Course Structure & Scheme

For

Master of Technology

In

Computer Science & Engineering

Guru Gobind Singh Indraprastha University
Kashmere Gate, Delhi – 6 [INDIA]
www.ipu.ac.in

w.e.f. 2004 - 2005

Master of Technology
(Computer Science & Engineering)

First Semester

Paper Code	Paper	L	T/P	Credits
CSE 601	Data Structure & Algorithm Analysis	4	-	4
CSE 603	Software Engineering Principles	4	-	4
CSE 605	Advanced Computer Architecture	4	-	4
CSE 607	Advanced Computer Graphics	4	-	4
CSE 609	Advanced Computer Networks	4	-	4
Practicals				
CSE 651	Lab. - I	0	4	2
CSE 653	Lab. – II	0	4	2
	Total	**20**	**08**	**24**

Master of Technology
(Computer Science & Engineering)

Second Semester

Paper Code	Paper	L	T/P	Credits
CSE602	Software Testing	4	-	4
CSE604	JAVA Programming and Applications	4	-	4
CSE606	Advanced Data Base Management System	4	-	4
Electives (Choose any Two)				
CSE608	AI and Applications	4	-	4
CSE610	Object Oriented Software Engineering	4	-	4
CSE 612	Genetic Algorithms	4	-	4
CSE614	Digital Signal Processing	4	-	4
CSE616	Mobile Computing	4	-	4
CSE618	Neural Networks	4	-	4
CSE620	Project Work	4	-	4
Practicals				
CSE652	Lab. – III	-	4	2
CSE654	Lab. – IV	-	4	2
CSE656	Lab. – V	-	4	2
	Total	**20**	**12**	**26**

Master of Technology
(Computer Science & Engineering)

Third Semester

Paper Code	Paper	L	T/P	Credits
CSE701	Network Management & Security	4	-	4
CSE703	Multimedia Technology	4		4
Electives (Choose any Two)				
CSE705	Advanced Software Project Management	4	-	4
CSE707	Data Warehousing & Data Mining	4	-	4
CSE709	Distributed Computing	4	-	4
CSE711	Embedded System Design	4	-	4
CSE713	Wireless & CDMA Technology	4	-	4
CSE715	Soft Computing	4	-	4
CSE717	Digital Image Processing	4	-	4
Practicals				
CSE751	Lab. – VI	-	4	2
CSE753	Lab. – VII	-	4	2
CSE755	Minor Project Work	-	8	6
CSE757	Seminar	-	-	2
	Total	**16**	**16**	**28**

Master of Technology
(Computer Science & Engineering)

Fourth Semester

Paper Code	Paper	L / P	Credits
CSE - 702	Dissertation	30	22
CSE – 704*	Seminar & Progress Report	-	3
CSE – 706*	Comprehensive Viva	-	2
	TOTAL	**30**	**27**

***Non University Exam System**

NOTE:

1. The total number of credits of the Programme M. Tech. = 105.
2. Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100.

Elective course will be offered only if it is either requested by 40% of sanctioned strength or 10 students, whichever is less.

Paper Code: CSE 601 **L C**
Paper: Data Structure & Algorithm Analysis **4 4**

Preliminaries:
Growth of functions, Summations, Recurrences: The substitution method, The iteration method, The master method, Divide and Conquer paradigm, Dynamic programming, Greedy Algorithms.

Sorting and Order Statistics:
Merge Sort, Heap sort, Quick sort, Sorting in linear time, Medians and Order statistics.

Searching and Data Structures for Disjoint Sets:
Hash Tables, Binary Search Trees, Red-Black trees, order statistic tree, disjoint-set Operations, Linked list representation of disjoint sets, Disjoint set forests.

Graph Algorithms:
Representation of Graphs, Breadth First Search, Depth First Search, Topological Sort, Strongly Connected Components, Algorithm for Kruskal's and Prim's for Finding Minimum cost Spanning Trees, Dijkstra's and Bellman Fort Algorithm for finding Single source shortest paths. All pair shortest paths and matrix multiplication, Floyd-Warshall algorithm for all pair shortest paths.

String matching:
The naïve String Matching algorithm, The Rabin-Karp Algorithm, String Matching with finite automata, The Knuth Marris Pratt algorithm.

NP-Complete Problem
Polynomial-time verification, NP-Completeness and Reducibility, NP-Completeness Proof, NP-Complete problems.

Text:

1. T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", PHI. 2nd Edition

References:

1. A .V. Aho, J . E . Hopcroft, J . D . Ulman "The Design & Analysis of Computer Algorithms", Addison Wesley.
2. V . Manber "Introduction to Algorithms – A Creative Approach", Addison Wesley.
3. Ellis Harwitz and Sartaz Sahani "Fundamentals of Computer Algorithms", Computer Science Press.
4. Peter Linz, "An Introduction to Formal Languages and Automata", Narosa Publishing House.
5. J.E.Hopcroft & J.D.Ullman, "Introduction to Automata Theory, Languages and Computation", Addison Wesley.
6. K.L.Mishra & N.Chandrasekaran, "Theory of Computer Science", PHI.
7. John C.Martin, "Introduction to Languages and Theory of Computation", TMH.

Paper Code: CSE – 603 **L C**
Paper: Software Engineering Principles **4 4**

Introduction:
Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models, Overview of Quality Standards like ISO 9001, SEI – CMM.

Software Requirements analysis & specifications:
Requirement engineering, requirement elicitation techniques like FAST, QFD & Use case approach, requirements analysis using DFD, Data dictionaries & ER Diagrams, Rquirements documentation, Nature of SRS, Characteristics & organization of SRS.

Software Project Planning:
Size Estimation like lines of Code & Function Count, Cost Estimation Models, Static single & Multivariable Models, COCOMO, COCOMO-II, Putnam resource allocation model, Risk Management.

