



## **Goa University**

**P.O. Goa University, Taleigao Plateau, Goa 403 206, India**

### **Syllabus of M.Sc. (IT) Programme**

Approved by the Board of Studies on 15<sup>th</sup> May 2006

#### **Introduction**

The MSc (IT) course is a two year, four semester full time course leading to the Master's degree in Information Technology (M. Sc. Information Technology). It is affiliated to the Goa University.

- **Purpose**

The purpose of this course is to empower students towards a career in Academic Research in Information Technology and towards a career in the IT industry.

- **Prerequisites**

Admission to the two year, four semester, full time course leading to the degree of Master's degree in Information Technology (M. Sc. Information Technology), is open to any candidate satisfying the following conditions:

- B.Sc (Computer Science/Mathematics/Statistics)/BCA with 55% at Degree Level.

The College admits students based on an entrance test conducted by the college. Students are admitted to M. Sc. (Information Technology) program once a year; candidates who have appeared for the degree examination and are awaiting results are also eligible to apply. In case such candidates are selected and their results are not available at the time of admission, these candidates will be given provisional admission and confirmed on submission of valid requirements within the last date prescribed by the university. The intake capacity for the first year admission for this course is 20.

- **Credits (theory, tutorials, practicals)**

There is an in-semester element and an end-semester element in the evaluation of the performance of the candidates. The in-semester evaluation is of 60 marks and end-semester evaluation is of 40 marks.

For a theory course the in-semester evaluation is a continuous assessment of 60 marks. At least 50 marks of the in-semester evaluation are assigned by conducting one or more class tests. The remaining 10 marks are evaluated through quizzes and assignments.

For a laboratory course, the assessment is continuous with 60 marks for the in-semester evaluation, consisting of laboratory experiments and assignments.

For a laboratory course, the end-semester examination is conducted by the Controller of Examinations, Goa University. Two examiners namely internal examiner and external examiner conduct the examination jointly. The Internal examiner is the one who has taught that course. The External examiner is appointed as per the ordinances of other M.Sc. courses of Goa University for this purpose. The end-semester laboratory examination is of 40 marks. The end-semester examination is assessed by on-line examination and viva-voce jointly conducted by internal and external examiner.

The fourth semester consists of a project for one full semester. The project is required to contain an implementation, which is demonstrable. Each project has an internal guide from that teaching institution. An internal and an external examiner jointly evaluate the project. The internal examiner is the internal guide of the project. An external examiner is appointed as per the ordinances for other M.Sc. courses of Goa University. The fourth semester project carries only qualitative evaluation such as excellent/very good/ good/pass/fail. A student getting a fail grade has to repeat the project. There is a Seminar paper that is to be presented at the end of the fourth semester.

The total number of credits for theory subjects is 54. The total number of credits for practical subjects is 24. The Seminar paper consists of 2 credits. The Project does not carry any credit. The total number of credits for the MSc (IT) course is 80.

- **Number of semesters, how the courses are distributed**

The MSc (IT) course consists of 4 semesters. The papers are distributed in the following manner:

### **Semester –I**

Paper	Paper name

code	
MIT 11	Advanced Course in Theoretical Computer Science
MIT 12	Distributed Systems
MIT 13	Writing Skills course
MIT 14	Information Retrieval
MIT 15	Applied Probability and Statistics
MIT 16	Lab - Advanced Core Java
MIT 17	Lab - Information Retrieval

### **Semester –II**

Subject code	Subject
MIT 21	Design and Analysis of Algorithms
MIT 22	Machine Learning
MIT 23	Speaking Skills course
MIT 24	Elective -I
MIT 25	Elective -II
MIT 26	Lab - Machine Learning
MIT 27	Lab - Statistical Computing using R

### **Semester –III**

Paper code	Paper name
MIT 31	System Security
MIT 32	Personality Enhancement + Presentation Skills
MIT 33	Elective-III
MIT 34	Elective -IV
MIT 35	Elective -V
MIT 36	Lab - Enterprise Java with Frameworks
MIT 37	Lab - System Security

#### **Semester –IV**

Paper code	Paper name
MIT 41	Seminar
MIT 42	Project Work

## M. Sc. (MSc-IT) List of Courses

In the following tables, L refers to lectures, T to tutorials and P to practicals. Description of a course appears on the page number listed in the tables.

### Compulsory Courses

Course Number and Name	L-T-P (hours/ week)	Credits	Page number
MIT 11 Advance Course in Theoretical Computer Science	3-1-0	4	<u>7</u>
MIT 12 Distributed Systems	3-1-0	4	<u>8</u>
MIT 13 Writing Skills course	1-1-0	2	<u>9</u>
MIT 14 Information Retrieval	3-1-0	4	<u>11</u>
MIT 15 Applied Probability and Statistics	3-1-0	4	<u>13</u>
MIT 16 Lab – Advanced Core Java	0-1-3	4	<u>14</u>
MIT 17 Lab – Information Retrieval	0-1-3	4	<u>14</u>
MIT 21 Design and Analysis of Algorithms	3-1-0	4	<u>15</u>
MIT 22 Machine Learning	3-1-0	4	<u>16</u>
MIT 23 Speaking Skills course	1-1-0	2	<u>18</u>
MIT 26 Lab – Machine Learning	0-1-3	4	<u>18</u>
MIT 27 Lab – Statistical Computing using R	0-1-3	4	<u>19</u>
MIT 31 System Security	3-1-0	4	<u>20</u>
MIT 32 Personality Enhancement + Presentation Skills	1-1-0	2	<u>21</u>
MIT 36 Lab – Enterprise Java with Frameworks	0-1-3	4	<u>22</u>
MIT 37 Lab – System Security	0-1-3	4	<u>22</u>
MIT 41 Seminar	1-1-0	2	
MIT 42 Project work			

### Optional Courses

Course Number and Name	L-T-P	Credits	Page Number
1 Multimedia Systems	3-1-0	4	<u>23</u>
2 Software Metrics & Project Management	3-1-0	4	<u>25</u>

3	Soft Computing	3-1-0	4	<u>26</u>
4	Database Management using PHP and MySQL	3-1-0	4	<u>27</u>
5	Web Technology with JavaScript and AJAX	3-1-0	4	<u>29</u>
6	Object-Oriented Analysis & Design using UML	3-1-0	4	<u>31</u>
7	Mobile Computing	3-1-0	4	<u>34</u>
8	Introduction to Data Compression	3-1-0	4	<u>37</u>
9	Embedded Systems Design	3-1-0	4	<u>37</u>
10	Compiler Design	3-1-0	4	<u>39</u>
11	Introduction to Computer Graphics	3-1-0	4	<u>41</u>
12	Network Design, Implementation and Administration	3-1-0	4	<u>42</u>
13	Operating System kernel and network programming	3-1-0	4	<u>43</u>
14	Optimization Techniques	3-1-0	4	<u>44</u>
15	Natural Language Processing	3-1-0	4	<u>45</u>
16	Component based Software development	3-1-0	4	<u>47</u>
17	Image Processing	3-1-0	4	<u>48</u>
18	Data mining and Data warehousing	3-1-0	4	<u>49</u>

## **Syllabus of the M. Sc. IT Curriculum**

### **Compulsory Courses**

#### **MIT11- Advanced Course in Theoretical Computer Science**

##### Automata Theory

Definition, Description, Transition systems, Acceptability of a string by finite automaton, N DFA, equivalence of DFA & N DFA, Conversion of N DFA to DFA, Mealy and Moore Machines, Minimization of Finite Automata

##### Formal Languages

Basic Definitions, Chomsky Classification of Languages, Languages and their relation, recursive and recursively enumerable sets, operations on languages, languages and automata

##### Regular Sets and Regular Grammars

Regular expressions, finite automata and regular expressions, pumping lemma for regular sets, application of pumping lemma, closure properties of regular sets, regular sets and regular grammars

##### Context-free languages

Context-free languages and derivation trees, ambiguity in CFG, Simplification of CFG, Normal forms for CFG, Pumping lemma for context free languages

##### Pushdown Automata, Turing Machines and Linear Bounded Automata

Basic definitions, Acceptance by PDA, Turing machine model and its representation, language acceptability by TM, Design of TM, Variants of Turing Machines

##### Computability theory

Church-Turing Thesis, Decidability, Halting problem, Reducibility, recursion theorem

##### Complexity Theory

Time and space measures, complexity classes P, NP, L, NL and PSPACE, complete problems, provably hard problems, interactive proof systems

Single level decompositions. Introduction to applied linear algebra

Operation Research and its scope. Necessity of operations Research in Industry.

