MAHATMA GANDHI UNIVERSITY

M.Tech in Computer Science & Information Systems
M.Tech in Computer Science & Engineering

REPORT OF THE EXPERT COMMITTEE

The Mahatma Gandhi University has constituted Expert Committees to frame the scheme and syllabus of the M.Tech course in Computer & Information Systems, vide U.O.No: 4016/Ac.AIV/1/Acad/09 dated 09/09/09 and of the M.Tech in Computer Science & Engineering, vide U.O.No: 4298(B)/Ac.AIV/1/Acad/09 dated 01/10/09

The members of the Committees are listed below:

1. Dr. Paulose Jacob K, Director, School of Computer Science Studies, CUSAT (Convenor)
2. Dr. David Peter, School of Computer Science Studies, CUSAT
3. Dr.Vineeth Paleri, HOD, Computer Science & Engineeing, NIT, Calicut.
4. Prof. Govindan V.K. Dept. of Computer Science and Engineering, NIT,Calicut.
5. Dr. Achuth Sankar S Nair, Center for Bio Informatics, University of Kerala.

Observations:

The Committee had several interactive sessions across the web and exchange of viewpoints to finalise the scheme. One strong point that has come up during such sessions was that the specialization of the M.Tech programme shall suit the broad requirement of a Post Graduate Engineering programme in the branch of Computer Science & Engineering, so as to cater to the academic aspirations of the potential candidates seeking the course. Accordingly subjects have been listed as core and electives with a view to formulating one or more specializations by appropriate choice of electives; the core subjects being fundamentally suitable for any Computer Science based programme. A total of five Electives form part of the curricular requirement for the programme, which can be judiciously chosen from among those listed, to suit the appropriate specialization.

It is also observed that the Mahatma Gandhi University vide U.O. No. Ac.AIV/1/2330©/ M.Tech/07 dated 28.03.'07 has recommended a unified scheme for M.Tech courses under Civil, Mechanical, Electrical & Electronics branches, but not including Computer Science branch. The current recommendation of the Expert Committee is precisely for the Computer Science branch, which is by and large in conformity with the scheme. The only variation is with respect to the curriculum for semester III. It is felt that "Industrial Training" for the Computer Science branch may be less appropriate than the two coursework and a Project that have been proposed in this report. It is this Project work that is carried over to form the dissertation in Semester IV. The Scheme is formulated based on the above observations of the Committee.

Electives have been grouped into A and B, such that CORE plus GROUP A electives form the structure for M.Tech in Computer Science & Engineering, while CORE plus Group B electives form the structure for M.Tech in Computer Science & Information Systems. It is envisaged that new additions of electives and their appropriate groupings could form new specializations; particularly significant in view of the fast pace of developments in Computer Science

Scheme Recommended:

Semester I

Sl.No.	Course No	Subject	Hrs/week			Evaluation Scheme					Credits
						Sessionals			ESE	**Total**	
			L	T	P	TA	CT	Sub Total			
1		Mathematical Foundation of Computer Science	3					50	100	150	3
2		Data Structures & Algorithms	3					50	100	150	3
3		Operating systems	3					50	100	150	3
4		Computer Architecture	3					50	100	150	3
5		Elective-I	3					50	100	150	3
6		Operating system **LAB**			3			50	100	150	1.5
7		Data structure & Algorithms **LAB**			3			50	100	150	1.5
8		Seminar			2	50		50		50	2
		Total								1100	20

Semester II

Sl.No.	Course No	Subject	Hrs/week			Evaluation Scheme					Credits
						Sessionals			ESE	**Total**	
			L	T	P	TA	CT	Sub Total			
1.		Compiler Design	3			20	30	50	100	150	3
2.		Database Technology	3			20	30	50	100	150	3
3.		Computer Networks	3			20	30	50	100	150	3
4.		Elective –II	3			20	30	50	100	150	3
5.		Elective-III	3			20	30	50	100	150	3
6.		Advanced Data Base **LAB**			3	**20**	30	50	100	150	1.5
7.		Networks **LAB**			3	20	30	50	100	150	1.5
8.		SEMINAR				50		50		50	2
9.		**Total**								1100	20

Semester III

Sl.No.	Course No	Subject	Hrs/week			Evaluation Scheme					Credits
						Sessionals			ESE	**Total**	
			L	T	P	TA	CT	Sub Total			
1.		Cryptography and Network Security	3			20	30	50	100	150	3
2.		Elective IV	3			20	30	50	100	150	3
3.		Elective V	3			20	30	50	100	150	3
4		Project work Phase I with Term Paper				100			50 VIVA	150	6
		TOTAL								600	15

L: Lecture T: Tutorial P: Practical CT: Class Test (Minimum 2)
TA: Teachers' assessment (based on attendance, assignments, tutorials etc)
ESE : End Semester Examination conducted by University

Semester IV

Sl.No.	Course No	Subject	Hrs/week			Evaluation Scheme					Credits
						Sessionals			ESE / Thesis	**Total**	
			L	T	P	TA	C T	Sub Total			
1		Project work Phase II / Dissertation	0	0	30	150	0	150	150	300	25
2		Comprehensive Viva							100	100	0
		TOTAL								400	25
		GRAND TOTAL FOR ALL SEMESTERS								3200	80

Electives suggested :

Group A	**Group B**
Digital image processing.	Natural language processing
Data warehousing and Data Mining	Pattern recognition
Object Oriented Software Engineering.	Bioinformatics
Advanced Network Programming	Grid computing
Wireless & Mobile Communication	Agent based Intelligent system
Embedded systems	Computer Network Administration
High Performance Networks.	Software structure & UML
Parallel Computation and Applications	Software Quality Assurance
Multicore Architecture	Genetic Algorithms and Applications
Professional Studies [as an Audit course**]**	

CONVENOR :

[Convenor acknowledges the contribution of the members of the Committee]

SYLLABUS

CORE

Mathematical foundations of Computer Science

Module 1

Modeling computation and languages: Finite state machines, deterministic and non deterministic finite state machines , Turing machines, Recursive and Recursively Enumerable languages, Decidability, Resource bounded computation, Complexity classes, , Complexity measures. Relationships among complexity measures, Polynomial time and space, Theory of NP-completeness.

