaq Ahmad, Sanjay Ranka, Chapman and Hall/CRC,2012
2. Energy Aware system design Algorithms and Architecture, Chong-Min Kyung,Sungiooyoo, Springer,2013.
3. Energy Aware computing, Bob steigerwald,Chris:Luero, Intel Press,2012.

WEB LINKS

1. <http://bigdata.csail.mit.edu/node/89>
2. <http://www.real-time-systems.com>

2. Michael Whitman, Herbert J. Mattord, "Management of Information Security", Third Edition, Course Technology, 2013.
3. William Stallings, "Cryptography and Network Security : Principles and Practices", Fifth Edition, Prentice Hall, 2012.
4. Michael Howard, David LeBlanc, John Viega, "24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them", First Edition, McGrawHill Osborne Media, 2013.
5. Matt Bishop, "Computer Security: Art and Science", First Edition, Addison-wesley, 2012

WEB LINKS

1. https://www.owasp.org/index.php/Top_10_2012
2. https://www.pcisecuritystandards.org/security_standards/pci_dss.shtml

COURSE OBJECTIVES

- To understand the phases of distributed computing.
- To know the transaction models and deadlocks.
- To build concepts regarding the fundamental principles of distributed systems.
- To learn the design issues and distributed system concepts.
- To learn the fundamentals of naming systems.

UNIT I INTRODUCTION 9

Characterization of distributed systems - Examples - Resource sharing and the web - Challenges – System models - Architectural and fundamental models - Networking and internetworking - Types of networks - Network principles - Internet protocols.

UNIT II MESSAGE PASSING AND SYNCHRONIZATION 9

Interprocess communication - The API for the internet protocols - External data representation and marshalling - Client-Server communication - Group communication - Desirable features message passing system- Issues in message passing- Synchronization- Clock synchronization- Event ordering- Mutual exclusion- Deadlock-Election Algorithm - Buffering.

UNIT III REMOTE PROCEDURE CALL 9

RPC model - Transparency of RPC- Implementing RPC mechanism- Stub generation- Marshaling arguments and results- Server management- Parameter passing semantics - Call semantics- Communication protocols for RPCs- Complicated RPC client server binding- Exception handling- Security- Special types of RPCs- RPCs in heterogeneous environments- Lightweight RPC.

UNIT IV DISTRIBUTED SHARED MEMORY 9

General architecture of DSM systems- Design and implementation of DSM- Granularity- Structure of shared memory space- Consistency models- Replacement strategy- Thrashing- Other approaches to DSM- Heterogeneous DSM and advantages of DSM.

UNIT IV DISTRIBUTED NAMING 9

Introduction- Desirable features of naming system- Fundamental concepts- System oriented names-Object locating mechanisms-Human oriented names- Name caches - Naming and security.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- apply basic principles and practices of Computer Science and Engineering to productively engage in the research
- design and conduct experiments, as well as to analyze
- design the interpret data on experiments relevant to Computer Science and Engineering practice
- identify, analyze, formulate and solve engineering problems
- manipulate and solve engineering problems

REFERENCES

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 2012.
2. Pradeep K Sinha . Distributed Operating Systems: Concepts and design,. IEEE computer society press, 2013.
3. Andrew S Tanenbaum, Maartenvan Steen, Distibuted Systems –Principles and Pardigms, Pearson Education, 2012.
4. Mullender, Distributed Systems, Addison Wesley, 2013.
5. M.L.Liu, Distributed Computing Principles and Applications, Pearson Education, 2013.

WEB LINKS

1. <http://www.cs.cf.ac.uk/Dave/C/node33.html>
2. <http://perso.ens-lyon.fr/laurent.lefevre/DOSMOS/DSM.html>

COURSE OBJECTIVES

- To describe approaches to enterprise application integration.
- To understand the integration middleware.
- To evaluate the integration approaches suitable for a given problem.
- To evaluate the integration of specified requirements.
- To understand the configuration model.

UNIT I INTRODUCTION 6

Requirements for EAI - Challenges in EAI – Integration with legacy systems – Integration with partners - Heterogeneous environment – Implementation approaches – Web services, messaging, ETL, direct data integration – Middleware requirements – Approaches to integration – services oriented and messaging.