Software Design:
Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design.

Software Metrics:
Software measurements: What & Why, Token Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics

Software Testing:
Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Regression Testing, Testing Tools & Standards.

Software Reliability:
Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Calender time Component.

Software Maintenance:
Management of Maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Software Tools and Environment:
Programming environments, Requirements analysis and design modeling tools, configuration management tools, Tool integration mechanisms

Text:

1. R. S. Pressman, "Software Engineering – A practitioner's approach", 5th ed., McGraw Hill Int. Ed., 2001.
2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International, 2001.

Reference:

1. R. Fairley, "Software Engineering Concepts", Tata McGraw Hill, 1997.
2. P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.
3. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, 1996.
4. James Peter, W Pedrycz, "Software Engineering", John Wiley & Sons
5. Sommerville, "Software Engineering ", 6th ed. Pearson Education, 2002.

Paper Code: CSE – 605 **L C**
Paper: Advanced Computer Architecture **4 4**

Parallel Computer Models:
The state of computing, multiprocessors and multicomputers, multivector and SIMD computers, architectural development tracks.

Program and Network Properties:
Conditions of parallelism, program partitioning and scheduling, program flow mechanisms. System Interconnect Architectures. Network properties and routing, static interconnection networks and dynamic interconnection networks, MPI and PVM architecture.

Processors and Memory Hierarchy:
Advanced processor technology- CISC, RISC, Superscalar, Vector, VLIW and symbolic processors, Memory hierarchy technology, Virtual memory technology (Virtual memory models, TLB, paging and segmentation)

Bus, Cache and Shared Memory:
Cache memory organization, shared memory organization, sequential and weak consistency models.

Pipelining and Super scalar techniques:
Linear Pipeline Processors, Nonlinear Pipeline processors, Instruction Pipeline Design, Arithmetic Pipeline Design

Parallel and Scalable Architecture:
Multiprocessors System Interconnects, Cache Coherence and Synchronization Mechanisms, Vector Processing Principles, Multivector Multiprocessors and Data Flow Architecture.

Text:
1. Kai Hwang "Advanced Computer Architecture", McGraw Hill.

References:
1. J.P.Hayes "Computer Architecture and Organization", McGraw Hill.
2. Harvey G. Cragon, "Memory Systems and Pipelined Processors", Narosa Publication.
3. V. Rajaranam & C.S.R. Murthy, "Parallel Computers", PHI.
4. R. K. Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications.
5. Kai Hwang and Zu, "Scalable Parallel Computers Architecture", McGraw Hill.
6. Stalling W., "Computer Organization & Architecture", PHI.

Paper Code: CSE – 607 **L C**
Paper: Advanced Computer Graphics **4 4**

Line Drawing and transformation:
Basic raster graphical algorithm for 2D primitives, Line drawing algorithm, 2D and 3D transformation

Clipping:
Window, Viewport, Clipping algorithm,

Curves and Surfaces:
Circle drawing algorithm, Ellipse drawing algorithm, Bezier curve, b-spline curve, surfaces, Solid modelling

Projection:
Parallel projection, Perspective projection , Computation of vanishing point

Visible surface determination:
Z-buffer algorithm, Scan line algorithm, Area subdivision algorithm, Raytracing algorithm

Shading:
Illumination mode, Specular reflection model, Shading models for curve surfaces, Radiosity method, Rendering, Recursive ray tracing, Texture mapping

Image Manipulation & Storage
What is an Image, Elementary Image processing techniques, Multipass transformation ,Image Compositing

Advanced Modelling Techniques
Procedural Models,Fractal Models,Grammar based models,particle systems,Volume rendering

Animation
3D animation, morphing, simulation of key frames

Text:

1. Foley - Computer Graphics Principles & Practice, 2nd ed. Pearson Education.
2. Hearn & Baker - Computer Graphics C version, 2nd ed. Pearson Education.
3. Woo-Open GL Programming Language version1.2,3rd edition Pearson Education
4. Hill-Computer Graphics using open GL 2nd edition Pearson Education

Reference:

1. Roger and Adams - Mathematical Element for Computer Graphics, 2nd ed., Tata McGraw Hill
2. Rogers – Procedural Element for Computer Graphics, 2nd ed., Tata McGraw Hill.

Paper Code: CSE – 609 **L C**
Paper: Advance Computer Networks **4 4**

Introduction
Introduction to Network models-ISO-OSI, SNA, Appletalk and TCP/IP models. Fundamentals of digital communication,channel capacity, bit error rate, media characteristics, FDM,TDM,CDMA, statistical multiplexing,point to point and broadcast communication

Queuing Models
Poisson Process, Markov chain, M/M/1 Queue- delay and little's formula. M/M/S/K Queues – average queue length, delay and waiting times.M/G/1 Queues

Data link protocols
Stop and wait protocols and Sliding window protocols - - performance and efficiency. Verification of protocols using Finite State Machines. Multi access protocols – ALOHA and CSMA and its variations. IEEE models and protocols- 802.3,802.4,802.5 and DQDB. Ad hoc networks.