Formal languages – classes of grammars-type 0 –context sensitive –context free – regular grammars.

Module 2

Crisp sets and Fuzzy Sets: Basic concepts- Fuzzy Logic-Fuzzy predicates-Fuzzy quantifiers.

Operations on Fuzzy Sets: Fuzzy Complement-Fuzzy unions-Fuzzy Intersection-combinations of operations-Theorems. Crisp Relations and Fuzzy Relations-Binary Relation-one-to-one and onto relation-Inverse fuzzy relation.

Module 3

Linear algebra:Vector spaces, Orthogonality, Eigen-value analysis, Vector and matrix norms, Multivariable analysis, Vector and matrix calculus, Unconstrained and constrained optimization problem solving methods.

Module 4

Simulation and stochastic process.Random variables, Functions of random variables, Sequences of random variables, Stochastic processes, Markov chains, Markov processes and queuing theory.Simulation : Discrete Event Simulation – Monte – Carlo Simulation – Stochastic Simulation – Applications to Queuing systems.

Module 5

Queing models. Queuing theory : General Concepts - Arrival pattern - service pattern - Queue disciplines - Markovian Queues - Single and Multi-server Models The Markovian model M/M/1 - steady state solutions – Little's formula.

Advanced queing models :Non-Markovian Queues – Pollaczek Khintchine Formula – Queues in Series – Open Queuing Networks –Closed Queuing networks.

References

1. An introduction to formal languages and automata By Peter Linz
2. Robertazzi. T.G. "Computer Networks and Systems – Queuing Theory and Performance Evaluation", Third Edition, Springer, 2002 Reprint.
3. Ross. S.M., "Probability Models for Computer Science", Academic Press, 2002.
4. R. P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 3/e, Addison-Wesley, New Delhi, 1994.
5. B. Kolman and R.C. Busby, Discrete Mathematical Structures for Computer Science, PHI, New Delhi, 1994.
6. J. Clark and D. A. Holton, A First Look at Graph Theory, Allied Publishers (World Scientific), New Delhi, 1991.
7. Ross. S.M., "Probability Models for Computer Science", Academic Press, 2002.
8. George J. Klir and Tina A. Folger- Fuzzy sets, Uncertainty and Informations –

Eastern Economy Edition

Data Structures and Algorithms

Module 1

Mathematical Induction - Asymptotic Notations – Properties of Big-oh Notation – Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis Memory Representation of Multi-dimensional Arrays – Time-Space Tradeoff.

Module 2

Trees :General and binary trees -traversals -Binary search trees - AVL Trees – Red-Black trees – Multi-way Search Trees –B-Trees – Splay Trees,Balancing
Segment Trees – k-d Trees – Point Quad Trees
HEAPS: .... Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps

Module 3

Searches in graphs-Shortest path-Minimal spanning tree -The union find problem - Hamiltonian path and travelling salesperson problems
Hashing:Hash functions ,Collision resolution ,Expected behavior

Module 4

Greedy methods ,Priority queue search ,Exhaustive search ,Divide and conquer ,Dynamic programming ,,Recursion Influence of data structure on algorithm performance

Module 5

NP-Completeness – NP-Hard – Recurrence Equations – Solving Recurrence Equations Huffman Coding – Convex Hull – Topological Sort – Tree Vertex Splitting – Activity Networks – Flow Shop Scheduling – Counting Binary Trees – Introduction to Randomized Algorithms.

References

1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, Uiversity Press, 2007.
2. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007.
3. G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Printice –Hall, 1988.
4. V.S. Subramanian, Principles of Multimedia Database systems, Morgan Kaufman, 1998.

Operating Systems

Module 1
Distributed computing systems fundamentals: Introduction to Distributed computing systems, Models, Popularity. Distributed computing system. Design issues of Distributed operating system. Distributed computing environment.

Module 2
Message Passing: Features of a good Message Passing System. Issues in IPC by Message Passing Synchronization, Bullring, Multidatagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failurehandling, Group Communication.
Remote Procedure Calls: RPC Model, Implementation. Stub Generation. RPC Messages, Marshaling Arguments and Results. Server Management, Parameter-Passing semantics, call semantics, Communication protocols for RPCs, Client-Server Building, Exception handling, Security RPC in Heterogeneous Environments, Lightweight RPC.

Module 3
Distributed Shared Memory: General architecture of DSM systems. Design and implementation Issues of DSM, Granularity, Structure of Shared Memory Space. Consistency models, Replacement strategy, Thrashing. Synchronization: Clock Synchronization. Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms

Module 4
Resource Management: Features of global scheduling algorithm. Task assignment approach, Load-Balancing and Load approach. Process Management: Introduction, Process Migration, Threads.

Module 5
Distributed File Systems: Features of good DFS, File models, File Accessing models. File-Sharing Semantics, File-Caching schemes, File Replication, Fault Tolerance, Automatic Transactions, Design Principles, Case study: DCE Distributed File Service.

References
1. Distributed Operating Systems concepts and design- .K. Sinha (PHI).
2. Modern Operating System-Singhal
3. Distributed Systems concepts and design-G.Coulouris, J.Dollimore & T.Kindberg
4. Modern Operating System-A.S. Tanenbaum(PHI).