UNIT II INTEGRATION PATTERNS 6

Introduction to integration patterns – Architecture for application integration – Integration patterns – Point to point, broker, message bus, publish/subscribe, Challenges in performance, security, reliability - Case studies

UNIT III SERVICE ORIENTED INTEGRATION 12

Business process integration - Composite applications-services – Web services – Service choreography and orchestration - Business process modeling - BPMN, Business process execution - BPEL – Middleware infrastructure - Case studies

UNIT IV MESSAGING BASED INTEGRATION 9

Messaging – Synchronous and asynchronous – Message structure – Message oriented middleware – Reliability mechanisms – Challenges – Messaging infrastructure – Java Messaging Services – Case studies

UNIT V ENTERPRISE SERVICE BUS 12

Enterprise Service Bus – routing, scalable connectivity, protocol and message transformations, data enrichment, distribution, correlation, monitoring – Deployment configurations – Global ESB, Directly connected, Federated, brokered ESBs – Application server based – Messaging system based – Hardware based ESBs – Support to SOA, message based and event based integrations - Case studies.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- describe different approaches to integration enterprise applications
- analyze specifications and identify appropriate integration approaches
- develop a suitable integration design for a given problem
- identify appropriate integration middleware for a given problem
- develop and deploy the configuration model

REFERENCES

1. George Mentzas and Andreas Frezen (Eds), "Semantic Enterprise Application Integration for Business Processes: Service-oriented Frameworks", Business Science Reference, 2012
2. WaseemRoshen, "SOA Based Enterprise Integration", Tata McGrawHill, 2012.
3. G Hohpe and B Woolf, "Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions", Addison-Wesley Professional, 2013

4. D Linthicum, "Next Generation Application Integration: From Simple Information to WebServices", Addison-Wesley, 2013
5. Martin Fowler, "Patterns of Enterprise Application Architecture", Addison- Wesley, 2013

WEB LINKS

1. http://en.wikipedia.org/wiki/Enterprise_application_integration
2. http://www.tutorialspoint.com/management_information_system/

COURSE OBJECTIVES:

- To understand of game design and development.
- To understand the processes, mechanics, issues in game design, game engine development.
- To understand modeling, techniques, handling situations, and logic.
- To design and develop interactive games.
- To developing the 2D, 3D interactive game programming.

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

UNIT II GAME DESIGN PRINCIPLES 9

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding

UNIT III GAMING ENGINE DESIGN 9

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics

UNIT IV GAMING PLATFORMS AND FRAMEWORKS 9

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, Unity

UNIT V GAME DEVELOPMENT 9

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- apply 3D concepts in Game programming
- gain knowledge about principles and levels of design in various game development
- gain knowledge about gaming engine design for controlling
- explore into various platforms and frameworks available for game development
- develop the 2D, 3D interactive game programming

REFERENCES

1. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” Morgan Kaufmann, 2 Edition, 2013.
2. JungHyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 1st edition, 2012.
3. Mike McShaffrfy, “Game Coding Complete”, Third Edition, Charles River Media, 2012.
4. Jonathan S. Harbour, “Beginning Game Programming”, Course Technology PTR, 3rd edition, 2013.
5. Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, Prentice Hall 1st edition, 2012.

WEB LINKS

1. <http://unity3d.com/5>
2. <http://en.wikipedia.org/wiki/DirectX>

COURSE OBJECTIVES

- To learn the key aspects of soft computing.
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications.
- To study the fuzzy logic components.
- To gain insight onto Neuro Fuzzy modeling and control.

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS 9

Introduction, Building block hypothesis, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem), Differences & similarities between GA & other traditional methods, Applications of GA.

UNIT III NEURAL NETWORKS 9

Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures – Advances in Neural Networks.

UNIT IV FUZZY LOGIC 9

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

UNIT V NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

TOTAL: 45 PERIODS**COURSE OUTCOMES**

At the end of the course the students will be able to

- implement machine learning through neural networks
- gain knowledge to develop genetic algorithm and support vector machine based machine learning system
- write genetic algorithm to solve the optimization problem
- understand fuzzy concepts and develop a fuzzy expert system to derive decisions
- model neurofuzzy system for data clustering and classification

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2013
2. KwangH.Lee, “First course on Fuzzy Theory and Applications”, Springer-Verlag Berlin Heidelberg, 2012.

3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 2012.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edition, 2013.
5. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2012.

WEB LINKS

1. http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol1/hmw/article1.html
2. http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/cs11/report.html