#### **List of Books**

1. K.L.P. Mishra and N.chandrasekaran, Theory of Computer Science(Second Edition)-Eastern Economy Edition
2. Sipser Micheal, Introduction to the Theory of Computation. Thomson/ Course Technology, 1996

## MIT 12-Distributed Systems

### 1. Introduction to Distributed System:

Goals, Hardware concepts, Software concepts and Client-Server model. Examples of distributed systems- The Internet; Intranets; Mobile and ubiquitous computing.

Challenges: Heterogeneity; Openness; Security; Scalability; Failure handling; Concurrency; Transparency, Types of distributed systems.  
System models: Introduction, Architectural models, Fundamental models.

### 2. Communication:

Layered protocols, Message-oriented communication, Stream-oriented communication. Client-server communication, Group communication - External data representation and marshalling, Communication between distributed objects, Remote procedures call, Events and notification, RMI.

3. **Processes:** Threads, Clients, Servers, Code Migration, Software agent.

4. **Naming:** Naming entities, Locating mobile entities, Removing un-referenced entities. Names, Identifiers and Addresses, Flat Naming, Structures Naming, Attribute Based Naming.

5. **Synchronization:** Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion.

6. **Transactions and Concurrency Control:** Introduction, Transactions, Nested transactions, Locks, Optimistic concurrency control, Timestamp ordering

7. **Distributed Transactions:** Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions,



1. **Consistency and Replication:** Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols.
  2. **P2P systems**
10. **Case Study:** J2EE, .NET framework

### **List of Books**

1. A. Taunenbaum, .Distributed Systems: Principles and Paradigms.
2. G. Coulouris, J. Dollimore, and T. Kindberg, .Distributed Systems: Concepts and Design., Pearson Education

### **MIT13-Writing Skills Course**

This course focuses on development of essential writing skills by raising awareness of the need for writing abilities and enhancing it with focused approach. It then proceeds to enable students to practice and reflect upon the conventions of written texts. In addition, the course will help the students become familiar with, and enhance skills related to critique, argumentation and research-based writing and technical writing. Students will acquire an awareness of and ability to use effectively the discourse patterns of Academic, Business and Technical English. This will improve critical reading and thinking skills, and give candidates an opportunity to develop their writing process through generating ideas, drafting, and its improvement. They will learn to take into consideration the expectations of their readership with regard to their writing. Upon completion of the course the students will be familiar with the conventions of writing reports or research papers, proposals, project reports, assignments and so on in the chosen field of study.

### **Objectives:**

- To understand the essential elements of Business & Technical Writing
- To understand common business document formats
- To learn how to make one's writing better, faster and more successful

**Contents:**

**Introduction & theory of Written Communication**

**The Writing process**

**Academic Writing**

Introduction to academic writing

Features of academic writing

Development of thesis

Avoiding plagiarism

**Business Writing**

Writing proposals

Writing long reports

Writing short reports including analysis and presentation of data

Documentation and document design

**Technical Writing**

Defining technical writing, including genre understanding and structure

Rhetorical & stylistic elements necessary for successful scientific and technical communication

Communication of knowledge and information through various means to audiences ranging from experts to laypersons

## **Critical thought & writing**

Defining critical thinking

Various activities involved in critical thought

The development of critical thinking

Critical thought as a genre of life

## **MIT14-Information Retrieval**

Introduction to Information Retrieval. Inverted indices and boolean queries. Query optimization. The nature of unstructured and semi-structured text. Course administrivia.

The term vocabulary and postings lists. Text encoding: tokenization, stemming, lemmatization, stop words, phrases. Optimizing indices with skip lists. Proximity and phrase queries. Positional indices.

Dictionaries and tolerant retrieval. Dictionary data structures. Wild-card queries, permuterm indices, n-gram indices. Spelling correction and synonyms: edit distance, soundex, language detection.

Index construction. Postings size estimation, sort-based indexing, dynamic indexing, positional indexes, n-gram indexes, distributed indexing, real-world issues.

Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law, variable-byte encoding. Blocking. Extreme compression.

Scoring, term weighting, and the vector space model. Parametric or fielded search. Document zones. The vector space retrieval model. tf.idf weighting. The cosine measure. Scoring documents.

Computing scores in a complete search system: Components of an IR system. Efficient vector space scoring. Nearest neighbor techniques, reduced dimensionality approximations, random projection.

Results summaries: static and dynamic. Evaluating search engines. User happiness, precision, recall, F-measure. Creating test collections: kappa measure, inter judge agreement. Relevance, approximate vector retrieval.

Relevance feedback. Pseudo relevance feedback. Query expansion. Automatic thesaurus generation. Sense-based retrieval. Experimental results of performance effectiveness.

Classification. Introduction to text classification. Naive Bayes models. Spam filtering.

K Nearest Neighbors, Decision boundaries, Vector space classification using centroids. Comparative results.

Support vector machine classifiers. Kernel Function. Evaluation of classification. Micro- and macro-averaging. Learning rankings.

Clustering. Introduction to the problem. Partitioning methods: k-means clustering; Hierarchical clustering. Latent semantic indexing (LSI). Applications to clustering and to information retrieval.

Web: What makes the web different. Web search overview, web structure, the user, paid placement, search engine optimization/spam. Web size measurement. Crawling and web indexes. Near-duplicate detection. Link analysis. Learning to rank

## **List of Books**

Introduction to Information Retrieval, by C. Manning, P. Raghavan, and H. Schütze. Cambridge University Press, 2008

Managing Gigabytes, by I. Witten, A. Moffat, and T. Bell.

Information Retrieval: Algorithms and Heuristics by D. Grossman and O. Frieder.

Modern Information Retrieval, by R. Baeza-Yates and B. Ribeiro-Neto.

Finding Out About, by R. Belew.

Mining the Web, by S. Chakrabarti.

Foundations of Statistical Natural Language Processing, by C. Manning and H. Schütze

## **MIT15-Applied Probability and Statistics**

### **Introduction**

Probability models, sample space events, algebra of events, graphical methods of representing events, probability axioms, combinational problems, conditional probability, independence of events, Baye's rule, Bernoulli trials.

### **Discrete random variables**

Introduction, random variables and their spaces, the probability mass function, distribution functions, special discrete distributions, analysis of program, the probability generating function, Discrete Random Vectors, independent random variables

### **Continuous random variables**

Introductions, the exponential distribution, some important distribution, functions of a random variable, jointly distributed random variables, distributions of sums, functions of normal random variables.

### **Expectation**

Introduction moments, expectation of functions of more than one random variable, moments and transforms of some important distributions, computations of mean time to failure, inequalities and limits theorems.

### **Conditional Distribution and Conditional Expectation**

Conditional Expectation,

### **Statistical Inference**

Introduction, Parameter Estimation, Hypothesis testing: z, t, chi square, F test, Regression, correlation and 'analysis of variance: Introduction, least squares curve fitting, the coefficient of Determination, confidence Intervals in linear Regression, correlation analysis, simple nonlinear regression, Higher dimensional least-squares fit, Analysis of variance;

Non parametric tests: sign test, u test, Rank test, Median test

### **Statistical Quality Control**

Control charts, Mean chart, R chart, sigma chart, C chart.