Network layer
Design issues for VC and datagram. Routing algorithms- Dijsktra's , Bellman-Ford, Flooding and broadcasting,link state routing, Flow and congestion control, internetworking, internet architecture and addressing

Transport layer
Design issues,Connection management, Elements of TCP/IP protocol, Finite state machine model

Session and presentation layer
Dialog management, synchronization and session primitives, presentation concepts, cryptography – DES, DES chaining, AES, Public key methods, MD5. Secure Socket layer

Application layer
SNMP, SMTP, RMON, DNS, email service, MIME and WWW

ATM and B-ISDN
Introduction to ATM, ATM layers and applications, ATM over IP, narrowband and broadband ISDN

Case study
Study of various network simulators, Network performance analysis using NS2

Text:
1. Andrew S. Tanenbaum " Computer Networks" by Pearson Education ,fourth edition.
2. Bertsekas and Gallagher " Data Networks" by Prentice hall, Second Edition

References:

1. William Stallings " Data and Computer Communication" , by Prentice hall, Seventh edition
2. William Stallings " Cryptography and Network security" by PHI, Third edition
3. Fred Halsall " Data Communications, Computer Networks and Open Systems" by Pearson Education , Fourth edition
4. William Shay " Understanding data Communication and Networks" by Thomson press , Second edition
5. William Stallings " High speed Networks and Internets" by Pearson education, second edition
6. Leon- Garcia and Widjaja " Computer Networks" by TMH , Second edition

Code No: CSE - 651	**P**	**C**
Lab: Lab. – I	**4**	**2**

The experiments will be based on the following papers:

1) Data Structure & Algorithm Analysis
2) Software Engineering Principles

Code No: CSE - 653	**P**	**C**
Lab: Lab. II	**4**	**2**

The experiments will be based on the following Papers:

1) Advanced Computer Graphics
2) Advanced Computer Networks

Paper Code: CSE – 602 **L C**
Paper: Software Testing **4 4**

Introduction:
What is software testing and why it is so hard?, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing, No absolute proof of correctness, Overview of Graph Theory.

Functional Testing:
Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Structural Testing:
Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

Reducing the number of test cases:
Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, Slice based testing

Testing Activities:
Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

Object Oriented Testing:
Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing.

Testing Tools:
Static Testing Tools, Dynamic Testing Tools, Characteristics of Modern Tools.

Text:

1. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.
2. Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.
3. Boris Beizer, "Software Testing Techniques", Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, "Software Testing", Pearson Education Asia, 2002

Reference:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
2. Boris Beizer, "Black-Box Testing – Techniques for Functional Testing of Software and Systems", John Wiley & Sons Inc., New York, 1995.
3. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.
4. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.
5. Gordon Schulmeyer, "Zero Defect Software", McGraw-Hill, New York, 1990.
6. Watts Humphrey, "Managing the Software Process", Addison Wesley Pub. Co. Inc., Massachusetts, 1989.
7. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984.
8. Glenford Myers, "The Art of Software Testing", John Wiley & Sons Inc., New York, 1979.

Paper Code: CSE – 604 **L C**
Paper: JAVA Programming and Applications **4 4**

Introduction to Java
Importance and features of Java, Concepts of Java Virtual machine (JVM)
Keywords, Constants, Variables and data types, operators and expressions, Control statements, Conditional statements, loops and iterations. Class definition, adding variables and methods, creating objects, constructors, defining methods, calling methods, method overloading. Creating an array, one and two dimensional array, string array and methods String and String Buffer classes, Wrapper classes.

Inheritance
Basic types, super classes, Multilevel hierarchy abstract and final classes, object class, Packages and interfaces, Access protection, extending Interfaces, Exception handling, Fundamental exception types, uncaught exception, throw, throws, final methods, creating own exceptions

Multithreaded programming
Review of fundamentals, Java thread model, synchronization, messaging, thread class, Run able interface, inter thread communication, Monitors, Deadlock, Producer/ Consumer problems, Wait() and notify(), Performance issues.

Input/Output
Basics, Streams, Byte and Character Streams, predefined streams, reading and writing from console and files, using Java packages.

Networking in Java
Networking fundamentals, Client/server model, Internet addresses, Sockets, networking classes and interfaces, using Java.net package, TCP/IP and data gram programming, HTTP protocol and URLs

Event Handling
Different mechanism, the delegation event model, classes, Event Listener Interfaces, Adapter and Inner classes, Working with windows, graphics and text, using AWT controls, Layout managers and menus, handling Image, animation, sound and video Java Applet

Programming Graphical System:
Reading and writing images, Image manipulation, Printing graphics, Print Services, Stream print service, Classes and interfaces for Data transfer, Building transferable image transferring java objects via system clipboard.

Text:
1. "Java –2 The Complete Reference" Patrick Naughton and Herbertz Schidt, second edition

References:
1. "Programming with Java" E. Balaguruswamy, Second edition, TMH
2. "HTML 4 Unleashed" Rick Dranell, Second edition, Tec media publication
3. "Dyanmic web publishing Unleashed" Shelley Powers, Second edition, Tec media
4. Cay S Horstmann and Gary Cornell, Java 2 Vol I and II-Sun Micro Systems-2001

Paper Code: CSE – 606 **L C**
Paper: Advanced Data Base Management System **4 4**

Relational Databases
Integrity Constraint revisited: Functional, Muiltivalued and Join Dependency, Template Algebraic, Inclusion and Generalised Functional Dependency, Chase Algorithms
Query Processing and Optimization: Valuation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Nuill Values and Partial Information.

Deductive Databases
Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation.

Objected Oriented and Object Relational Databases
Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases
Case Studies: Gemstone, O_2, Object Store, SQL3, Oracle xxi, DB2

Parallel and Distributed Databases
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, Parallel Query Evaluation.

Advanced Transaction Processing
Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors.

Active Database and Real Time Databases
Triggers in SQL, Event Constraint and Action : ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery

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.

Data Mining
Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Discovery

Data Warehousing
Data Warehousing Architecture, Multidimensional Data Model, Update Propagation OLAP Queries.

