MIT-ADT UNIVERSITY
A Leap Towards World Class Education

MAEER's
MIT Art, Design and Technology University, Pune

MIT SCHOOL OF ENGINEERING, PUNE

(BOARD OF STUDIES IN COMPUTER SCIENCE AND ENGINEERING)

APPROVED COURSES

VALID FROM A. Y. 2017-2018

Prof.(Dr.) Rajneshkaur Sachdeo
Chairperson BOS,
Computer Science and Engineering,
MIT SOE

Prof.(Dr.) Rajneshkaur Sachdeo
Dean – Engineering,
MIT ADT - University

Seal

CONTENTS

MIT Art, Design and Technology University, Pune

MIT School of Engineering

DETAIL SYLLABUS

FOR

FIRST to SECOND YEAR

M.TECH. (Computer Science and Engineering)

2017-18

FACULTY OF ENGINEERING

(BOARD OF STUDIES IN COMPUTER SCIENCE AND ENGINEERING)

Prof. (Dr.) Rajneeshkaur Sachdeo

Dean Engineering

Office Seal

About the Program

Nomenclature of program: Master's Degree in Computer Science and Engineering

Program code: M. Tech - Computer Science and Engineering (**MTCS**)

Duration: 2 years

Background and Preface of the program:

The Department of Computer Science & Engineering is a discipline that integrates several fields of computing systems and engineering required to develop computer hardware and software. It mainly concerns with analyzing and solving computer-oriented problems. The customary endeavours include writing software and firmware, the erudition of operating systems, cybersecurity, networking, biomedical, embedded systems, artificial intelligence, computer graphics, computational linguistics, privacy and security, robotics, managing databases, networks and energy-efficient architectures, program languages, and machine learning and visualization.

A two-year M.Tech. Computer Science and Engineering Programme is designed to mold undergraduates to competent graduates by imparting innovative and critical thinking ability. The programme helps to reform students towards competitive market trends and challenges. It is a great opportunity for university graduates seeking complement theoretical learning with practical experience.

The students of M.Tech. programme in Computer Science and Engineering are equipped to undertake challenging trends in the Software Industry, in areas like Network security, Embedded systems and Internet of Things, Intelligent Systems, etc.

The curriculum of M.Tech-CSE programme offers interdisciplinary specializations covering the recent Business and Industry practices.

Objectives and USPs of the program:

1. To inculcate a strong learning atmosphere by enhancing teaching attainment, and assisting students to analyze, design, and implement the solution to real-world problems.
2. To prepare students with competency in rational thinking, problem-solving and providing synthesized solutions for computational complexity.
3. To embrace in-depth knowledge to demonstrate student's research ability and culture in high emerging disciplines of computer science.
4. To ensure that students instil an ability to relate academic intelligence towards the development of industry and society.
5. To instruct professionalism in students by civilizing good communication skills, entrepreneurial skills and leadership qualities.

Eligibility:

For PG Programmes, students must possess a valid score of GATE examination / MIT-PGCET.

Potential scope after completion of program:

Computer engineering graduates typically have some of the highest starting salaries in engineering. Computer engineers have the option of moving into hardware or software positions, or blending the two.

Typical industries hiring computer engineers include financial services, computer manufacturers, chemical companies, defense contractors, consulting, transportation, manufacturing, automation Industry and consumer goods. Computer engineers are equally successful in large multinational firms and small startups.

About program structure

Overall curriculum synopsis (At-a-Glance) LTP mode
Semester wise course work details with credit points
Assessment structure of the program
Detailed program outline with reference books

Follow In

(Minimum Credits to be earned: 76)

Coding for course/ subject: 17MTCS101, Where; **17** = Year of BOS, **MTCS** = Branch Code, **1**= Semester No.,**01 to N** = Sequence No of Subject.