## **List of Books**

1. Gupta S.G., and V.K.Kapoor, Introduction to Probability and Statistics,
2. Sheldon M. Ross, Probability,
3. P. S. Mann, Introduction to Statistics, Willey Student Edition

### **MIT16 Lab – Advanced Core Java**

1. Review of elementary OO concepts using Java
2. Exception Handling
3. Assertions
4. Collection and Generics Framework
5. I/O and N IO
6. Serialization
7. Reflection
8. Threading
9. Swing
- 10.RMI

### **MIT17 Lab – Information Retrieval**

Utilization of HADOOP or any similar platform to implement:

- A data collection system for managing large distributed systems.
- A scalable, distributed database that supports structured data storage for large tables.
- A data warehouse infrastructure that provides data summarization and ad hoc querying.
- A software framework for distributed processing of large data sets on compute clusters.
- A high-level data-flow language and execution framework for parallel computation.
- A high-performance coordination service for distributed applications.

## **MIT21-Design and Analysis of Algorithms**

### **Introduction**

The Role of Algorithm in computing, Framework for design and analysis of algorithms, Growth of functions: asymptotic notation; Recurrences: substitution method, recursion-tree method, master method; Probabilistic analysis and randomized algorithms, indicator random variables.

### **Advanced Design and Analysis Techniques**

Dynamic programming: assembly line scheduling, matrix-chain multiplication, elements of DP, longest common subsequence;

Greedy algorithms: activity-selection problem, elements of greedy strategy, Huffman codes;

Amortized analysis: aggregate analysis, accounting method, potential method, dynamic tables

### **Graph Algorithms**

Elementary graph algorithms; Minimum spanning tree: growing a spanning tree, Kruskal and Prim

algorithm; Single-source shortest paths: Bellman-ford algorithm, Dijkstra's algorithm.

All pairs shortest paths: shortest paths and matrix multiplication, floyd-warshall algorithm.

### **Number theoretic algorithms:**

GCD, Modular arithmetic, Chinese remainder theorem, RSA, Primality testing

### **String matching:**

Naïve algorithm, Rabin-Karp algorithm

### **Computational geometry:**

Line segment properties, intersection, finding convex hull, finding closest pair of points

### **NP-Completeness:**

Polynomial time, polynomial time verification, NP-completeness and reducibility

**Approximation algorithms:**

The vertex cover problem, Traveling salesman problem, the set-covering problem

**Main Reading**

1. Cormen Thomas, L. Charles, R. Ronald, S. Clifford, "Introduction to Algorithms", Second Edition, IEEE, PHI.
2. Knuth Donald, "The Art of Computer Programming Vol I, II, III", Addison Wesley

**List of Books:**

- 1) Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms, Galgotia, 2<sup>nd</sup> Edition.
- 2) A. Aho, J. Hopcroft, & J. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley.
- 3) Richard Gilberg & Behrouz Forouzan, Data Structure: a Pseudo code Approach,

**MIT22-Machine Learning**

Problems, Problem Spaces and Search : Defining the problem as a State space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search problems

Heuristic search techniques : Generate and test, Hill climbing, Best First search, Problem definition, Constraint satisfaction, Means-ends analysis

Knowledge representation using predicate logic: Representing simple facts in logic, Representing instants and is a relationship, Computable functions and predicates, Resolution, Natural deduction.

Representing knowledge using rules: procedural versus declarative knowledge, logic programming, forward versus backward programming, Matching, Control knowledge.



Symbolic reasoning under uncertainty: Introduction to non monotonic reasoning, logics for non monotonic rerasoning, augmenting a problem solver, implementing using depth first search and breadth first search

Statistical reasoning : Probablility and Bayes theorem, certainty factors and rule based system, Bayesian networks, Dempster Shafer theory, Fuzzy logic.

Concept learning and the general-to-specific ordering: A concept learning task, concept learning as search, Find-S : finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithms, remarks on version spaces and candidate elimination, Inductive bias.

Decision tree learning : Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithms, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Artificial neural networks : Neural networks representation, appropriate problems for neural network learning, Perceptrons, Multilayer networks and the back propagation algorithms, remarks on the back propagation rule, an illustrative example: Face recognition

Introduction to Machine Learning and Software Engineering : The Challenge. Learning Approaches. SE Tasks for ML. Applications. State-of-the-Practice in ML&SE. Status. Applying ML Algorithms to SE Tasks

### **List of Books:**

1. Stuart Russell and Peter Norvig, Artificial Intelligence – A modern Approach, Pearson Education
2. Tom M. Mitchell, Machine Learning, MscGraw Hill, 1996
3. Elaine Rich and Kevin Knight, Artificial Intelligence, TMH
4. P.N. Tan, M. Steinbach and V.Kumar, Introduction to Data mining, Pearson India, 2007
5. Machine Learning Applications in Software Engineering by Du Zhang & Jeffrey J P Tsai

## **MIT23-Speaking Skills Course**

### **Objectives:**

To increase personal confidence in delivering speeches to small & large audiences  
To understand and gain non-verbal skills essential to effective speaking.  
To develop the abilities required to present, inform, negotiate & persuade.  
Various facets of speaking skills will be taught, from public speaking to conducting a discussion.

### **Contents:**

Introduction & theory of verbal communication

Features of verbal communication

Listening skills

### **Public speaking**

Preparation for public speaking

Delivery of speech

### **Meetings / group activity**

Team work

Leadership skills

Conducting a discussion

## **MIT26-Lab – Machine Learning**

Models for static and dynamic problems, for either classification, regression or density estimation

Building an online learning community

Machine Learning in software metrics – characterizing software as faulty or not, detecting faults in software

## MIT27-Lab-Statistical Computing using R

The R Environment. Getting Started with R. Using the R Online Help System.  
Functions, Arrays, Data Frames, and Lists. Workspace and Files. Using Scripts. Using  
Packages. Graphics

### List of Books:

1. Statistical computing with R, Maria L. Rizzo, *Bowling Green State University, Ohio, USA*  
Series: Chapman & Hall/CRC Computer Science & Data Analysis
2. Data Manipulation with R ~ Phil Spector

## **MIT 31-System Security**

### **Introduction**

Basic concepts: threats, vulnerabilities, controls; risk; confidentiality, integrity, availability; security policies, security mechanisms; assurance; prevention, detection, deterrence

### **Basic cryptography**

Basic cryptographic terms, Historical background, Symmetric crypto primitives, Modes of operation, Cryptographic hash functions, Asymmetric crypto primitives

### **Program security**

Flaws, Malicious code: viruses, Trojan horses, worms, Program flaws: buffer overflows, time-of-check to time-of-use flaws, incomplete mediation

Defenses: Software development controls, Testing techniques

### **Intruders**

Intrusion detection, Password Management

### **Network security**

Network threats: eavesdropping, spoofing, modification, denial of service attacks

Introduction to network security techniques: firewalls, virtual private networks, intrusion detection

### **Management of security**

Security policies

Risk analysis

Physical threats and controls

### **Security in conventional operating system**

Memory, time, file, object protection requirements and techniques

Protection in contemporary operating systems

Identification and authentication

Identification goals

Authentication requirements

Human authentication

Machine authentication

### **Database management systems security**

Database integrity  
 Database secrecy  
 Inference control  
 Multilevel databases

### **Miscellaneous**

Legal aspects of security  
 Privacy and ethics

### **List of Books:**

1. Charles P. Pfleeger and Shari L. Pfleeger. Security in Computing (3<sup>rd</sup> edition). Prentice-Hall. 2003. ISBN: 0-13-035548-8
2. William Stallings, “Cryptography And Network Security – Principles and Practices”, Prentice Hall of India, Third Edition, 2003

### ***MIT 32 - Personality Enhancement & Presentation Skills***

Personality Development- Introduction to Personality and Self development  
 Identify different types of personalities.  
 Discover one’s personality type.

Attitude-Understanding attitude formation and correction.  
 Recognise and classify the types of attitude.

Inter Personal Relations- Empathy, Relationship building

Personal Grooming- Personal Hygiene  
 Dress Codes  
 Appearance and Poise

Social graces, etiquette- Deportment and Proper Social Conduct  
 Courtesy and manners  
 conventions in social behaviour and expected behaviour patterns

Protocol-

Conventions of official interaction, collective, personal and written.

Dining and Table Etiquette- Restaurant Etiquette, Party Etiquette, etc.

Culminating in complete 5 course Sit Down Meal.

Presentation skills – 1 Preparation and planning, structure of an Oral Presentation

Presentation skills – 2 Visuals, body language, voice and pronunciation

Presentation skills – 3 Creating interest and establishing a relationship with the audience.