Text Books

1. Elmarsi, "Fundamentals of Database Systems", 4th Edition, Pearson Education
2. R. Ramakrishnan, "Database Management Systems", 1998, McGraw Hill International Editions

Reference Books:

1. Date, "Introduction to Database System", 7th Edition
2. S. Abiteboul, R. hull and V. Vianu, "Foundations of Databases", 1995, Addison – Wesley Publishing Co., Reading Massachutts
3. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision – Wesley,
4. D. Maier, "The Theory of Relational Databases", 1993, Computer Science Press, Rokville, Maryland

Paper Code: CSE – 608 **L C**
Paper: AI and Applications **4 4**

Introduction:
Introduction to intelligent agents

Problem solving:
Solving problems by searching : state space formulation, depth first and breadth first search, iterative deepening

Intelligent search methods:
A* and its memory restricted variants

Production systems:
Design implementation and limitations, case studies

Game Playing:
Minimax, alpha-beta pruning

Knowledge and reasoning:
Propositional and first order logic, semantic networks, building a knowledge base, inference in first order logic, logical reasoning systems

Planning:
STRIPS partial order planning, uncertain knowledge and reasoning, probabilistic reasoning systems, Baysian networks

Learning from observations:
Inductive learning, learning decision trees, computational learning theory, Explanation based learning

Applications:
Environmental Science, Robotics, Aerospace, Medical Scioence etc.

Text Books:
1. "AI, a modern approach" by Russel and Norvig, Pearson Education
2. "AI" by Rich and Knight, Tata McGraw Hill
3. "Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill

Paper Code: CSE – 610 **L C**
Paper: Object Oriented Software Engineering **4 4**

Introduction to Software Engineering:
Software Engineering Development, Software Life Cycle Models, Standards for developing life cycle models.

Object Methodology & Requirement Elicitation:
Introduction to Object Oriented Methodology, Overview of Requirements Elicitation, Requirements Model-Action & Use cases, Requirements Elicitation Activities, Managing Requirements Elicitation

Architecture:
Model Architecture, Requirements Model, Analysis Model, Design Model, Implementation Model, Test Model

Modeling with UML:
Basic Building Blocks of UML, A Conceptual Model of UML, Basic Structural Modeling, UML Diagrams

System Analysis:
Analysis Model, Dynamic Modelling & Testing

System Design:
Design concepts & activities, Design models, Block design, Testing

Component Based Computing
Fundamentals: Definition and nature of components, components and interfaces, Interfaces as contracts, the benefits of components.
Basic Techniques: component design and assembly, Relationship with the client-server model and with patterns, Use of objects and object lifecycle services, use of object brokers

Case Studies

Text Books:
1. Stephen R. Scach, "Classical & Object Oriented Software Engineering with UML and Java", McGraw Hill, 1999.
2. Ivar Jacobson, Magnus Christerson, et. al. "Object Oriented Software Engineering: A use Case Driven approach" Addison wisely, 1992

Paper Code: CSE – 612 **L C**
Paper: Genetic Algorithms **4 4**

Introduction
A brief history of evolutionary computation, Elements of Genetic Algorithms, A simple genetic algorithm, Applications of genetic algorithms

Genetic Algorithms in Scientific models
Evolving computer programs, data analysis & prediction, evolving neural networks, Modeling interaction between learning & evolution, modeling sexual selection, measuring evolutionary activity.

Theoretical Foundation of genetic algorithm
Schemas & Two-Armed and k-armed problem, royal roads, exact mathematical models of simple genetic algorithms, Statistical- Mechanics Approaches.

Computer Implementation of Genetic Algorithm
Data structures, Reproduction, crossover & mutation, mapping objective functions to fitness form, fitness scaling, coding, a multiparameter, mapped, fixed point coding, discretization and constraints.

Some applications of genetic algorithms
The risk of genetic algorithms, De Jong & function optimization, Improvement in basic techniques, current application of genetic algorithms

Advanced operators & techniques in genetic search
Dominance, duplicity, & abeyance, inversion & other reordering operators. Other micro operators, Niche & speciation, multiobjective optimization, knowledge based techniques, genetic algorithms & parallel processors.

Text:
1. David E. Goldberg, "Genetic algorithms insearch, optimization & Machine Learning" Addison Wesley, 1989

References:
1. Melanle Mitchell, "An introduction to genetic algorithms" MIT press, 2000.
2. Masatoshi Sakawa, "Genetic Algorithms & Fuzzy Multiobjective Optimization", Kluwer Academic Publisher, 2001
3. D. Quagliarella, J Periaux, C Poloni & G Winter, "Genetic Algorithms in Engineering & Computer science", John Wiley & Sons, First edition, 1997

Paper Code: CSE – 614 **L C**
Paper: Digital Signal Processing **4 4**

Introduction
Signals and signal Processing, characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signals Processing applications.

Time Domain Representation of Signals & Systems
Discrete Time Signals, Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.

Transforms
Z-transforms, Inverse Z-transform, properties of Z-transform, & its applications in system analysis & design. Discrete Fourier Transform & its properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Fast Fourier Transform (FFT) & methods for computing FFT.

LTI Systems
Transform-Domain Representation of LTI Systems: the frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions, complementary transfer functions, Discrete-Time processing of random signals Digital Processing of Continuous-Time Signals: sampling of Continuous Signals, Analog Filter Design, Anti-aliasing Filter Design, Sample-and-hold circuits, A/D & D/A converter, Reconstruction Filter Design.

Digital Filter Structure
Block Diagram representation, Signal Flow Graph Representation, Equivalent Structures, bone FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, and tunable IIR Digital filters. Cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function, Digital Sine-Cosine generator.

Digital Filter Design
Impulse invariance method of IIR filter design, Bilinear Transform method of IIR Filter Design, Design of Digital IIR notch filters, and FIR filter Design, FIR filter design based on Frequency Sampling approach.

Text:

1. Proakis, " Digital Signal Processing" PHI, Second edition
2. Sanjit K. Mitra, " Digital Signal Processing: A computer based approach" TMH, Second Edition.