Computer Architecture

Module 1
Computation Models:- Concept
Relationships between concepts of CM(Connection Machine), Programming language and architecture. Basic computation models von- Newman computation model key concepts relating to CM.
Concepts of Computer Architecture - Evolution and concept- Abstraction
- Multi level hierarchical framework and extensions

Module 2
Parallel Processing :- - Basic concepts- Types and level of parallelism- Classification
- Basic parallel techniques
- Relationship between languages and parallel architecture.

Module 3
Instruction level parallel processors :- - Evolution and overview of ILP processors

- Dependencies between instructions- Instruction scheduling- Preserving sequential consistency- Speed up potential of ILP processing

Module 4
Pipelined processors:-- Concepts- Design space of pipelines- Pipelined instruction processing - Pipelined execution of integers and Boolean instructions - Pipelined processing of load and stores

Module 5
Superscalar processor :- - Introduction- Parallel decoding- Superscalar instruction issue - Shelving- Register naming- Parallel execution - Preserving the sequential consistency of instruction execution and exception processing. - Implementation of super scalar CISC processor using a superscalar RISC care

References

1. Advanced Computer Architecture a design space approach.
- Sima, Fauntain, Kscucle, Pearson Edition
2. Parallel Computer Architecture – David Culler and J. Palsingh, Morgan Kaufmann
3. Introduction to parallel Algorithms - Joseph J.A. , Addison Wesley
4. Parallel programming - Barry Wilkinson, C.Michael Allen
5 John L. Hennessey and David A. Patterson, " Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, 4th. edition, 2007.

6.David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture : A hardware/ software approach" , Morgan Kaufmann / Elsevier, 1997.

7.William Stallings, " Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition, 2006.

6 . "Computer Architecture and parallel Processing" Kai Hwang and A.Briggs International Edition McGraw-Hill.
7. Advanced Computer Architectures, Dezso Sima, Terence Fountain, Peter Kacsuk, Pearson.
8. Advanced Computer Architecture by kai Hwang

Compiler Design

Module 1
Principles Of Compiler – Compiler Structure – Properties of a Compiler – Optimization – Importance of Code optimization – Structure of Optimizing compilers – placement of optimizations in optimizing compilers – ICAN – Introduction and Overview – Symbol table structure – Local and Global Symbol table management

Module 2
Intermediate representation – Issues – High level, medium level, low level intermediate languages – MIR, HIR, LIR – ICAN for Intermediate code – Optimization – Early optimization – Constant folding – scalar replacement of aggregates – Simplification – value numbering – constant propagation – redundancy elimination – loop optimization

Module 3
Procedure optimization – in-line expansion – leaf routine optimization and shrink wrapping – register allocation and assignment – graph coloring – code scheduling – control flow and low level optimizations – inter-procedural analysis and optimization – call graph – data flow analysis – constant propagation – alias analysis – register allocation – global references – Optimization for memory hierarchy

Module 4
Code Scheduling – Instruction scheduling – Speculative scheduling – Software pipelining – trace scheduling – percolation scheduling – Run-time support – Register usage – local stack frame – run-time stack – Code sharing – position–independent code – Symbolic and polymorphic language support

Module 5
Case Studies – Sun Compilers for SPARC – IBM XL Compilers – Alpha compilers – PA –RISC assembly language – COOL – (Classroom Object oriented language) - Compiler testing tools – SPIM

References

1. Steven S. Muchnick, "Advanced Compiler Design Implementation", Morgan Koffman – Elsevier Science, India, Indian Reprint 2003
2. Keith D Cooper and Linda Torczon, " Engineering a Compiler, Elsevier Science, India.
3. Introduction to Assembly language programming: for Pentium and RISC processors. By Sivarama P. Dandamudi
4. Allen Holub "Compiler Design in C", Prentice Hall of India, 1990.
5. Alfred Aho, V. Ravi Sethi, D. Jeffery Ullman, "Compilers Principles, Techniques and Tools", Addison Wesley, 1988.
6. Charles N. Fischer, Richard J. Leblanc, "Crafting a compiler with C",- Benjamin-
   Cummings Publishing Co., Inc. Redwood City, CA, USA

Database Technology

Module1
Query and transaction processing: Data Storage and Querying : Storage and File Structure - Indexing and Hashing – Physical Database Design and Tuning - Query Processing Algorithms – Query Optimization Techniques – Transaction Management: Transaction Processing Concepts – Concurrency Control – Recovery Techniques – Database Security.

Module 2

Parallel and Distributed Databases: Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies**.**

Module 3

Object and Object relational databases**:** Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL / Oracle – Case Studies.

Module 4

Enhanced Data models**:** Active Database Concepts and Triggers – Temporal Databases – Spatial Databases – Multimedia Databases – Deductive Databases – XML Databases: XML Data Model – DTD - XML Schema - XML Querying - Geographic Information Systems - Genome Data Management**.**

Module 5

Emerging Technologies: Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols – Web Databases - Information Retrieval - Data Warehousing - Data Mining.

References

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, “ Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006.
4. C.J.Date, A.Kannan and S.Swamynathan,”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
5. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition 2004.