### ***MIT-36 Lab – Enterprise Java with Frameworks***

#### **Struts Syllabus**

Introduction to Struts Framework, The Model Layer, The View Layer, The Controlled Layer, Validator, Tiles, Declarative Exception Handling, Struts Modules, Internationalizing Struts Applications, The HTML Tag Library, The Bean Tag Library, The Logic Tag Library, The Nested Tag Library

#### **List of Books:**

1. Struts: The Complete Reference by James Homes
2. Students will solve at least 1 Programming problem on each of these topics. They are expected to implement a mini-project in teams.

### ***MIT – 37 Lab - System Security***

Implementing Cryptography Algorithms using Linux

Exposure to Network Programming

Web security assignments (creating a database and program and hacking through)

Operating system Security (Linux and Windows)

## Optional Courses

### **1. Multimedia Systems**

#### **Introduction**

Defining the scope of multimedia, Hypertext and Collaborative research, Multimedia and personalised computing, Multimedia on the map, Emerging applications, The challenges

#### **The convergence of computers, Communications, and entertainment products**

The technology trends, Multimedia appliances, Hybrid Devices, Designers perspective, industry perspective of the future, Key challenges ahead, Technical, regulatory, Social.

Architectures and issues for Distributed Multimedia systems

Distributed Multimedia systems, Synchronization, and QOS Architecture, The role of Standards, A frame work for Multimedia systems

Digital Audio Representation and processing

Uses of Audio in Computer Applications, Psychoacoustics, Digital representation of sound, transmission of digital sound, Digital Audio signal processing, Digital music making, Speech recognition and generation, digital audio and the computers.

Video Technology

Raster Scanning Principles, Sensors for TV Cameras, Colour Fundamentals, Colour Video, Video performance Measurements, Analog video Artifacts, video equipments, World wide television standards.

Digital Video and Image Compression

Video compression techniques, standardization of Algorithm, The JPEG Image Compression Standard, ITU-T Recommendations, The MPEG Motion Video Compression Standard, DVI Technology.

Operating System Support for Continuous Media Applications

Limitation of Workstation Operating system, New OS support, Experiments Using Real Time Mach.

Middleware System Services Architecture

Goals of Multimedia System services, Multimedia system services Architecture, Media stream protocol.

Multimedia Devices, Presentation Services, and the User Interface

Client control of continuous multimedia, Device control, Temporal coordination and composition, toolkits, hyper applications.

Multimedia File systems and Information Models

The case for multimedia information systems, The file system support for continuous Media, Data models for multimedia and Hypermedia information, Content- based Retrieval of Unstructured Data.

Multimedia presentation and Authoring

Design paradigms and User interface, barriers to wide spread use, research trends.

Multimedia Services over the Public Networks

Requirements, Architecture, and protocols, Network services, applications.

Multimedia Interchange

Quick time Movie File Format, QMFI, MHEG (Multimedia and Hypermedia Information Encoding Expert Group), Format Function and representation, Track model and Object model, Real Time Interchange.

Multimedia conferencing

Teleconferencing Systems, Requirements of Multimedia Communications, Shared Application Architecture and embedded Distributed objects, Multimedia Conferencing Architecture

### **List of Books:**

1. Multimedia Systems by John F. Koegel Buford- Pearson Education
2. Multimedia in Practice – Judith Jeffcote (PHI)



3. Multimedia Computing, Communication & Applications – Ralf Steinmetz, Klara Nahrstedt (PH-PTR Innovative technology series)
4. Multimedia, Production, Planning & Delivery – John Villamil, Casanova (PHI)
5. Virtual Reality and Multimedia – Durano R. Begault (AP professionals)
6. Principles of Interactive Multimedia – Elsom, Cook (TMH)

## **2. Software Metrics & Project Management**

1. What is Project? What is Project management? Project phases and project life cycle, organizational structure, Qualities of Project Manager.
2. Project Management Components.  
Project Integration Management-Project plan development and execution, change controls, configuration management.
3. Scope Management-Strategic planning ,scope planning,definition ,verification and control.
4. Time management- Activity planning, schedule development and control.
5. Cost Management- Cost estimation and Control.
6. Quality Management- Quality planning and assurance.
7. Human Resource Management- Organizational planning , staff acquisition.
8. Communication Management-Information distribution , reporting.
9. Risk Management-Risk identification,Quantification and control.
10. Procurement Management- Solicitation, contract administration.
11. Software Metrics- The scope of software metrics, software metrics data collection, analyzing software data, measuring size, structure, external attributes.
12. Software Reliability- Measurement and prediction, resource measurement, productivity, teams and tools.
13. Planning a measurement program.

What is metrics plan?: Developing goals, questions and metrics. Where and When: Mapping measures to activities.

How: Measurement tools.

Who: Measurers , analyst, tools revision plans.

#### 14. Quality Standards – CMM, PSP/TSP

#### **List of Books:**

1. Information Technology Project Management By -Kathy Schwalbe.
2. Software Metrics A rigorous and practical approach By – Norman Fenton, Shari Lawrence Pfleeger.
- 3: Software Engineering By- Roger Presman.

### **3.SOFT COMPUTING**

#### **1.Introduction**

Soft computing paradigms-Neural network-Fuzzy logic-derivation free optimization methods of Genetics algo.-soft computing characteristics.

#### **2. Fuzzy logic**

sets-properties-arithmetics-member functions- fuzzy relations-relation equations-fuzzy measures-types of uncertainty-members of uncertaintiesmeasures of fuzziness-probabilities Vs possibilities-measures of fuzzy events.

#### **3. Neural computing**

neuron modelling- learning in simple neuron-perception earning curve-proof limitations of perception.

#### **4. Neural networks**

Multilevel perception-algo-visualizing network behaviour-B:PN-self organizing network-Kohonen algo.- Hopfield network-adaptive resonance theory-pattern classification.

#### **5. Genetic algorithms**

Introduction- Biological terminology-search space and fitness landscapes elements of genetic algorithms -Genetic algorithm in problem solving.

#### **List of Books:**

1. JS Jang ,C.T. Sun , E.Mizutani, " Neuro-fuzzy and soft computing" Prentice International.
2. Simon Haykin " Neural networks - A comprehensive foundation" PHI
3. Melanie Mitchell , " An introduction to Genetic algorithms", PHI

#### ***4.Database Management using PHP and MySQL***

##### **Introduction to PHP**

Incorporating PHP Within HTML

This Book's Examples

The Structure of PHP

##### **Expressions and Control Flow in PHP**

Expressions

Operators

Conditionals

Looping

Implicit and Explicit Casting

PHP Dynamic Linking

##### **PHP Functions and Objects**

PHP Functions

Including and Requiring Files

PHP Version Compatibility

PHP Objects

##### **PHP Arrays**

Basic Access

The foreach...as Loop

Multidimensional Arrays

Using Array Functions

##### **Practical PHP**

Using printf

Date and Time Functions

File Handling

System Calls  
XHTML

## **Introduction to MySQL**

MySQL Basics  
Summary of Database Terms  
Accessing MySQL via the Command Line  
Indexes  
MySQL Functions  
Accessing MySQL via phpMyAdmin

## **Mastering MySQL**

Database Design  
Normalization  
Relationships  
Transactions  
Using EXPLAIN  
Backing Up and Restoring

## **Accessing MySQL Using PHP**

Querying a MySQL Database with PHP  
A Practical Example  
Practical MySQL

## **Form Handling**

Building Forms  
Retrieving Submitted Data  
An Example Program

## **Templating with Smarty**

Why Smarty?  
Installation  
Creating Scripts  
Creating Templates  
A Practical Example

**Cookies, Sessions, and Authentication**

Using Cookies in PHP

HTTP Authentication

Using Sessions

**List of Books:**

MySQL The Complete Reference –by Vikram Vaswani, TMH

PHP 5 and MYSQL Bible - Converse, Tim and others

Smarty PHP Template Programming And Applications -Hasin Hayder ,J. P. Maia ,Lucian Gheorghe***5. Web Technology with JavaScript and AJAX***