References:

1. Monson H. Hayes, " Schaum's Outline of Digital Signal Processing", Mcgraw Hill, 1999.
2. Richard W. Hammming, "Digital Filters", Dover Pubns, 1998.
3. Lars Wanhammar, " DSP Integrated Circuits", Academic Press, First edition, 1999.
4. Simon S. Haykin, " Adaptive Filter Theory, " Prentice Hall, 3rd Edition.

Paper Code: CSE – 616 **L C**
Paper: Mobile Computing **4 4**

Wireless and Mobile Network Architecture:
Principle of Cellular Communication, Overview 1G, 2G, 2.5G and 3G and 4G technologies. GSM Architecture and Mobility management, hand off management, Network signalling. Mobile Computing fundamental challenges, Mobile Devices –PDA and mobile OS, PalmOs, Win CE and Symbian.

Mobile IP Protocol Architecture: Mobile IP and IP v 6 and its application in mobile computing. Cellular Digital Packet Data CDPD, VOIP, GPRS Services, Wireless Local Loop-WLL system.

Wireless Application Protocol (WAP):
The Wireless Application Protocol application environment, wireless application protocol client software, hardware and websites, wireless application protocol gateways, implementing enterprise wireless application protocol strategy,

Wireless Markup Language:
An Introduction to Wireless Technologies, Markup Languages , An Introduction to XML, Fundamentals of WML., Writing and Formatting Text , Navigating Between Cards and Decks, Displaying Images, Tables, Using Variables, Acquiring User Input

Wireless Markup Language Script:
An Introduction to WMLScript, WMLScript Control Structures, Events, Phone.com Extensions, Usability

Application of Mobile computing:
ASP and Dynamic WAP Sites, XML and XSLT, Dynamic WML Generation with ASP and XSLT, Developing WAP Applications using Emulators.

Distributed Mobile Computing
Distributed OS and file systems, Mobile Computing Software (Pervasive Computing) Development Strategies and tools, Data Management for Mobile Computing.

Text:

1. Yi Bing Lin, "Wireless and Mobile Networks Architecture", John Wiley.
2. Wrox "The Beginning WML and WML Script", Wrox Publication
3. Tomasz Imielinski et.al, Mobile Computing, Kluwer Academic Press 1996.
4. Uwe Hansmann, Pervasive Computing Handbook. The Mobile World, IEE publication 2002
5. Jochen Burkhardt, et.al. Pervasive Computing, Technology and Architecture of Mobile Internet Applications, Addison Wesley, 2002

Paper Code: CSE – 618 **L C**
Paper: Neural Networks **4 4**

Introduction:
History, overview of biological Neuro-System, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning.

Supervised Learning and Neurodynamics:
Perceptron training rules, Delta, Back propagation training algorithm, Hopfield Networks, Associative Memories.

Unsupervised and Hybrid Learning:
Principal Component Analysis, Self-organizing Feature Maps, ART networks, LVQ,

Applications:
Applications of Artificial Neural Networks to Function Approximation, Regression, Classification, Blind Source Separation, Time Series and Forecasting.

Text:
1. Anderson J.A., "An Introduction to Neural Networks", PHI, 1999.

Reference:
1. Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
2. Freeman J.A., D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison-Wesley, Reading, Mass, (1992).
3. Golden R.M., "Mathematical Methods for Neural Network Analysis and Design", MIT Press, Cambridge, MA, 1996.
4. Cherkassky V., F. Kulier, "Learning from Data-Concepts, Theory and Methods", John Wiley, New York, 1998.
5. Anderson J.A., E. Rosenfield, "Neurocomputing: Foundatiions of Research, MIT Press, Cambridge, MA, 1988.
6. Kohonen T., "Self-Organizing Maps", 2nd Ed., Springer Verlag, Berlin, 1997.
7. Patterson D.W., "Artificial Neural Networks: Theory and Applications", Prentice Hall, Singapore, 1995.
8. Vapnik V.N., "Estimation of Dependencies Based on Empirical Data", Springer Verlag, Berlin, 1982.
9. Vapnik V.N., "The Nature of Statistical Learning Theory", Springer Verlag, New York, 1995.
10. Vapnik V.N., "Statistical Learning Theory: Inference from Small Samples", John Wiley, 1998.

Paper Code: CSE – 720	**L**	**C**
Paper: Minor Project Work I	**4**	**4**

The student will submit a synopsis at the beginning of the semester for the approval to the project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the project committee for evaluation purpose at the end of the semester in a specified format.

Code No: CSE - 652	**P**	**C**
Lab: Lab. – III	**4**	**2**

The experiments will be based on the following papers:

1) Software Testing
2) JAVA Programming and Applications

Code No: CSE - 654	**P**	**C**
Lab: Lab. IV	**4**	**2**

The experiments will be based on the following Paper:

1) Advanced Data Base Management System

Code No: CSE - 656	**P**	**C**
Lab: Lab. V	**4**	**2**

The experiments will be based on the following Paper:

1) Electives

Paper Code: CSE – 701 **L C**
Paper: Network Management and Security **4 4**

Introduction
Classical security Techniques and Computer Network Security Concepts. Confidentiality and Security, Security Policy and Operations Life Cycle, Security System Development and Operations

Secure Networking Threats
The Attack Process. Attacker Types. Vulnerability Types. Attack Results. Attack Taxonomy. Threats to Security: Physical security, Biometric systems, monitoring controls, and Data security and intrusion and detection systems.

Encryption Techniques
Conventional techniques, Modern techniques, DES, DES chaining, Triple DES, RSA algorithm, Key management. Message Authentication and Hash Algorithm, Authentication requirements and functions secure Hash Algorithm, Message digest algorithm, digital signatures. AES Algorithms.