SEMESTER-I

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTCS101	Research Methodology	3	0	0	3	40	60	100
17MTCS102	Advanced Mathematics for Computation	3	1	0	4	40	60	100
17MTCS103	Applied Algorithm	3	1	0	4	40	60	100
17MTCS104	Operating System Design	3	0	0	3	40	60	100
17MTCS1_ _	Core Elective – I	3	0	0	3	40	60	100
17MTCS111	Laboratory Practice -I	0	0	4	2	40	60**	100
17MTCS121	Technical Seminar-I	0	0	4	2	100	--	100
Total		**15**	**2**	**8**	**21**	**340**	**360**	**700**

Outcome: The students will be able to solve complex real world problems. Case studies in subjects are useful to students to work in respective industries.

SEMESTER-II

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTCS201	Network Modelling and Design	3	1	0	4	40	60	100
17MTCS202	Advanced Computer Architecture	3	0	0	3	40	60	100
17MTCS203	Compiler Optimization Techniques	3	1	0	4	40	60	100
17MTCS204	High Performance Databases	3	0	0	3	40	60	100
17MTCS2_ _	Core Elective – II	3	0	0	3	40	60	100
17MTCS211	Laboratory Practice - II	0	0	4	2	40	60**	100
17MTCS221	Mini Project	0	0	4	2	100	--	100
Total		**15**	**2**	**8**	**21**	**340**	**360**	**700**

Outcome: The students will be able to do research using different research methodologies. They will be competent to work in software industry on various platforms and in various domains.

SEMESTER-III

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTCS301	Software Design Patterns	3	1	0	4	40	60	100
17MTCS302	Infrastructure and Information Storage Management	3	0	2	4	40	60	100
17MTCS3_ _	Core Elective – III	3	1	0	4	40	60	100
17MTCS3_ _	Core Elective – IV	3	1	0	4	40	60	100
17MTCS321	Technical Seminar-II	0	0	4	2	40	60**	100
17MTCS322	Dissertation Phase-I	0	0	4	2	40	60**	100
Total		**12**	**3**	**10**	**20**	**240**	**360**	**600**

Outcome: The students will be able to know how to start their own start-up industries and how to apply the knowledge in real world scenarios.

SEMESTER-IV

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTCS421	Dissertation Phase-II	0	0	28	14	100	200	300
Total		**0**	**0**	**28**	**14**	**100**	**200**	**300**

Outcome: The students will be able to apply software engineering practices and knowledge of learnt methodologies to develop their research projects.

LIST OF ELECTIVES

Elective	Course Name	
Elective-I	17MTCS131	Information Retrieval and Data Mining
	17MTCS132	Artificial Intelligence and Machine Learning
	17MTCS133	Distributed Operating Systems
Elective-II	17MTCS231	Digital Image Processing
	17MTCS232	Neural Networks and Fuzzy logic
	17MTCS233	Mobile and Pervasive Computing
Elective-III	17MTCS331	Social Network Analytics
	17MTCS332	Bio Informatics
	17MTCS333	Green Computing
	17MTCS334	Cloud Computing
Elective-IV	17MTCS335	Natural Language Processing
	17MTCS336	Soft Computing
	17MTCS337	Wireless Sensor Networks
	17MTCS338	Software Risk and Disaster Management

Definition of Credit:-

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab)/week	1 credit

Code	Definition
L	Lecture
T	Tutorial
P	Practical
CA	Continuous Assessment
FE	Final Evaluation

Course/Subject code:

1	7	M	T	C	S	1	0	1
Year of BoS		Bachelors (BT)/ Maters of Technology(MT)/ Integrated M.Tech (MI)		BoS / Program code with/without specialization		Semester 1 - 9 and X - for tenth Semester	01 – 10 --- Theory subjects 11 – 20 --- Practical's 21 – 30 --- Technical Seminar/mini projects/projects 31 – 40 --- Elective with/ without practical's	

Assessment Structure and Passing %

Assessment	Content	Marks	Passing %	Min Marks for Passing
CA (Theory)	Assignments/ Class work / Quizzes / Tests/ Regularity / Punctuality	10 Marks	40%	40
	Mid-term Exam	30 Marks		
FE (Theory)	End term Exam	60 Marks		
CA (Practical)	Lab Assignments/ Tests/ Regularity / Punctuality / Timely submission	40	40%	40
FE (Practical)	External Examination	60 (**50 exam +10 viva = 60**)		

17MTCS101: RESEARCH METHODOLOGY 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

Unit I: Fundamentals Of Research (09 hrs)

Introduction-Meaning of Research, Objectives & Motivation, Types of Research & Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Problems Encountered by Researchers in India; **Defining a Research Problem**:- Research problem, Bringing clarity and focus to your research problem, significance of formulating research problem, Considerations in selecting a research problem, Steps in formulating a research problem.