Exploring JavaScript

JavaScript and HTML Text

Using Comments

Semicolons

Variables

Operators

Variable Typing

Functions

Global Variables

The Document Object Model

**Expressions and Control Flow in JavaScript**

Expressions

Operators

The with Statement

Using onError

Using try...catch

Conditionals

Looping

Explicit Casting

JavaScript Functions, Objects, and Arrays

JavaScript Functions

JavaScript Objects  
JavaScript Arrays

JavaScript and PHP Validation and Error Handling  
Validating User Input with JavaScript  
Regular Expressions  
Redisplaying a Form After PHP Validation

### **Introduction to AJAX**

- How AJAX is different from classical web pages
- Its impact on the user experience
- What kinds of applications can benefit
- Who is using it now, and why
- Why AJAX totally changes Web application development
- How AJAX can be integrated with conventional web applications

### **Basic AJAX technologies**

- Using HTML/XHTML for document structure
- Using CSS to define look and feel
- Understanding Javascript
- Understand the DOM
- Use Javascript to create, remove, move and stylize content

### **Using AJAX effectively**

- Impacts on User Experience
- Impacts on the Development Process

### **Further AJAX technologies**

- Managing AJAX communication
- Managing Data with XML and JSON
- Object-oriented Javascript
- Components

### **Specific AJAX techniques**

- Building an application using a single page
- Auto-completion
- Validation
- Dynamic Lists
- Dynamic Generation of Linked Lists

## **Design Patterns for AJAX**

- What is a Design Pattern
- Refactoring
- The Overall UI Pattern
- Using the MVC Pattern
- Implementing Patterns

## **JavaScript libraries for AJAX**

- Why Javascript Libraries
- Prototype Library
- Scriptaculous Library
- RICO Library
- Dojo Library

## **AJAX Tools**

- Overview of AJAX Tools
- Google Web Toolkit
- Ruby on Rails
- Adobe Flex

## ***6.Object Oriented Analysis and Design using UML***

### Introduction

Role of analysis and design in software development, purpose of analysis models, design model\$, introduction to OO analysis and design approach, comparison of OOAD and SSAD approaches, over view of OO analysis and design activities, overview of popular GOAD methodologies - common features and differences.

### Introduction to UML

What is UML? Overview of various UML models.

### Use case modeling

Concepts of use case model, actors, association of actors to use cases, use case description, structuring use cases with «uses» and «extend» relationships, purpose of

use case modeling, guidelines for use case modeling, finding actors, finding use cases, use case realization

### Structural Modeling

UML class diagram concepts - object, classes, class properties - attributes, operations, relationships between classes - association, aggregation, composition, inheritance, dependency, basic association adornments-multiplicity, role names; concept of package, grouping of classes into Packages.

### Behavioral Modeling

Modeling object interaction using UML interaction diagrams - Sequence diagrams, collaboration diagrams; modeling the behavior of reactive objects using UML state chart diagrams; modeling systems workflows or operations using UML activity diagram .

### Introduction to the Unified Software Development Process

Key features of the Unified Software Development Process - iterative model, use-case driven, architecture-centric, phases, iterations and workflows.

### Software Architectural Design, Architecture modeling in UML

Software architectural design issues, organization into subsystems, handling concurrency, allocation of subsystems to processors, choosing strategy for implementing persistent data stores, choosing strategy to control access t



global resources, choosing strategy for software control implementation, overview of common architectural styles. Architecture modeling in UML - modeling active objects, deployment diagram.

#### Class design

Class design activities, guidelines for - designing algorithms, design optimization, implementing state chart of class, adjustment of class hierarchies to increase reuse; design options for implementing associations, refinement of classes with attributes details and operations details, determining visibility between objects, physical packaging of classes into software modules, UML implementation diagram - Component diagram.

#### OO Design Patterns

Introduction to OO design patterns, a template for describing designs patterns, a classification scheme for OO design patterns, uses of design patterns, patterns v/s frameworks, and illustration of some OO design patterns.

#### Implementation Guidelines

Mapping a design class diagram for implementation in OO language such C++ or Java. Overview of code generation and reverse engineering features of an OO case tool.

#### **List of Books:**

1. Craig Larman, Applying UML and Patterns: An Introduction to Object Oriented
2. .Analysis and Design; Pearson Low price edition
3. Martin Folwer and Kendall Scott; UML Distilled; Addison- Wesley
4. James Rumbaugh, Michael Blaha, William Premerlani, Frederick Edduy and William Lorensen; Object-Oriented Modeling and Design; Prentice-Hall
5. Grady Booch; Object-Oriented Analysis and Design with Applications, 2nd Edition; Addison- Wesley
6. Jacobson, Booch and Rumbaugh; Unified Software Development Process; Addison- Wesley
7. Hans-Erik Eriksson and Magnus Penker; UML Toolkit; Wiley publishing
8. Rebecca Wirfs-Brock, Brian Wilkerson and Lauren Wiener; Designing Object-Oriented Software; Prentice Hall India

## **7. MOBILE COMPUTING**

### **1. Introduction to Mobile Computing**

- i. Introduction and need for Mobile computing
- ii. Mobility and portability
- iii. Mobile and Wireless devices
- iv. Applications
- v. Brief History of wireless communication

### **2. Wireless Transmission**

- i. General Concepts of multiplexing and modulation
- ii. Spread Spectrum
- iii. Cellular Systems
- iv. Cellular Phone Array
- v. Mobile Phone Technologies (1G, 2G, 2.5G, 3G)

### **3. Medium Access Control Layer**

- i. Why specialized MAC? - hidden and exposed terminals- near and far terminals
- ii. General Concepts and comparison of SDMA, FDMA, TDMA, CDMA

### **4. Global System for Mobile Comm.**

- i. Mobile Services (Bearer, Tele-and-supplementary services)
- ii. System Architecture- Radio subsystem - Network and switching subsystem - Operation subsystem
- iii. Protocols - Localization and calling - Handover
- iv. Value Added Services- SMS Architecture, Mobile Originated and Mobile Terminated, procedures - Cell Broadcast Service Architecture, Message Transfer Procedure – MMS Architecture, Protocol framework, Message Transfer Procedure - Location Services, Logical Reference Model, Control Procedures, Network Architecture, determination of Location Information, Location based services
- v. GPRS

### **5. Mobile IP**

- i. Goals, assumptions and requirements
- ii. Entities and terminologies
- iii. Agent Discovery

- iv. Registration
- v. Tunneling and encapsulation
- vi. Reverse Tunneling
- vii. IPv6
- viii. IP micro-mobility support – Cellular IP, Hawaii, Hierarchical mobile IPv6
- ix. Mobile Routing : Destination sequence distance Vector, Dynamic Source Routing, Alternative Matrix, Adhoc Routing Protocols -Flat, Hierarchical, Geographic-position-assisted

## **6. Mobile TCP**

- i. Traditional TCP - Congestion Control, Slow start, Fast retransmit / Fast recovery
  - Implications on mobility
- ii. Classical TCP improvements Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective Retransmission, Transaction oriented TCP
- iii. TCP over 2.5/3G wireless networks

## **7. Wireless Application Protocol**

- i. Architecture
- ii. Wireless datagram protocol
- iii. Wireless transport layer security
- iv. Wireless transaction protocol
- v. Wireless session protocol
- vi. Wireless application environment
- vii. WML
- viii. WML Scripts
- ix. Push Architecture
- x. Push – Pull Services

## **8. Platform/Operating Systems**

- i. Palm OS
- ii. Windows CE
- iii. Embedded Linux
- iv. J2ME (Introduction)
- v. Symbian (Introduction)
- vi. File Systems (Book1)

## **9. Java for Wireless Devices**

- i. Setting up the development environment
- ii. Basic Data types, Libraries (CLDC, MIDP)

## **10. UI Controls**

- i. Displayable and Display
- Image
- Events and Event Handling
- List and choice
- Text box
- Alerts

### **11. Persistent Storage**

- i. Record Stores
- ii. Records
- iii. Record Enumeration

### **12. Network MIDlets**

- i. The Connection Framework
- ii. Connection Interface
- iii. Making a connection using HTTP
- iv. Using datagram connection