Designing Secure Networks
Components of a Hardening Strategy. Network Devices. Host Operating Systems. Applications. Appliance-Based Network Services. Rogue Device Detection, Network Security Technologies The Difficulties of Secure Networking. Security Technologies. Emerging Security Technologies General Design Considerations, Layer 2 Security Considerations. IP Addressing Design Considerations. ICMP Design Considerations. Routing Considerations. Transport Protocol Design Considerations

Network Security Platform Options
Network Security Platform Options. Network Security Device Best Practices, Common Application Design Considerations. E-Mail. DNS. HTTP/HTTPS. FTP. Instant Messaging.

IPsec VPN Design Considerations
VPN Basics. Types of IPsec VPNs. IPsec Modes of Operation and Security Options. Topology Considerations. Design Considerations. Site-to-Site Deployment Examples.

Secure Network Management and Network Security Management
Organizational Realities. Protocol Capabilities. Tool Capabilities. Secure Management Design Options. Network Security Management, Firewalls, Trusted systems, IT act and cyber laws.

Text:
1. Sean Convery, " Network Security Architectures, Published by Cisco Press, First Ed. 2004
2. William Stalling "Cryptography and Network Security" Pearson Education

References:
1. Charels P. Pfleeger "Security in Computing" Prentice Hall
2. Jeff Crume "Inside Internet Security" Addison Wesley

Paper Code: CSE – 703 **L C**
Paper: Multimedia Technology **4 4**

Introduction:
Concept of Multimedia ,Media & data stream, main properties of multimedia system , Data stream characteristics &for continuous media Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation.

Components of multimedia:
Text, Basic sound concepts , MIDI , Speech ,Basic concept of Images ,Graphics format ,Overview of image processing ,Basic concepts of Video & animation, Conventional system, Transmission, Enhanced system ,High Definition system ,Computer based animation ,.Design & Authoring Tools, Categories of Authority Tools, Types of products

Data Compression
Coding requirement ,Source , entropy, hybrid coding, JPEG, MPEG, Text compression using static Huffmann technique, Dynamic Huffmann Technique, Statistical coding techniques

Computer Technology
Hybrid system, digital system

Optical Storage Media
Video Disk and other WORMS, Compact Disk Digital audio ,Advantage of CD-DA ,Frames tracks blocks of CD-DA,CD-ROM ,Further CD-ROM based developments, Principles of CDWO ,Prospects of CD technologies

Virtual Reality
Introduction to Virtual reality & Virtual reality Systems,
Related Technologies: Tele-operation & Augmented reality system
VRML Programming, Domain Dependent Application like Medical, Visualisation
Visibility computation, Time Critical rendering,
Image based VR system

Text / Reference:

1. David Hillman, "Multimedia Technology & Applications", Galgotia Publications.
2. Steinmetz "Multimedia Computing Communication and Application" Pearson Edn.
3. John Vince "virtual Reality Systems" Pearsn Education
4. Andleigh and Thakarar "Multimedia System Design" PHI
5. Nigel Chapman & Jenny Chapman, "Digital Multimedia", Wiley Publications.
6. D.P. Mukherjee, "Fundamentals of Computer Graphics and Multimedia", PHI.

Paper Code: CSE – 705 **L C**
Paper: Advanced Software Project Management **4 4**

Introduction to Software Project Management:
Software development as a project; Stakeholders in software project; Software product, process, resources, quality, and cost; Objectives, issues, and problems relating to software projects.

Overview of Project Planning:
Steps in project planning; Defining scope and objectives; work breakdown structure; Deliverables and other products; time, cost, and resource estimation; Alternatives in planning

Project Evaluation:
Strategic assessment; Technical assessment; Cost-benefit analysis; Cash flow forecasting; Cost-benefit evaluation techniques; Break-even analysis; Risk evaluation

Selection of Appropriate Project Approach:
Choosing development technology and methodology; choice of process model; Rapid application development; Waterfall model; V-process model; Spiral model; Prototyping,; Incremental delivery.

Software Effort Estimation
Problem in software estimation; Effort estimation techniques; Expert judgement; Estimation by analogy; Delphi technique; Algorithmic methods; Top-down and bottom-up estimation; Function point analysis; Object points; COCOMO model.

Activity Planning
Network planning model; Activity-on-arrow network; Precedence network; Forward pass; Backward pass; Critical path; Slack and float.

Risk Analysis and Management
Nature and categories of risk in software development; risk Identification; Risk assessment; Risk mitigation, monitoring, and management; Evaluating schedule risk using PERT.

Recourse Allocation
Nature of project resources; Identifying resource requirement of activities; Allocating and scheduling resources; cost of resources; Standard, planned, and actual cost; Cost variance; time-cost trade-off.

Project Tracking and Control
Measurement of physical and financial progress; Earned value analysis; Status reports; Milestone reports; Change control.

Contact Management
Outsourcing of products and services; Types of contracts; Stages in contract placement; Terms of contract; Contract monitoring; Acceptance testing

Managing People and Organizing Teams
Organizational behaviour; Recruitment and placement; Motivation; Group behaviour; Individual and group decision making; Leadership and leadership styles; forms of organizational structures.

Software Quality Assurance
Planning for quality; Product versus process quality management; Procedural and quantitative approaches; Defect analysis and prevention; Statistical process control; Pareto analysis; Causal analysis; Quality standards; ISO 9000; Capability Maturity Model; Quality audit.

Configuration Management
Configuration management process; Software configuration items; Version control; change control; Configuration audit; Status reporting.

Text:

1. Bob Hughes and Mike Cotterell, "Software Project Management", Third Edition 2002, McGraw-Hill
2. Pankaj Jalote, "Software Project Management in Practice", 2002, Pearson Education Asia.