Computer Networks

Module 1

Foundations of Networking: Communication Networks – Network Elements – Switched Networks and Shared media Networks – Probabilistic Model and Deterministic Model – Data grams and Virtual Circuits – Multiplexing – Switching - Error and Flow Control – Congestion Control – Layered Architecture – Network Externalities – Service Integration – Modern Applications

Module 2

Quality of Service: Traffic Characteristics and Descriptors – Quality of Service and Metrics – Best Effort model and Guaranteed Service Model – Limitations of IP networks – Scheduling and Dropping policies for BE and GS models – Traffic Shaping algorithms – End to End solutions – Laissez Faire Approach – Possible improvements in TCP – Significance of UDP in inelastic traffic

Module 3

High Performance Networks**:** Integrated Services Architecture – Components and Services – Differentiated Services Networks – Per Hop Behaviour – Admission Control – MPLS Networks – Principles and Mechanisms – Label Stacking – RSVP – RTP/RTCP

Module 4

High Speed Networks: Optical links – WDM systems – Optical Cross Connects – Optical paths and Networks – Principles of ATM Networks – B-ISDN/ATM Reference Model – ATM Header Structure – ATM Adaptation Layer – Management and Control – Service Categories and Traffic descriptors in ATM networks

Module 5

Network Management**:** ICMP the Forerunner – Monitoring and Control – Network Management Systems – Abstract Syntax Notation – CMIP – SNMP Communication Model – SNMP MIB Group – Functional Model – Major changes in SNMPv2 and SNMPv3 – Remote monitoring – RMON SMI and MIB

References

1. Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education, 2004.
2. Larry L Peterson and Bruce S Davie, 'Computer Networks: A Systems Approach', Fourth Edition, Morgan Kaufman Publishers, 2007.
3. Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002
4. William Stallings, 'High Speed Networks: Performance and Quality of Service', 2nd Edition, Pearson Education, 2002.
5. Mani Subramaniam, 'Network Management: Principles and Practices', Pearson Education, 2000
6. Kasera and Seth, 'ATM Networks: Concepts and Protocols', Tata McGraw Hill, 2002.

Cryptography and Network Security

Module 1

Introduction to cryptography :- Concepts, approaches and principles of digital information security, types of attacks, security model, cryptographic techniques – substitution and transposition techniques, stegano graphy techniques.

Module 2

Symmetric Key cryptography: Algorithm types and modes block cipher design principals and criteria, DES, IDEA, AES, RCS, Blowfish, Differential and liner cryptography.

Asymmetric key cryptography. Principal of public key crypto systems RSA algorithm, key management, Diffi-Hellman key exchange elliptic curve arithmetic, elliptic curve cryptography, Zero knowledge proof systems.

Module 3

Message Authentication and Hash functions: Authentication function message authentication codes, Hash functions and their security, MD5 secure hash algorithms, HMAC. Digital signature, authentication protocols and applications digital signature, authentication protocols, Digital signature standards, Kerberos, X.509 authentication service, PGP and S/MIME.

Module 4

IP Security: Architecture, IP and IPV6, Authentication header, Encapsulating security payload, combines security associations, key management.

Web Security:- Web Security consideration, secure socket layer, transport layer security, and secure electronic transaction, secured VPN.

Module 5

Legal, Privacy and Ethical issues in digital security. Program and data Protection by patents, copyrights and trademarks, information and the law, computer crime, privacy, ethical issues in digital security and codes of professional ethics.

References

1. Cryptography and network security- principles and practice – William Stallings (3rd Edition, Person Prentice Hall) .
2. Network Security private communication in a practice – char tic Kaufman, Radio Perl man, Mike spicier (2nd Edition Pearson Print ice Hall)
3. Cryptography and network security – Atul Kahate (TMGH)

Electives – Group A

Digital Image Processing

Module 1

Fundamentals of Image Processing: Introduction – Elements of visual perception, Steps in Image Processing Systems, image Acquisition – Sampling and Quantization – Pixel Relationships – Colour Fundamentals and Models, File Formats. Introduction to the Mathematical tools.

Module 2

Image Enhancement and Restoration : Spatial Domain Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – DFT, FFT, DCT, Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

Module 3

Image Segmentation and Feature Analysis**:** Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Feature Analysis and Extraction.

Module 4:

Multi Resolution Analysis and Compressions: Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms, Fast Wavelet transforms, Wavelet Packets.

Image Compression: Fundamentals – Models – Elements of Information Theory – Error Free Compression – Lossy Compression – Compression Standards – JPEG/MPEG.

Module 5:

Applications of Image Processing: Representation and Description, Image Recognition-Image Understanding – Image Classification – Video Motion Analysis – Image Fusion – Steganography – Colour Image Processing.

References:

1. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Third Edition, Third Edition, Brooks Cole, 2008.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice-Hall India, 2007.
4. Madhuri A. Joshi, 'Digital Image Processing: An Algorithmic Approach", Prentice-Hall India, 2006.
5. Rafael C.Gonzalez , Richard E.Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", First Edition, Pearson Education, 2004.

Data Warehousing and Data Mining

Module 1

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Module 2

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Module 3

Classification and Prediction: - Issues Regarding 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

Module 4

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.

Module 5

Mining Object, Spatial, Multimedia, Text and Web Data:

Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

References:

1. Jiawei Han and Micheline Kamber "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.
2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

Object Oriented Software Engineering

Module 1
Classical Paradigm: System Concepts – Project Organization – Communication – Project Management

Module 2:
Process Models: Life cycle models – Unified Process – Iterative and Incremental – Workflow – Agile Processes

Module 3:
Analysis: Requirements Elicitation – Use Cases – Unified Modeling Language, Tools – Analysis Object Model (Domain Model) – Analysis Dynamic Models – Non-functional requirements – Analysis Patterns

Module 4:
Design: System Design, Architecture – Design Principles - Design Patterns – Dynamic Object Modeling – Static Object Modeling – Interface Specification – Object Constraint Language

Module 5:
Implementation, Deployment and Maintenance: Mapping Design (Models) to Code – Testing - Usability – Deployment – Configuration Management – Maintenance

References:

9. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd ed, Pearson Education, 2004.
10. Craig Larman, Applying UML and Patterns 3rd ed, Pearson Education, 2005.
11. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.
12. Ivar Jacobson, Grady Booch, James Rumbaugh, The Unified Software Development Process, Pearson Education, 1999.
13. Alistair Cockburn, Agile Software Development 2nd ed, Pearson Education, 2007.