### **13. Wireless Messaging**

- i. Architecture for Messaging application
- ii. Messaging API
- iii. Types of applications
- iv. Pros and cons of messaging

**References:** <http://java.sun.com/products/wma>  
<http://forum.nokia.com>

### **List of Books:**

1. Mobile Communications Jochen Schiller, Pearson Education, 2<sup>nd</sup> Edition
2. Pervasive Computing Technology and Architecture of Mobile Internet Applications  
 Jochen Burkhardt, Dr. Horst Henn, Steffen Hepper, Klaus Rintdorff, Thomas Schack , Pearson Education
3. Wireless Java Programming with J2ME Yu Feng and Dr, Jun Zhu , Techmedia Publications, 1st edition
4. Complete Reference J2ME
5. Mobile Networks GSM and HSCSD Nishit Narang, Sumit Kasera, TataMcGrawHill
6. Mobile Computing Asoke K Talukdar, Roopa R. Yavagal, TataMcGrawHill

## **8. Introduction to Data Compression**

1. **Introduction:** Compression techniques, Modeling and Coding
2. **Huffman Coding:** Huffman Coding algorithm, Adaptive Huffman Coding, Golomb Codes, Rice Codes, Tunstall Codes, Applications of Huffman Coding
3. **Arithmetic Coding:** Coding a sequence, Generating a binary code, Comparison of Huffman and Arithmetic Coding, Adaptive Arithmetic Coding, Applications
4. **Dictionary Techniques:** Static Dictionary, Adaptive Dictionary, Applications
5. **Context based Compression:** Prediction with partial match, the Burrows- Wheeler Transform, Associative code of Buyanovsky, Dynamic Markov Compression
6. **Lossless Image Compression:** The old JPEG standard, CALIC, JPEG – LS, Multi resolution approaches, FACSIMILE Encoding, MRC – T.44
7. **Scalar Quantization:** The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non Uniform Quantization, Entropy coded Quantization
8. **Vector Quantization:** Advantages of Vector quantization over Scalar quantization, The Linde-Buzo-Grey Algorithm, Tree Structured Vector Quantizers, Structured Vector Quantizers, Variations on the Theme.

### **List of Books:**

Khalid Sayood, Introduction to Data Compression, Morgan Kauffmann

## **9.Embedded Systems Design**

### **Introduction to embedded system:**

A First Look at Embedded systems- Examples of Embedded systems- applications area-categories of

embedded system – recent trends in embedded system:

### **Design challenge –**

optimizing design metrics Common design metrics- Processor technology- General-purpose processors –

software - Single-purpose processors – hardware- Application-specific processor- IC technology

### **Architecture of embedded system:**

hardware architecture –software architecture - Programming for embedded system.

### **The process of embedded system development**

Interrupts-Microprocessor-Architecture-Interrupt Basics-The Shared-Data Problem-Interrupt Latency shared

data problems- survey of software architecture -Round-Robin-Round-Robin with Interrupts-

Interrupt Latency –RTOS.

### **RTOS**

architecture of kernel –task and task scheduler-interrupt service routines- semaphores-message queuesmail

boxes-pipes –events-timer – memory management –interrupt routines in RTOS Environment overview

of embedded /real time operating system .

### **Embedded Software Development Tools**

-Host and Target Machines-Linker/Locators for Embedded Software-Getting Embedded Software into the

Target System.

**Debugging Techniques** Testing on Your Host Machine-Instruction Set Simulators-The assert Macro-Using Laboratory Tools

### **An Example System-**

What the Program Does-Environment in which the Program Operates

### **Task Image creation –**

operating system software –target image creation for windows XP embedded- porting RTOS on a microcontroller

based development board.

### **Representative embedded systems programming**

in Linux-programming in RTLinux-Development of Navigation System – Development of

protocol converter-mobile Java applications.

### **State machine and concurrent process models –**

Introduction- Models vs. languages, text vs. graphics- Models vs. languages-  
Textual languages versus

graphical languages-An introductory example- A basic state machine model:  
finite-state machines (FSM)-

Finite-state machines with data path model: FSMD- Using state machines-  
Describing a system as a state

machine-Comparing the state machine and sequential program model-  
Capturing a state machine model in

a sequential programming language-Hierarchical/Concurrent state machine  
model (HCFSM) and the State

charts language

**Program-state machine model (PSM) –**

The role of an appropriate model and language

**Concurrent process model-**

Use of Esterel language for embedded software development

### **List of Books:**

1. Embedded software primer by David Simon – Pearson
2. Art of embedded system by Jack Ganssle
3. Embedded systems Architecture by Tammy Noergaard – Elsevier publications
4. Embedded /Real time systems – by DR.K.V.K.K.Prasad. – Dreamtech
5. Esterel language by Gerard Berry ( web site reference)
6. Embedded system design by Arnold S.Berger
7. model checking by Edmund M.clark
8. Embedded Systems Building Blocks by Jean LaBrosse
9. Embedded Systems Design by Arnold Berger
10. The Art of Programming Embedded Systems by Jack Ganssle

## **10. Compiler Design**

**Introduction to Compilers,**

Lexical analysis, Regular Expressions, Finite automation. N.F.A., N.F.A. to D.F.A. conversion, D.F.A., minimization of D.F.A., Lex tool.

### **Context Free Grammar,**

Derivations & Parse trees, Syntax analysis: Parsing, Top Down Parser, Recursive descent Parser, Predictive parsing, LL(1) Parsing table, Bottom Up Parsing, Shift Reduce parsing, Operator precedence parsing, LR Parsing methods, SLR, LRDL, LALR, YACC tool.

### **Syntax directed translation :**

Syntax directed translation schemes, Implementation of syntax directed translation schemes, Intermediate codes, Post fix notation parse trees & syntax trees, three address codes, quadruples, triples, Translation of assignment statements, Boolean expression, statements that after flow of control, Post fix translation, Translation with Up down parsing.

### **Error detection & recovery:**

Errors, lexical phase errors, Syntactic phase errors, semantic errors.

**Code Optimization :** Loop optimization, DAG representation of basic block, value numbers & algebraic laws, Global data flow analysis, Dominators, Reducible flow graph, Depth first search, Loop invariant computation, Induction variable elimination.

### **Data flow Analysis :**

Reaching definition, Available Expression , copy propagation, Backward flow problems, Very busy expression & code hoisting code.

### **Code Generation :**

A simple code generation, code generation from DAG & labeled trees.

### **Register allocation :**

coloring by implication, coalescing, graph coloring implementation, Register allocation for Trees.

### **List of Books:**

1. Alfred V. Aho, Jeffrey D. Ullman & Ravi Sethi, "Principles of Computer Design" Narosa Publication.
2. Trembley et al, " Theory & Practice of Compiler Writing ", McGraw Publication.
3. Andrew W. Appel, " Modern Compilers Implementation in Java".
4. Dhamdhere " Compiler Principles".



## **11.Introduction to Computer Graphics**

Prerequisite: Algorithms & Data structures

### **Introduction:**

Tour of computer graphics applications, Fundamentals of Raster graphics workstation, representation of points, line and an image.

### **Basic raster graphics algorithms:**

DDA and Bresenham algorithm for lines and circles, 2D line clipping (Sutherland Cohen), Scan converting a 2D polygon, area-fill algorithms, solid 2D polygon clipping (Sutherland-Hodgman)

### **2D-3D Geometric Transformations:**

Translation, Scaling, Rotation, homogenous representation, Viewing transformation (window to view port to physical device), two-dimensional modeling transformations three-dimensional modeling transformations, 3 D viewing transformations including 3D to: 2D projections and camera transformation.

### **Modelling:**

!Parametric curves and surfaces: Hermite, Bez\_er, B-Spline, Solid models: Boundary, weep, CSG, fractals and procedural modeling.