Reference:

1. Roger S. Pressman, "Software Engineering: A practitioner's Approach", Fifth Edition 2001 McGraw-Hill
2. Robert T. Futrell, Donald F. Shafer, and Linda I.. Shafer, "Quality Software Project Management" 2002, Pearson Education Asia.
3. Ramesh Gopalaswamy, "Managing Global Software Projects", 2003, Tata McGraw-Hill

Paper Code: CSE – 707 **L C**
Paper: Data Warehousing & Data Mining **4 4**

Data Warehousing:
Introduction to Data Warehousing: Evolution of Data Warehousing, Data Warehousing concepts, Benefits of Data Warehousing, Comparison of OLTP and Data Warehousing, Problems of Data Warehousing.

Data Warehousing Architecture
Architecture: Operational Data and Datastore, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and Highly summarised Data, Archive/Backup Data, Meta-Data, architecture model, 2-tier, 3-tier and 4-tier data warehouse, end user Access tools.

Data Warehousing Tools and Technology
Tools and Technologies: Extraction, cleaning and Transformation tools, Data Warehouse DBMS, Data Warehouse Meta-Data, Administration and management tolls, operational vs. information systems.
OLAP & DSS support in data warehouse.

Distributed Data Warehouse
Types of Distributed Data Warehouses, Nature of development Efforts, Distributed Data Warehouse Development, Building the Warehouse on multiple levels.

Types of Data Warehouses & Data Warehouse Design
Host based, single stage, LAN based, Multistage, stationary distributed & virtual data-warehouses. Data warehousing Design: Designing Data warehouse Database, Database Design Methodology for Data Warehouses, Data Warehousing design Using Oracle,
OLAP and data mining: Online Analytical processing, Data mining.

Knowledge discovery
Knowledge discovery through statistical techniques, Knowledge discovery through neural networks, Fuzzy technology & genetic algorithms.

Text:
"Building the Data Warehouse", W.H.Inmon, 3rd Edition, John Wiley & Sons.
"Developing the Data Warehouse", W.H.Inmon, C.Kelly, John Wiley & Sons.
Thomas Connoly, Carolyn Begg-"Database Systems-A practical approach to Design, Implementation and management" 3rd Edition Pearson Education

Reference:
1. W.H.Inmon, C.L.Gassey, "Managing the Data Warehouse", John Wiley & Sons.
2. Fayyad, Usama M. et. al., "Advances in knowledge discovery & Data Mining", MIT Press.

Paper Code: CSE – 709 **L C**
Paper: Distributed Computing **4 4**

Fundamentals of Distributed Computing:
Architectural models for distributed and mobile computing systems. Basic concepts in distributed computing such as clocks, message ordering, consistent global states, and consensus.

Basic Algorithms in Message:
Passing Systems, Leader Election in Rings, and Mutual Exclusion in Shared Memory, Fault-Tolerant Consensus, Causality and Time. Message Passing: PVM and MPI.

Distributed Operating Systems:
OS and network operating systems, Distributed File systems. Middleware, client/server model for computing, common layer application protocols (RPC, RMI, streams), distributed processes, network naming, distributed synchronization and distributed object-based systems.

Simulation:
A Formal Model for Simulations, Broadcast and Multicast, Distributed Shared Memory, Fault-Tolerant Simulations of Read/Write Objects Simulating Synchrony, Improving the Fault Tolerance of Algorithms, Fault-Tolerant Clock Synchronization.

Distributed Environments:
Current systems and developments (DCE, CORBA, JAVA).

Advanced Topics:
Randomization, Wait-Free Simulations of Arbitrary Objects, Problems Solvable in Asynchronous Systems, Solving Consensus in Eventually Stable Systems, High Performance Computing-HPF, Distributed and mobile multimedia systems. Adaptability in Mobile Computing. Grid Computing and applications. Fault tolerant Computing Systems.

Text/Reference:

1. Hagit Attiya, Jennifer Welch, Distributed Computing: Fundamentals, Simulations, and Advanced Topics, 2nd Edition, March 2004
2. Mullendar S. Distributed Systems, 2nd Ed. Addison, Wesley 1994.
3. Tannenbaum, A. Distributed Operating Systems, Prentice Hall 1995.
4. Helal, Abdelsalam A. *et al.* Anytime, Anywhere Computing: Mobile Computing Concepts and Technology, Kluwer Academic Publishers 1999.
5. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems: Concepts and Design *Third Edition* Addison-Wesley, Pearson Education, 2001.
6. Cay S Horstmann and Gary Cornell, Java 2 Vol I and II-Sun Micro Systems-2001

Paper Code: CSE – 711 **L C**
Paper: Embedded System Design **4 4**

Software and hardware aspects of Embedded system

Section-A

The concepts of embedded system design, Embedded microcontroller cores, embedded memories, examples of embedded systems.

Technological aspects of embedded system: interfacing between analog and digital blocks, signal conditioning, Digital signal processing, subsystem interfacing, interfacing with external systems, user interfacing, Design tradeoffs due to process compatibility, Thermal consideration etc.

Software aspects of embedded systems: real time programming languages and operating systems.

Section-B

Introduction, CPU architecture, registers, instruction sets addressing modes Loop timing, timers, Interrupts, Interrupt timing, I/o Expansion, I2C Bus Operation Serial EEPROM, Analog to digital converter, UART Baud Rate-Data Handling-Initialisation, Special Features - serial Programming-Parallel Slave Port.

Section-C

Motorola MC68H11 Family Architecture Registers, Addressing modes Programs. Interfacing methods parallel I/o interface, Parallel Port interfaces, Memory Interfacing, High Speed I/o Interfacing, Interrupts-interrupt service routine-features of interrupts-Interrupt vector and Priority, timing generation and measurements, Input capture, Output compare, Frequency Measurement, Serial I/o devices RS.232, RS.485. Analog Interfacing, Applications. ARM processors.