Unit II: Research Design & Sampling (09 hrs)

Meaning, Need and Types of research design, Features of Good Design, Important concepts of research design, Different research designs, Basic Principles of research designs & important experimental designs. **Design of Sample Surveys**: - Sample design, Sampling & Non-sampling errors, Sample Surveys vs. Census Surveys, Types of Sampling Designs, Probability & Non-probability Sampling

Unit III: Measurement And Scaling Techniques (09 hrs)

Measurement in Research, Measurement Scales, Sources of Error in Measurement, Sound Measurement Test, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Multidimensional Scale, Scale Construction Techniques,

Unit IV: Data Collection & Analysis: (09 hrs)

Collection of Primary Data, Observation Method, Interview Method, Experiments & Surveys, Collection of Secondary Data, Selecting appropriate method for Data Collection, Case study method, Data Preparation process, Descriptive statistics, and Sampling & Statistical Inference; Chi-Square Tests, Anova Technique-one way & two way, Latin square design, ANOCOVA, Sign Tests, Wilcoxon Signed Rank Sum Test for single population, Mann Whitney U Test, Run Tests, Linear Regression Analysis.

Unit V: Hypothesis Testing And Report Writing: (09 hrs)

Hypothesis, Hypothesis Testing, Test Statistics & Critical Regions, Critical value & Decision Rules, Procedure for Hypothesis Testing, Hypothesis Testing for Testing Mean, Proportion & Variance, Hypothesis Testing for Difference of Two Mean, two proportions & two Variances, P-Value Approach, Power of the Test, Limitations of the Tests of Hypothesis, Report writing: Meaning, Techniques and Precautions in Interpretation, Significance of Report Writing, Different steps in Report Writing, Report Layout, Types of Reports, Oral presentation, Mechanics & Precautions for Writing Research Reports.

TEXT BOOKS:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9
2. RESEARCH METHODOLOGY a step-by-step guide for beginners by Ranjit Kumar, SAGE Publications Ltd, ISBN 978-1-84920-300-5.

17MTCS102: ADVANCED MATHEMATICS FOR COMPUTATION 3 1 0 4

(Under revision)

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

Unit I Linear Algebra (09 hrs)

Vector spaces: definition, linear independence of vectors, basis, inner product and inner product space, orthogonality, Gram-Schmidt procedure, subspaces, Matrices: coordinate-dependent linear transformations, null and range spaces, Linear algebraic equations: existence and uniqueness of solution, elementary row/column operations, Gauss elimination and Gauss Jordon methods, Echelon form, pivoting, LU decomposition and Cholesky method, Gauss-Seidel and Jacobi iterative methods,

Unit II Probability and Fuzzy Set (09 hrs)

A review of concepts of probability and random variables: Classical, relative frequency and axiomatic definitions of probability, addition rule, conditional probability, multiplication rule, Bays' Theorem.

Discrete and continuous random variables, probability mass and probability density function.

Introduction to fuzzy set, operations of fuzzy set, fuzzy arithmetic and relations, fuzzy relation equation, fuzzy logics.

Unit III Complex Variables (09 hrs)

A review of concept of limit, continuity, differentiability & analytic functions. Cauchy Riemann Equations, Line Integral in the complex plane, Cauchy Integral Theorem & Cauchy Integral Formula & its consequences, Power series & Taylor Series(in brief) ,Zeros & Singularity, Laurent' Series, Residues, Evaluation of Real Integrals

Unit IV Statistics (09 hrs)

Sampling Distributions: Chi-Square, t and F distributions. Estimation: The method of moments and the method of maximum likelihood estimation, confidence intervals for the mean(s) and variance(s) of normal populations. Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test, tests of hypotheses on a single sample, two samples

Unit V Transform Calculus (09 hrs)