Advanced Network Programming

Module1:
Java Fundamentals**:** Java I/O streaming - filter and pipe streams - Byte Code interpretation - reflection - Dynamic Reflexive Classes - Threading - Java Native Interfaces- Swing.

Module2:
Network Programming in Java: Sockets - secure sockets - custom sockets – UDP datagrams - multicast sockets - URL classes - Reading Data from the server - writing data - configuring the connection - Reading the header - telnet application - Java Messaging services

Module 3:
Applications in Distributed Environment**:** Remote method Invocation - activation models - RMI custom sockets - Object Serialization - RMI - IIOP implementation - CORBA - IDL technology - Naming Services - CORBA programming Models - JAR file creation

Module 4:
Multi-tier Application Development: Server side programming - servlets - Java Server Pages - Applet to Applet communication - applet to Servlet communication - JDBC - Using BLOB and CLOB objects - storing Multimedia data into databases - Multimedia streaming applications - Java Media Framework.

Module 5:
Enterprise Applications: Server Side Component Architecture - Introduction to J2EE - Session Beans - Entity Beans - Persistent Entity Beans - Transactions.

References:

1. Elliotte Rusty Harold, " Java Network Programming", O'Reilly publishers, 3rd Edition, 2004. (UNIT II)
2. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 2001. (UNIT III and UNIT V)
3. Hortsmann & Cornell, "CORE JAVA 2 ADVANCED FEATURES, VOL II", Pearson Education, 2002. (UNIT I and UNIT IV)
4. Web reference: http://java.sun.com.
5. Patrick Naughton, "COMPLETE REFERENCE: JAVA2", Tata McGraw-Hill, 2003

Wireless and Mobile communication

Module 1:
Introduction: Wireless networks- emerging technologies- WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols - Wml scripts and applications- Tele communications : GSM- DECT- TETRA – UMTS- IMT-200 - .
Satellite Systems: Basics- Routing- Localization- Handover- Broadcast Systems: Overview – Cyclic Repetition of Data- Digital Audio Broadcasting – Digital Video Broadcasting

Module 2:
Mobile computing environment :Functions-architecture-design considerations ,content architecture -CC/PP exchange protocol ,context manager. Data management in WAE- Coda file system- caching schemes- Mobility QOS. Security in mobile computing.

Module 3:
Location management : Handoff in wireless mobile networks-reference model-handoff schemes. Location management in cellular networks - Mobility models- location and tracking management schemes- time, movement ,profile and distance based update strategies. ALI technologies

Module 4:
WAP : WAP push architecture - Datagram Protocol- Transport Layer Security- Transaction Protocol- Session Protocol- Application Environment-Wireless Telephony Application

Module 5:
Open protocols : Service discovery technologies- SDP, Jini, SLP, UpnP protocols–data synchronization- SyncML framework - Context aware mobile services -Context aware sensor networks, addressing and communications. Context aware security.

References:

1. Ivan Stojmenovic , Handbook of Wireless Networks and Mobile Computing, John Wiley & sons Inc, Canada, 2002.
2. Asoke K Taukder,Roopa R Yavagal,Mobile Computing, Tata McGraw Hill Pub Co. , New Delhi, 2005.
3. J.Schiller, Mobile Communication, Addison Wesley, 2000.
4. William Stallings, Wireless Communication and Networks, Pearson Education, 2003.
5. Singhal, WAP-Wireless Application Protocol, Pearson Education, 2003

Embedded Systems

Module 1:
Introduction to Embedded Systems: Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

Module 2:
Devices and Buses for Devices Network**:** I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '12C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

Module 3:
Embedded Programming: Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

Module 4:
Real Time Operating Systems – Part - 1
OS Services – Interrupt Routines Handling, Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics - Inter Process Communication And Synchronisation – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – RPCs.

Module 5:
Real Time Operating Systems – Part - 2
Study of RTOS, VxWorks - Basic Features - Task Management Library at the System - Library Header File - VxWorks System Functions and System Tasks - Inter Process (Task) Communication Functions - Case Study of Coding for Sending Application Layer Byte Streams on a TCP/IP Network Using RTOS Vxworks

References:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw Hill, First reprint 2003
2. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

Parallel Computation and Applications

Module 1
Introduction to Parallel Processing. - Criteria for judging the architecture, Architectural classification schemes, Trends towards parallel processing, Parallelism in uni processor systems, Parallel Computer Structure, Applications of parallel processing
Principles of Pipelining - Principles of Linear and non-linear pipelining, classification of pipeline processors, general pipelines and reservation tables, Interleaved memory organization .

Module 2

Structures and algorithms for Array Processors - SIMD array processors: SIMD computer organization, Masking and data routing mechanisms, SIMD interconnection networks: static v/s dynamic, mesh connected ILLIAC network, Barrel Shifter network, Shffle-exchange and omega network.

Module 3

Multiprocessor Architecture - Functional structures, UMA and NUMA multiprocessors. Interconnection Networks: Time shared or common buses, Bus arbitration algorithm, Cross bar switch and multiport memories, Comparison of multiprocessor interconnection structure, multistage networks for multiprocessors.