Embedded system development

Embedded system evolution trends. Round - Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

RTOS & its overview:

Real Time Operating System: Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.

Text Books:

1. David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
2. John B Peat man " Design with Microcontroller ", Pearson education Asia, 1998.
3. Jonartthan W. Valvano Brooks/cole " Embedded Micro computer Systems. Real time Interfacing ", Thomson learning 2001.

References:

1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages", Second Edition. Harlow: Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.
3. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
4. Heath, Steve, " Embedded Systems Design ", Newnes 1997.

Paper Cope: CSE – 713 **L C**
Paper: Wireless and CDMA Technology **4 4**

Transmission Fundamentals
Analog and Digital Data Transmission fundamentals, Channel Capacity. Transmission Media. Multiplexing. LANs, MANs, and WANs. Switching Techniques. Circuit-Switching. Packet Switching. Asynchronous Transfer Mode- ATM

Spread Spectrum Techniques
The Concept of Spread Spectrum. Frequency Hopping Spread Spectrum. Direct Sequence Spread Spectrum. Code-Division Multiple Access. Generation of Spreading Sequences.

Cellular Wireless Networks
Cellular Network Concept, First Generation (1G) Analog, Second Generation (2G) Digital TDMA. GSM and mobility management in GSM, Third Generation Systems (3G) CDMA and 4 G Technology overview.

Protocols Architecture: The TCP/IP Protocol Architecture and Mobile IP.

IEEE 802.11 Wireless LAN Standard.
IEEE 802 Protocol Architecture. IEEE 802.11 Architecture and Services. IEEE 802.11 Medium Access Control. IEEE 802.11x Standards.

Blue tooth Technology
Radio Specifications. Base band Specification. Link Manager Specification. Logical Link Control and Adaptation Protocol.

Wireless Application Protocol (WAP)
The Wireless Application Protocol application environment, wireless application protocol client software, wireless application protocol gateways, implementing enterprise wireless application protocol strategy and Security Issues in Wireless LAN. Wireless network management, GPRS, and VOIP services.

CDMA Technology
Principles of Wideband CDMA (WCDMA), CDMAOne and CDMA2000, Universal Mobile Telecommunications System (UMTS), Evolution of Mobile Communication Networks, Call Controls and Mobility Management in CDMA.Quality of Service (QoS) in 3G Systems, CDMA network planning, design and applications.

Text/Reference:

1. William Stalling, Wireless Communications and Networks. Prentice Hall 2002
2. Yi-Bing Lin, Imrich Chlamtac, Wireless and Mobile Network Architecture, John Wiley-2001.
3. M. R. Karim, Mohsen Sarraf, W-CDMA and cdma2000 for 3G Mobile Networks, McGraw-Hill Professional, 2002.

Paper Code: CSE – 715 **L C**
Paper: Soft Computing **4 4**

Neural Networks:
History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Fuzzy Logic:
Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Operations on Fuzzy Sets:
Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Arithmetic:
Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Fuzzy Logic:
Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information:
Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Introduction of Neuro-Fuzzy Systems:
Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic:
Medicine, Economics etc.

Genetic Algorithm:
An Overview, GA in problem solving, Implementation of GA

Text:

1. "An Introduction to Neural Networks", Anderson J.A., PHI, 1999.
2. "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
3. "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI, 1995.
4. "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.

Reference:

1. "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
2. "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

Paper Code: CSE – 717 **L C**
Paper: Digital Image Processing **4 4**

Introduction And Digital Image Fundamentals:
Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbours, connectivity, Distance measure between pixels, Imaging Geometry.

Image Transforms:
Discrete Fourier Transform, Some properties of the two-dimensional fourier transform, Fast fourier transform, Inverse FFT.

Image Enhancement:
Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Lowpass filtering, Highpass filtering, Homomorphic filtering, Colour Image Processing.

Image Restoration:
Degradation model, Diagnolization of Circulant and Block-Circulant Matrices, Algebraic Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.

Image Compression:
Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards.

Image Segmentation:
Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Representation and Description:
Representation schemes like chain coding, Polygonal Approximatiion, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.

Recognition and Interpretation:
Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods, Interpretatiion.

Text:
1. Rafael C. Conzalez & Richard E. Woods, “Digital Image Processing”, AWL.
2. A.K. Jain, “Fundamental of Digital Image Processing”, PHI.

Reference:
1. Rosefield Kak, “Digital Picture Processing”,
2. W.K. Pratt, “Digital Image Processing”,

Code No: CSE - 751	**P**	**C**
Lab: Lab. – VI	**4**	**2**

The experiments will be based on the following paper:

1) Multimedia Technology

Code No: ITR-753	**P**	**C**
Lab: Lab. VII	**4**	**2**

The experiments will be based on the following Papers:

1) Electives

Code No: CSE - 755	**P**	**C**
Lab: Minor Project Work	**8**	**6**

The student will submit a synopsis at the beginning of the semester for approval to the project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the project committee for evaluation purpose at the end of the semester in a specified format.

Code No: CSE - 755	**P**	**C**
Lab: Seminar	**0**	**2**

The student will have to present the progress of the project work through seminars and progress reports at the interval of four weeks.

Code No: CSE - 702	**P**	**C**
Paper: Dissertation	**30**	**22**

The student will submit a synopsis at the beginning of the semester for the approval from the project committee in a specified format. Synopsis must be submitted within a two seeks. The first defense, for the dissertation work, should be held with in a one month. Dissertation Report must be submitted in a specified format to the project committee for evaluation purpose.

Code No: CSE - 704	**P**	**C**
Paper: Seminar & Progress Report	**-**	**3**

Code No: CSE – 706	**P**	**C**
Paper: Comprehensive Viva	**-**	**2**