Concept of Transforms, Laplace Transform(LT) and its existence, Properties of Laplace Transform, Evaluation of LT and inverse LT, Evaluation of integral equations with kernels of convolution type and its Properties, Complex form of Fourier Integral, Introduction to Fourier Transform, Properties of general (complex) Fourier Transform, Concept and properties of Fourier Sine Transform and Fourier Cosine Transform, Evaluation of Fourier Transform, Solution of ordinary differential equation and one dim.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications
3. B. Dasgupta, "Applied Mathematical Methods", Pearson Education, 2006
4. George J.Klir & Bo Yuan, "Fuzzy sets and fuzzy logic: theory and applications" Printice Hall of India.
5. Kuldeep Singh "Linear Algebra (step by step)", Oxford University Press.
6. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons
7. B.V.Ramana "Higher Engineering Mathematics",Mc Graw Hill

17MTCS103: APPLIED ALGORITHMS 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

REVIEW OF DESIGN STRATEGIES (09 hrs)

Divide and conquer, Greedy strategy, Dynamic programming, Backtracking, Branch and Bound. Max flow problem , Complexity analysis.

COMPLEXITY THEORY (09 hrs)

P, NP and NP-Complete complexity classes; A few NP-Completeness proofs.

APPROXIMATION ALGORITHMS (09 hrs)

Introduction, vertex Cover Problem, set cover, TSP, Analysis of approximation algorithms

GEOMETRIC ALGORITHMS (09 hrs)

Convex full problem – formulation, solving by Graham scan algorithm, Jarvis march algorithm; closest pair of points – problem formulation, solving by divide & conquer method.

LINEAR PROGRAMMING (09 hrs)

Formulation of Problems as Linear Programs. Duality. Simplex, Interior Point, and Ellipsoid Algorithms.

TEXT BOOKS:

1. Cormen, Leiserson, Rivest, “Introduction to Algorithms”, PHI
2. Bressard, “Fundamentals of Algorithms”, PHI
3. Horowitz, Sahni, “Fundamentals of Computer Algorithm”, Galgotia

REFERENCE BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education
2. Jon Kleinberg, Evas Tardos, “Algorithm Design”, Pearson Education
3. Algorithms, Kenneth Berman and Jerome Paul, Cenage Learning ISBN-13 978-81-315-0521-2R

17MTCS104: OPERATING SYSTEM DESIGN 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

OPERATING SYSTEM DESIGN INTRODUCTION: (09 hrs)

Basics of Operating Systems, Introduction to operating system design techniques, A virtual Computer, The Hardware Interface- The CPU, Memory and Addressing, Interrupts I/O, Devices, The Operating System Interface - System Calls, Information and Meta-Information, Operating System Objects Naming, Devices as Files, The Process, Inter –process Communication, UNIX-style Process Creation, Standard Input and Standard Output, Communicating with Pipes, Operating System Examples, The User Interface to an Operating System, Design Techniques I: Operating Systems and Design, Design Problems, Design Techniques, Two Level Implementation, Interface Design, Connection in Protocols, Interactive and Programming Interfaces, Decomposition Patterns.

PROCESS DESIGN: **(09 hrs)**

Implementation of a Simple Operating System, Implementation of Processes, System Initialization, Process Switching, System Call Interrupt Handling, Program Error Interrupts, Disk Driver Subsystem, Implementation of Waiting, Flow of Control Through the Operating System, Signaling in an Operating System, Interrupts in the Operating System, Operating Systems as Event and Table Managers, Process Implementation, Examples of Process Implementation, Mono-programming, Parallel System- Parallel Hardware, Atomic Actions, Threads, Kernel-mode Processes

INTER-PROCESS COMMUNICATION PATTERN: (09 hrs)

Patterns of Inter process communication, Process competition problems, New message-passing system calls, IPC Patterns- Mutual Exclusion, Signaling, Rendezvous, Producer-Consumer, Client-Server, Multiple Servers and Clients, Database Access and Update, Failure of Processes, Processes: Everyday Scheduling, Preemptive Scheduling Methods, Policy versus Mechanism in Scheduling, Scheduling in Real Operating Systems, Deadlock, Two Phase Locking, Starvation, Synchronization, Semaphores, Programming Language Based Synchronization Primitives, Message Passing Design Issues, Design Techniques II: Indirection, Using State Machines, Win Big Then Give Some Back, Separation of Concepts, Reducing a Problem to a Special Case, Reentrant Programs, Using Models for Inspiration, Adding a New Facility To a System.