Algorithm Analysis - Mathematical background, What to analyze, Running time calculation, Logarithms in Running time

Module 4

Algorithm design techniques - Greedy algorithms, Simple Scheduling algorithms, Multiprocessor case, Huffman code analysis, Bin packing algorithms, Back tracking algorithms,Turnpike reconstruction algorithm

Parallel processing terminology - Speed up, scaled speed up and parallelizability (3.6 of Ref Text 3)

Module 5

Elementary parallel algorithms - Hypercube SIMD model, Shuffle-exchange SIMD model, 2-D mesh SIMD, UMA multiprocessor, Broadcast

Matrix multiplication - Algorithms for Processor arrays, Algorithms for multiprocessors and multicomputers. Sorting - Lower bounds on parallel sorting, Odd-Even transposition sort

References

1. Kaihwang and Faye A. Briggs, Computer Architecture and Parallel Processing McGraw Hill Series.
2. Kaihwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability.
3. Michael J. Quinn, Parallel Computing – Theory and Practice – McGraw Hill Publication.
4. Mark Allen Weiss- Data Structures and Algorithm Analysis in C – Benjamin/Cummings Publication.

High Performance Networks

Module 1:
Basics of Networks**:** elephone,computer,Cable television and Wireless network,networking principles ,Digitilization: Service intergration,network services and layered architecture, traffic charecterization and QOS,networks services:network elements and network mechanisms

Module 2:
Packet switched networks: OSI and IP models: Ethernet (IEEE 802.3);token ring(I EEE 802.5),FDDI,DQDB,frame relay,:SMDS:Internet working with SMDS

Module 3:
Internet and TCP/IP networks: Overview internet protocol;TCP and VDP;performance of TCP/IP networks circuit switched networks:SONET;DWDM,Fibre to home,DSL.Intelligent networks,CATV.

Module 4:
ATM and wireless networks**:** Main features- adressing, signalling and routing;ATM headre structure-adaptation layer, management and control;BISDN;Interworking with ATM ,Wireless channel,link level design,channel access;Network design and wireless networks

Module 5:
Optical networks and switching: Optical links- WDM systems,cross-connects ,optical LAN's, optical paths and networks;TDS and SDS:modular switch designs-Packet switching,distributed,shared,input and output buffers

References:

1. Jean warland and Pravin Varaiya,High,Performance Communication Networks,2nd Edition,Harcourt and Morgan Kauffman,London,2000
2. Leon Gracia,Widjaja,Communication networks,Tata Mc Graw Hill,New Delhi,2000
3. Sumit Kasera,Pankaj Sethi,ATM Networks,Tata McGraw Hill,New Delhi,2000
4. Behrouz.a. Forouzan,Dta Communication and Networking,Tata Mc Graw Hill,New Delhi,2000

Multicore Architecture

Module 1
Fundamentals of SuperScalar Processor Design, Introduction to Multicore Architecture – Chip Multiprocessing, homogeneous Vs heterogeneous design - SMP – Multicore Vs Multithreading.

Module 2
Shared memory architectures– synchronization – Memory organization – Cache Memory – Cache Coherency Protocols - Design of Levels of Caches.

Module 3

Multicore programming Model – Shared memory model, message passing model, transaction model – OpenMP and MPI Programming.

Module 4
PowerPC architecture – RISC design, PowerPC ISA, PowerPC Memory Management Power 5 Multicore architecture design, Power 6 Architecture.

Module 5

Cell Broad band engine architecture, PPE (Power Processor Element), SPE (Synergistic processing element), Cell Software Development Kit, Programming for Multicore architecture.

References:

1. Hennessey & Pateterson, "Computer Architecture A Quantitative Approach", Harcourt Asia, Morgan Kaufmann, 1999
2. Joseph JaJa, Introduction to Parallel Algorithms, Addison-Wesley, 1992.
3. IBM Journals for Power 5, Power 6 and Cell Broadband engine architecture.
4. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability and Programmability" McGraw-Hill, 1993
5. Richard Y. Kain, "Advanced Computer Architecture: A System Design Approach", PHI, 1999
6. Rohit Chandra, Ramesh Menon, Leo Dagum, and David Kohr, Parallel Programming in OpenMP, Morgan Kaufmann, 2000.

Electives : Group B

Natural Language Processing

Module 1

Introduction: Knowledge in speech and language processing - Ambiguity - Models and Algorithms - Language, Thought and Understanding. Regular Expressions and automata: Regular expressions - Finite-State automata. Morphology and Finite-State Transducers: Survey of English morphology - Finite-State Morphological parsing - Combining FST lexicon and rules - Lexicon-Free FSTs: The porter stammer - Human morphological processing

Module 2

Syntax: Word classes and part-of-speech tagging: English word classes - Tagsets for English - Part-of-speech tagging - Rule-based part-of-speech tagging - Stochastic part-of-speech tagging - Transformation-based tagging - Other issues. Context-Free Grammars for English: Constituency - Context-Free rules and trees - Sentence-level constructions - The noun phrase - Coordination - Agreement - The verb phase and sub categorization - Auxiliaries - Spoken language syntax - Grammars equivalence and normal form - Finite-State and Context-Free grammars - Grammars and human processing. Parsing with Context-Free Grammars: Parsing as search - A Basic Top-Down parser - Problems with the basic Top-Down parser - The early algorithm - Finite-State parsing methods.

Module 3

Advanced Features and Syntax. Features and Unification: Feature structures - Unification of feature structures - Features structures in the grammar - Implementing unification - Parsing with unification constraints - Types and Inheritance. Lexicalized and Probabilistic Parsing: Probabilistic context-free grammar - problems with PCFGs - Probabilistic lexicalized CFGs - Dependency Grammars - Human parsing.

Module 4

Semantic. Representing Meaning: Computational desiderata for representations - Meaning structure of language - First order predicate calculus - Some linguistically relevant concepts - Related representational approaches - Alternative approaches to meaning. Semantic Analysis: Syntax-Driven semantic analysis - Attachments for a fragment of English - Integrating semantic analysis into the early parser - Idioms and compositionality - Robust semantic analysis. Lexical semantics: relational among lexemes and their senses - WordNet: A database of lexical relations - The Internal structure of words - Creativity and the lexicon.