### **Rendering:**

, I  
Visible, surface algorithms (back-face cull, Z-buffer), basic physics, of light and reflection, rendering equation, global illumination models, simple local illumination model (Phong model), general theory of ray tracing (primary rays, secondary reflection rays, shadow rays, transmitted rays, concepts of ray tree), ray-sphere intersection, ray-plane intersection, ray-box intersection, texture and bump mapping including 2D to 3D (using bitmaps) and 3 D to 3D (procedural textures and a noise function), anti-aliasing (Nyquist theorem)

### **List of Books:**

1. . Hearn D and M.P. Baker, Computer Graphics, Prentic-Hall India.
2. . Foley J.D.A. van Dam, S.K. Feiner and J.F. Huhges (3rd edition)  
Computer Graphics-Principles and Prtactice, Redaing M.A. Addison  
Wesley
3. . Burger P.D. Gillies, Interactive Computer Graphics, Addison Wesley  
. Watt A, Fundamentals of Three-Dimensional Computer Graphics,

Addison Wesley

4. Ammeraal L. Computer Graphics of Java Programmers, John Wiley

## **12. Network Design, Implementation and administration**

- Overview of Network Service Design:  
Introduction, Strategy for Network Service Implementation, Issues in Network design
- TCP/IP:  
Introduction to TCP/IP, Benefits of using TCP/IP, IP addressing, IP Network and Host addressing, Classes of IP addresses, Subnet mask, Subnetting and super netting  
IP configuration, TCP/IP & security, IPsec, protecting IP traffic, QOS and QOS connections  
Optimizing Network design,
- DHCP Dynamic Host Control Protocol:  
DHCP function and Protocol, Installation of DHCP server and clients, Features of DHCP server and information, Monitoring and troubleshooting, Using DHCP and non routed and routed Network, Securing DHCP services, Optimizing DHCP performance
- DNS Domain Name Service:  
Overview of DNS protocol, DNS Namespace, Zone of authority and name resolutions, Installation of DNS server, Configuring DNS server and clients, Features of DNS server Reverse lookup, DNS and intranet, Placement of DNS server, Using BIND, DNS dynamic update protocol, Securing dynamically updated DNS service Replication Resolving Query resolution time and impact, On Network traffic due to replication, Optimizing DNS performance.
- Network Security:  
Public key infrastructure concepts, Public key encryption (Basic cryptographic concepts)  
Public key authentication, Certificate authentication I, Installation and Management of certifying server, Issuing certificate, Revoking certificates, Common Network security problems, Ipsec, Ipsec data exchange protocol, Installing and configuring Ipsec  
Ipsec services, Configuring TCP/IP secure services, Monitoring and troubleshooting
- Routing:  
Overview of TCP/IP routing, Static V/s Dynamic routes, Adding and deleting static routes  
Demand on dial routing, Routing protocol, Installing and configuring RIP, Installing and configuring OSPF, Installing and configuring IGP, Secure IP

routing, Protecting data using trends, Router Authentication, Router Placement and performance optimization.

- Network administration:

SNMP & RMON - Overview and features, MIB Management Information base

Installing SNMP Servers, SNMP communities, Authentication and securing Monitoring and analysis and troubleshooting, Overview and installation configuration: fire wall, NAT, E-mail (Send mail), Radius, Remote access servers, proxy servers.

- Securing above services

- Information logging and monitoring and troubleshooting

**List of Books:**

1. OS documentation of Linux/ Unix or WIN 2000

***13. Operating system kernel and network programming***

Organisation of unix user interface. Programmer interfaces. The environment of a unix process, system calls, programming system calls. File I/O, File and Directories, standard I/O library, File related system calls. Process control, Process relationships. Process groups, sessions, controlling Terminal, Process related system calls.

Signals, Signal concept, Reliable and unreliable signals, Signal sets, Signal related system calls.

Terminal I/O multiplexing, Memory mapped I/O, related system calls

Interprocess Communication, Pipes, Message queues, Semaphores and shared memory.

Advanced interprocess communication, stream pipes, open server.

Introduction: Overview of computer networks, seven-layer architecture. Communication protocols, Internet protocols, SNA, Protocol comparison. Test networks and hosts, discovering network topology, 64 bit architecture.

Transport layer: introduction to TCP and UDP protocols, TCP port numbers and concurrent servers, protocol usage by common internet applications

Berkely Sockets: Socket address structures, socket functions for TCP Client /server, Day time client /server example.

I/O multiplexing: Basic I/O model, asynchronous and synchronous I/O model.

Socket options: Generic ,IPv4 , IPv6 and TCP.

Elementary UDP socket programming: Name and address conversions.

**List of Books:**

1. Steven W.R. "Advanced Programming in UNIX Environment"  
Pearson Education.
2. Steven W.R., UNIX network programming, second edition, Pearson education.
3. Ralph Davis, Win 32 network programming, Addison Wesley

**14. Optimization Techniques:**

Linear Programming: Graphical method for two dimensional problems, simplex method, Big M method, two phase method, revised simplex method- primal and dual –dual simplex method- sensitivity analysis – transportation problem and its solution-assignment problem and its solution by Hungarian method.

Integer Programming: Gomory cutting plane methods, Branch and Bound method.

Queuing Theory: characteristics of queuing systems-steady state M/M/I,M/M/K and M/M/C queuing models.

Replacement Theory: Replacement of items that deteriorate, Replacement of items that fail, Group replacement and individual replacement.

Inventory theory: inventory problems, single item deterministic models, economics lot size models without shortages and with shortages having production rate infinite and finite.

PERT and CPM Arrow networks-time estimates – earliest expected time, latest allowable occurrence time, critical path- probability of meeting scheduled date of completion of project –calculations on CPM network-various floats for activities- Critical path- updating project-operation time cost trade off curve-project time cost trade off curves-selection of schedule based on cost analysis.

Nonlinear programming: Algorithms for solving nonlinear problems.

**List of Books:**

1. Gillet B.E, "Introduction to Operations Research: A computer Oriented Algorithmic Approach", Tata Mcgraw Hill, New York,1990.
- 2.Gross D. and Harris, C.M. "Fundamentals of Queuing Theory", John Wiley

and Sons, New Yourk,1980.

3. Hiller F. and Lieberman G.J., “Introduction to Operations Research”, Holden Day, New York, 1985.

4. Kambo N.S. “Mathemetical Programming Techniques”, McGraw Hill, New York,1985.

5.Kanti swarup, Gupta P.K. and Man Mohan, “Operations Research”, sultan Chand & Sons, New Delhi,1990.

6.Mital K.V. “Optimisation Method in Operations research and Systems Analysis”, New Age International(P) Ltd., New Delhi, 1992.

7. Shafer L.R. Litter J.B. and Meyer W.L. “The Critical Path Methods”, Mc Graw Hill, New York, 1990.

8. Taha H.A., “Operations Research-An introduction”, McMillan Publishing Co. New York, 1986.

## ***15.Natural Languages Processing***

### **Introduction**

Ambiguity, Models and algorithm, Language, thought and understanding.

### **Regular Expressions and Automata**

Regular Expressions, Basic Regular Expression Patterns, Disjunction, Grouping, and Precedence,

Advanced Operators, Regular Expression substitution, Memory, and ELIZA

### **Finite-State Automata**

Using an FSA for Recognition, Formal Languages, Non-Deterministic FSAs,

Using an NFSA to Accept

Strings, Recognition as Search

### **Morphology and Finite-State Transducers**

English Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological

Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite-State Transducers,

Orthographic Rules and Finite-state Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs:

The Porter Stemmer

### **N-grams**

Counting Words, Simple N-grams, Smoothing, Backoff, Deleted Interpolation, N-grams for Spellings,

Entropy.

### **Word Classes and Part-of-Speech Tagging**

English classes, tagsets POS tagging, Rule based POS tagging, Stochastic POS tagging, HMM tagging,

Transformation based tagging, Multiple tags and multiple words, unknown words,

### **Context-Free Grammars for English**

Context Free rules and trees, Sentence level construction, Noun Phrase, coordination, Agreement, Verb

phrase, Auxiliaries, Grammar Equivalence and normal form.

### **Parsing with Context-Free Grammars.**

Parsing as Search, A Basic Top-Down Parser, Adding Bottom-Up Filtering, Problems with the Basic Top-

Down Parser, Left-Recursion, Ambiguity, Repeated Parsing of Subtrees, The Earley Algorithm, Finite-

State Parsing methods.