MEMORY MANAGEMENT: (09 hrs)

Levels of Memory Management, Linking and Loading a Process, Variations in Program Loading, The Memory Management Design Problem and solution, Dynamic Memory Allocation, Keeping Track of the Blocks, Multiprogramming Issues, Memory Protection, Memory Management System Calls, Multiprogramming Issues, Memory Protection, Virtual Memory-Implementing Virtual Memory, Virtual Memory Systems, Design Techniques III: Multiplexing, Late binding, Static Versus Dynamic, Space-Time Tradeoffs, Simple Analytic Models

I/O DEVICES, FILE SYSTEMS AND RESOURCE MANAGEMENT: (09 hrs)

I/O Devices, I/O Systems, File Systems- File Naming, File System Objects and Operations, File System Organization-File Storage Methods, Resource Management: Types of Resources, Integrated Scheduling, Queuing Models of Scheduling, Protection of Resources, User Authentication, Mechanisms for Protecting Hardware Resources, Representation of Protection Information, Mechanisms For Software Protection, The Client Server Mode Design Techniques IV: Caching, Optimization and Hints, Hierarchical Names, Naming of Objects, Unification of Concepts.

TEXT BOOKS:

1. Charles Crowley, " Operating System: A Design-Oriented Approach", Tata McGraw-Hill

REFERENCES:

1. Andrew S. Tanenbaum, Albert S. Woodhull, "Operating Systems Design and Implementation", Third Edition, Prentice Hall
2. Maurice Bach, "The Design of the Unix Operating System", Prentice-Hall

17MTCS111: LABORATORY PRACTICE – I 0 0 4 2

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

Sr. No.	Assignment Title
1.	Write program to simulate system calls of operating system.
2.	Write a kernel module and recompile the kernel.
3.	Building cubes and OLAP analysis
4.	Map Reduce and Hadoop Implementation for Distributed Computing
5.	Mini Project : Selection of problem to give solution so that the concepts of Algorithms Analysis , Data bases and Distributed Systems can be applied.

17MTCS121: TECHNICAL SEMINAR-I **0 0 4 2**

CA : 100 Marks FE : 00 Marks No. of Total Lectures = 30 Hours

State-of-the-art topic should be approved by the guide; useful for professional growth in the field of expertise. The presentation should cover motivation, mathematical modelling, data-table discussion and conclusion. The reports should be prepared using LATEX derivative. To maintain the quality of the seminar work it is mandatory on the seminar guides to maintain a progressive record of the seminar contact of 1 per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table (as additional teaching load); such record of progressive work shall be referred by the examiners during evaluation.

17MTCS201: NETWORK MODELING AND DESIGN 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION: (09 hrs)

Overview of Analysis, Architecture, and Design Processes, A Systems Methodology, Service Characteristics & Description, Performance Characteristic, User Requirements, Application, device & network Requirement, Gathering and Listing Requirements, Developing Service Metrics, Characterizing Behavior, Developing RMA Requirements, Developing Delay Requirements, Developing Capacity Requirements.

FLOW ANALYSIS: (09 hrs)

Flows, Identifying and Developing Flows, Data Sources and Sinks, Flow Models, Flow Prioritization, Example Application of Flow Analysis, Example Application of Flow Analysis.

NETWORK ARCHITECTURE: (09 hrs)

Component Architectures, Reference Architecture, Architectural Models, Systems and Network Architectures, Addressing Mechanisms, Routing Mechanisms, Addressing Strategies, Routing Strategies.

NETWORK MANAGEMENT, PERFORMANCE ARCHITECTURE: (09 hrs)

Defining Network Management, Network Management Mechanisms, Architectural Considerations, Scaling Network Management Traffic, Checks and Balances, Managing Network Management Data, Developing Goals for Performance, Performance Mechanisms, Architectural Considerations.