Module 5

Applications Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation - Robust word sense disambiguation - Information retrieval - other information retrieval tasks. Natural Language Generation: Introduction to language generation - Architecture for generation - Surface realization - Discourse planning - Other issues. Machine Translation: Language similarities and differences - The transfer metaphor - The interlingua idea: Using meaning - Direct translation - Using statistical techniques - Usability and system development.

References:

7. Daniel Jurafsky & James H.Martin, " Speech and Language Processing", Pearson Education (Singapore) Pte. Ltd., 2002.
8. James Allen, "Natural Language Understanding", Pearson Education, 2003.
9. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.
10. Tomek Strzalkowski " Natural Language Information Retrieval ", Kluwer academic Publishers, 1999.
11. Christopher D.Manning and Hinrich Schutze, " Foundations of Statistical Natural Language Processing ", MIT Press, 1999.

Grid Computing

Module 1
Grid Computing: Introduction - Definition - Scope of grid computing

Module 2
Grid Computing Initiatives: Grid Computing Organizations and their roles – Grid Computing analog – Grid Computing road map.

Module 3:
Grid Computing Applications: Merging the Grid sources – Architecture with the Web Devices Architecture.

Module 4:
Technologies: OGSA – Sample use cases – OGSA platform components – OGSI – OGSA Basic Services.

Module 5:
Grid Computing Tool Kits :Globus Toolkit – Architecture, Programming model, High level services – OGSI .Net middleware Solutions.

References:

5. Joshy Joseph & Craig Fellenstein, "Grid Computing", PHI, PTR-2003.
6. Ahmar Abbas, "Grid Computing: A Practical Guide to technology and Applications", Charles River media – 2003.

Agent Based Intelligent Systems

Module 1:
Introduction **:**Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching - Heuristics -Constraint Satisfaction Problems - Game playing.

Module 2:
Knowledge Representation and Reasoning: Logical Agents-First order logic-First Order Inference-Unification-Chaining- Resolution Strategies-Knowledge Representation-Objects-Actions-Events

Module 3:
Planning Agents: Planning Problem-State Space Search-Partial Order Planning-Graphs-Nondeterministic Domains-Conditional Planning-Continuous Planning-MultiAgent Planning.

Module 4:
Agents and Uncertainity: Acting under uncertainty – Probability Notation-Bayes Rule and use - Bayesian Networks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory - Decision Network – Complex Decisions.

Module 5:
Higher Level Agents**:** Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars- Future of AI.

References :

6. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Prentice Hall, 2002
7. Michael Wooldridge, "An Introduction to Multi Agent System", John Wiley, 2002.
8. Patrick Henry Winston, Artificial Intelligence, III Edition, AW, 1999.
9. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992

Computer Network Administration

Module 1
Data Communication and network management overview:Analogy of telephone network management, Data and telecommunication network, distributed computing environment, TCP/IP based networks – Internet and intranet, communication protocols and standards, challenges of information technology manager Network management – goals, organization and functions, network and system management, network management system platform, current status and future of network management.

Module 2
Basic foundation: Standards, models and languages: Network management standards, network management model, organization model, information model, communication model, ASN.1, Encoding structure, macros, and functional model.

Module 3
SNMP 1 network management: Organization and information models: Managed network, International organization and standard SNMP model, organization model, system overview, information models

Module 4
SNMP v1 network management: Communication and functional models, SNMP model, functional model, Major changes in SNMP v2 and v3 SNMP Management: RMON – Remote monitoring, RMON, SMI & MIB, RMON1, RMOPN2, ATM Remote monitoring, case study of internet traffic using RMON.

Module 5
Network management tools and systems: network management tools, network statistics measurement systems, network management systems, commercial network management systems,System management, Enterprise management solutions.

References:
1. Network Management principles and practice Mani Subramanian (Pearson Edition)
2. SNMP – SNMPv2 , SNMPv3 & RMON 1 – William Stalling (Pearson Edition)
3. Network Administration – Steve Wisniewski

BIOINFORMATICS

Module I - Fundamentals of Biological Systems
Introduction to cells: Structure of prokaryotic and eukaryotic cells. Cell organelles and their functions. Molecules of life: Introduction to carbohydrates, proteins, lipids and nucleic acids – Different structural forms and functional organizations. DNA replication, transcription and translation. Gene regulation.

Module II - Sequence Analysis
Introduction to Sequence alignment, Substitution matrices, Scoring matrices –PAM and BLOSUM. Local and Global alignment concepts, dot plot, dynamic programming methodology, Multiple sequence alignment –Progressive alignment. Database searches for homologous sequences – FASTA and BLAST versions.

Module III - Genomics and Proteomics
Functional Genomics: Gene expression analysis by cDNA micro arrays, SAGE, Strategies for generating ESTs and full length inserts; EST clustering and assembly; EST databases- DBEST, UNIGENE
Proteomics: Protein and RNA structure prediction, polypeptic composition, secondary and tertiary structure, algorithms for modeling protein folding, structure prediction, proteomics, protein classification, experimental techniques, ligand screening, post-translational modification prediction.

Module IV - Computer Aided Drug Design
Introduction to the concepts of molecular modeling. Molecular structure and internal energy.
Macromolecular modeling. Design of ligands for known macromolecular target sites. Drug – receptor interactions. Classical SAR/QSAR studies and their implications to the 3-D modeler. Molecular Docking. Structure-based drug design for all classes of targets.

References:

1. Andreqas D. Baxevanis, B. F. Francis Ouellette. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins John Wiley and Sons, New York (1998).