### **Features and Unification.**

Feature structures, Unification of feature structures, Feature structures in grammar, Implementing

unification, Parsing with unification constraints, Types and inheritances.

### **Lexicalized and Probabilistic Parsing.**

Probabilistic Context free grammars. Problems with PCFGs, Probabilistic Lexicalized CFGs, .Dependency

Grammars, Human Parsing.

### **Representing Meaning.**

Computational Desiderata for representation, Meaning Structure of Language, Some Linguistically relevant

concepts: Categories, Events, Representing time, Aspects, Representing beliefs, Pitfalls. Alternative

approaches to meaning.

### **Semantic Analysis**

Syntax-Driven Semantic Analysis, Semantic Augmentations to context-Free Grammar Rules, Quantifier

Scoping and the Translation of Complex-Terms. Attachments for a Fragment of English. Sentences, Noun

Phrases, Verb Phrases. Prepositional Phrases, Integrating Semantic Analysis into the Earley Parser. Idioms

and Compositionality, Robust Semantic Analysis

### **Lexical Semantics**

Relation among lexes and their senses, WordNet, Internal structure of Words, Creativity and the Lexicon.

### **Word Sense Disambiguation and Information Retrieval**

Selectional restriction based disambiguation. Robust word sense disambiguation. Information Retrieval

concepts.

### **Discourse**

Reference Resolution, Text Coherence, Psycholinguistic studies of reference and coherence.

**Natural Languages Generation**

An architect for generation, Surface realization, Discourse planning, Microplanning, Lexical Selection, Evaluating generation system.

**Machine Translation**

Language similarities and Differences, The transfer Metaphor, The Interlingua Idea: using Meaning, direct Translation, Using statistical techniques, Usability and system development.

**List of Books:**

1. Natural Language processing by Daniel Jurafsky, James H Martin, Pearson Education asia

**16. Component based Software Development**

Description: Understand the concepts and technology behind component based software development. Building software components using existing standard technologies COM. Building software components using existing standard technologies COM, or Java Beans and CORBA. The course should cover either of these technologies.

Prerequisite: Familiar with using C++, Win 32 API programming or java programming.

Introduction to general philosophy of Component based software development

Introduction to general philosophy of Component based software development

Introduction to COM components, creating COM components, component reuse, local and remote components, Automation ATL, COM threading model, structured storage, Persistent Objects, Connection points, OLE documents, Active X controls, introduction to MTS, COM+, .NET

OR

Introduction to javabeans, javabeans properties, sterilization, introspection (reflection), persistence (JAR files), elementary multi threading in java EJB

History of origin of CORBA, Overview of CORBA common services, simple programs using CORBA, OMA Components, CORBA IDL, Static and dynamic invocation interfaces, interfaces repository.

**List of Books:**

1. Dale Rogerson; Inside COM, Microsoft Press
2. JavaBeans Unleashed: Techmedia; SAM publications
3. Kraig Brocksmidt, Inside OLE, Microsoft Press
4. David Chappell, Understanding ActiveX and OLE, Microsoft press
5. Guy Eddon, Henry Eddon, Inside Distributed Com, Microsoft Press
6. M. Campoine, K. Walrath and Addison Humel, The Java Tutorial continued, The Rest of the JDK, Addison Wesley
7. K. Arnold and J. Gosling, The Java Pogramming Languages, 2<sup>nd</sup> Edition (1997), Addison Wesley
8. R Englander, O'reilly, Developing java Beans(1997)
9. S.Oaks and H.Waing, O'Reilly, Java Threads,(1997)

**17. Image Processing****Introduction**

Image formation model, representation, spatial and Gray Level resolution, Colour models-RGB, CMY and HIS models

**Image Enhancement In Spatial Domain**

Piecewise linear transformation, Histogram equalization, Histogram specification, image averaging, spatial filters – smoothing and sharpening, Laplacian filter, sobel operator, Canny edge detector.

**Image Enhancement In Frequency Domain**

2D Discrete Fourier transform and its inverse, filtering in frequency domain, Ideal and Gaussian Low pass filters, high pass filtering, separability property Of 2D Fourier transform, Fast Fourier Transform.

**Image Segmentation**

Line detection, Edge detection, Edge linking and boundary detection, Hough Transform, Thresholding, Region based segmentation

**Morphological Image Processing**

Logic operations involving binary images, Dilation and Erosion, Opening and closing, Applications to Boundary extraction, region filling, connected component extraction.

**Image Compression**



Coding redundancy- Huffman coding, LZW coding, run length coding, Lossy compression – Lossy predictive coding, transform coding- DCT, bit allocation, Compression standards – JPEG, video Compression.

### **Image Representation**

Boundary description, Shape numbers, Fourier descriptors, Texture, principal Components based description.

### **3D Vision**

Projective geometry, single perspective camera, stereopsis, the fundamental matrix – its estimation from image point correspondences, applications of epipolar geometry in vision, correlation based and feature based stereo correspondence, shape from motion, optical flow.

### **List of Books:**

1. Gonzalez and Woods, “Digital Image Processing” 2002, Pearson education, Asia.
2. Sonka, Hlavac and Boyle Brooks/Cole, “Image Processing, Analysis, and Machine Vision”, 1999, Thomson Asia Pte Ltd Singapore.
1. Jain and Rangachar, “Machine Vision”, 1999, McGraw Hill International Edition.
2. Schalkoff, John Wiley and Sons, “Digital Image Processing & Computer Vision”, 1989, John Wiley and Sons.

## ***18.Data Mining and Data Warehousing***

### **Introduction and Background**

Introduction to the multidisciplinary field of data mining,. Discussion on the evolution of database technology that has led to the need for data warehousing and data mining. Stress on importance of its application potential. Introduction to the different key words and techniques.

### **Data Warehousing And OLAP**

Insight of data warehouse and on-line analytical processing, Aggregation Operations, models for data Warehousing, star schema, fact and dimension tables Conceptualization of data warehouse and multidimensional databases. Life cycle of data warehouse development. Relationship between data warehouse and data mining.

### **Data Mining Primitives**

Data preprocessing including data cleaning, data integration, data transformation. Definition and Specification of a generic data mining task. Description of Data mining query language with few example queries.

### **Association Analysis**

Different methods(algorithms) for mining association rules in transaction based data bases. Illustration of confidence and support. Multidimensional and multilevel association rules. Classification of association rules. Discussion on few association rule algorithms e.g. Apriori, frequent pattern growth etc.

### **Classification and Predictions**

Different Classification algorithm, including C4.5, CART etc., use of genie index, decision tree induction, Bayesian classification, neural network technique of back propagation, fuzzy set theory and genetic algorithms.

### **Clustering**

Partition based clustering, Hierarchical clustering, model based clustering for continuous and discrete data. Discussion on scalability of clustering algorithms

Web Mining: web usage mining, web content mining, web log attributes, use of web mining in efficient surfing and personalization.

Mining Complex type of data: Data mining issues in object oriented databases, spatial databases and multimedia data bases, time-series data bases, and text data bases.

### **Applications of Data Warehousing And Data Mining.**

Exploration of web sites on data ware housing and data mining applications including bibliography data bases, Corporate Houses and Research labs.

### **List of Books:**

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques," 1<sup>st</sup> Edition Indian Reprint 2001, Harcourt India Private Limited, ISBN 1-55860-489-8.
2. Vipin Kumar
3. Margaret Dunham, "Data Mining: Introductory and Advanced Topics," 1st Edition, 2003, Prentice Hall (Pearson Publication), ISBN 0-13-088892-3.
4. Arun K Pujari, "Data Mining Techniques". Universities Press.
5. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education.
6. Soumen Chakravarty, Web Mining.
7. T. Mitchell, "Machine Learning", 1997, McGraw Hill.
8. S.M. Weiss and N. Indurkha, "Predictive Data Mining", 1998, Morgan Kaufmann.
9. M. Jarke, M. Lenzerni, Y. Vassiliou, and P. Vassiladis, "Fundamentals of Data Warehouses", 2000, Springer Verlag, Isbn 3-540-65365-1.