2. C. Rastogi, Namita Mendiratta, Parag Rastogi. Bioinformatics-concepts,skills, Applications
3. Bioinformatics Sequence and Genome Analysis. 2001. David W. Mount. Cold Spring Harbor laboratory Press.
4. Andrew,R. Leach Molecular modeling: Principles and applications Prentice Hall Publications
5. N. Claude Cohen. Guidebook one molecular modeling in drug design.
6. Shanmughavel, P. 2005. Principles of Bioinformatics, Pointer Publishers, Jaipur, India.

Pattern Recognition

Module 1
Pattern Classifier:
Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm - Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

Module 2
Unsupervised Classification:
Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

Module 3
Structural Pattern Recognition
Elements of formal grammars - String generation as pattern description - Recognition of syntactic description - Parsing - Stochastic grammars and applications - Graph based structural representation.

Module 4
Feature Extraction and Selection:
Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation - Binary feature selection.

Module 5
Recent advances:
Neural network structures for Pattern Recognition - Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers - Pattern classification using Genetic Algorithms.

References:

1. Robert J.Schalkoff, Pattern Recognition : Statistical, Structural and Neural Approaches, John Wiley &
Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.

4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

Genetic Algorithms and Applications

Module 1
Fundamentals of genetic algorithm: A brief history of evolutionary computation-biological terminology-search space -encoding, reproduction-elements of genetic algorithm-genetic modeling-comparison of GA and traditional search methods.

Module 2
Genetic technology: steady state algorithm - fitness scaling - inversion. Genetic programming - Genetic Algorithm in problem solving

Module 3
Genetic Algorithm in engineering and optimization-natural evolution –simulated annealing and Tabu search .Genetic Algorithm in scientific models and theoretical foundations.

Module 4
Implementing a Genetic Algorithm – computer implementation - low level operator and knowledge based techniques in Genetic Algorithm.

Module 5
Applications of Genetic based machine learning-Genetic Algorithm and parallel processors, composite laminates, constraint optimization, multilevel optimization, real life problem.

References:

1. Melanie Mitchell, 'An introduction to Genetic Algorithm', Prentice-Hall of India, New Delhi, Edition: 2004
2. David.E.Golberg, 'Genetic algorithms in search, optimization and machine learning', Addition-Wesley-1999
3. S.Rajasekaran G.A Vijayalakshmi Pai,'Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and Applications', Prentice Hall of India, New Delhi-2003.
4. Nils.J.Nilsson,'Artificial Intelligence- A new synthesis', Original edition-1999.

Software Quality Assurance

Module 1
Concepts: Concepts of Quality Control, Quality Assurance, Quality Management - Total Quality Management; Cost of Quality; QC tools - 7 QC Tools and Modern Tools; Other related topics - Business Process Re-engineering –Zero Defect, Six Sigma, Quality Function Deployment, Benchmarking, Statistical process control.

Module 2
Software Engineering Concepts:
Software Engineering Principles, Software Project Management, Software Process, Project and Product Metrics, Risk Management, Software Quality Assurance; Statistical Quality Assurance - Software Reliability, Muse Model; Software Configuration Management; Software Testing; CASE (Computer Aided Software Engineering).

Module 3
Quality Assurance Models. Models for Quality Assurance-ISO-9000 - Series, CMM, SPICE, Malcolm Baldrige Award.

Module 4
Software Quality Assurance related topics. Software Process - Definition and implementation; internal Auditing and Assessments; Software testing -Concepts, Tools, Reviews, Inspections & Walkthroughts; P-CMM.

Module 5
Future Trends .PSP and TSP, CMMI, OO Methodology, Clean-room software engineering, Defect injection and prevention.

References:

6. Watts Humphery, "Managing Software Process ", Addison - Wesley, 1998.
7. Philip B Crosby, " Quality is Free: The Art of Making Quality Certain ", Mass Market, 1992.
8. Roger Pressman, "Software Engineering ", Sixth Edition, McGraw Hill, 2005

Software structures and UML

Module 1
Object Oriented Design and Modelling: Object Oriented Fundamentals, Objects and object classes, object oriented design process, importance of modelling, principles of modelling, object oriented modelling.
Introduction to UML: Conceptual model of UML, building blocks of UML, Mechanisms in UML, architecture, software development life cycle.

Module 2
Basic Structural Modelling: Classes, relationships, common mechanisms, class and object diagrams.
Advanced structural Modelling: Advanced classes, advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

Module 3
Collaboration Diagrams and Sequence Diagrams: Terms, concepts and depicting a message in collaboration diagrams. Terms and concepts in sequence diagrams. Difference between collaboration and sequence. diagram. Depicting synchronous messages with/without priority call back mechanism.

Module 4
Basic behavioral modeling : Interactions, use cases, Use Case Diagrams, Interaction Diagrams and activity diagrams.
Advanced behavioral modelling: Events and signals, state machines, process and threads, time and space, state chart diagrams.

Module 5
Architectural Modelling: Terms, Concepts, examples, Modelling techniques for component diagrams and deployment diagrams.

References:

1. Grandy Booch, James Rumbough, Ivar Jacobson. ‘ The Unified Modelling Language User Guide.
Pearson Edutaion 2002.
2. Ian Sommerville, ‘ Software Engineering Sixth Edition’ 2003.
3. Meilir Page Jones, ‘ Fundamentals of Object Oriented Design in UML’ , Addison Wesley, 2000

Professional Studies

Module 1 : Research Methodology

Module 2 : IPR – an exposure

Module 3 : Technical Writing, Academic Publishing, Impact Factors, Open Access Journals etc

Module 4 : Professional Societies – IEEE, ACM, CSI – their resources