NETWORK DESIGN: (09 hrs)

Design Concepts, Design Process, Vendor, Equipment, and Service-Provider Evaluations, Network Layout, Design Traceability, Design Metrics.

TEXT BOOKS:

1. Network Analysis, Architecture & Design, 3rd Edition, James D. McCabe, Morgan publication

REFERENCES:

1. Top Down Network Design, CISCO, Priscilla Oppenheimer, 3rd edition
2. Analysis of Computer and Communication Networks, Fayez Gebali, Springer Science & Business Media, 24-Jun-2008 - Technology & Engineering

17MTCS202: ADVANCED COMPUTER ARCHITECTURE 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

OVERVIEW OF COMPUTER DESIGN: (09 hrs)

Review of Fundamentals of CPU, Memory and IO, Necessity of high performance, Constraints of conventional architecture, Parallelism in uni-processor system, Evolution of parallel processors, future trends, Architectural Classification, Applications of parallel processing, Performance Metrics and Measures, Speedup Performance Laws.

INSTRUCTION LEVEL AND DATA LEVEL PARALLEL PARALLELISM: (09 hrs)

ILP concepts – Pipelining overview – Compiler Techniques for Exposing ILP – Dynamic Branch Prediction – Dynamic Scheduling – Multiple instruction Issue – Hardware Based Speculation – Static scheduling – Multi-threading – Limitations of ILP – Case Studies. Vector architecture – SIMD extensions – Graphics Processing units – Loop level parallelism

MULTIPROCESSORS AND THREAD LEVEL PARALLELISM: (09 hrs)

Symmetric and Distributed Shared Memory Architectures – Performance Issues –Synchronization – Models of Memory Consistency – Case studies: Intel i7 Processor, SMT & CMP Processors, Introduction to Multithreading

MEMORY AND I/O: (09 hrs)

Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time – Main memory and performance – Memory technology. Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system.

STUDY OF PARALLEL PROGRAMMING CONCEPTS: (09 hrs)

Parallel algorithms for multiprocessors, classification of parallel algorithms, performance of parallel algorithms Operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI), Threads (in shared memory system) ,Parallel Programming Languages : Fortran 90, Occam, C-Linda, CCC etc.

TEXT BOOKS:

1. John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th. edition, 2007.
2. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill

REFERENCES:

1. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGrawHill international Edition
2. Sima D, Fountain T and Kacsuk P, "Advanced Computer Architectures: A Design Space
3. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture: A hardware/software approach" , Morgan Kaufmann /Elsevier Publishers, 1999.
4. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003

17MTCS203: COMPILER OPTIMIZATION TECHNIQUES 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION: (09 hrs)

The Structure of a Compiler, The Science of Building of Compiler and Applications, Overview of lexical analysis, Lexical analyzer generator, Syntax Analysis, Parser Generator, Conceptual view of Syntax Directed Translation, how compiler optimization works, Optimizing Compiler, Types of Optimization.

CONTROL FLOW AND DATA FLOW ANALYSIS: (09 hrs)

Control Flow Analysis and Data Flow Analysis, Control Flow Graphs, Basic Blocks and Flow Graphs, Optimizations of Basic Blocks, DAG representation of basic blocks, optimizing transformations, Principle Sources of Optimization, Loop Optimizations, LLVM compiler to carry on simple optimizations. Data Flow Analysis- Data Flow Based on any or all paths, Data Flow-Based Optimizations, Partial Redundancy Elimination (PRE), The worklist algorithm, better ordering of the constraints and influence on the performance of the algorithm, Constraint Based Analysis, Tainted Flow Analysis.

PARALLEL AND DISTRIBUTED COMPILERS: (09 hrs)

Instruction Level Parallelism, Processor Architecture- Code Scheduling Constraints, Basic Block Scheduling, Global Scheduling, Software Pipelining. Parallel programming models, Processes and threads, Shared variables Message passing, Parallel Object Oriented languages, Tuple space, Automatic Parallelization, Predictive Modeling in a Polyhedral Optimization Space, Polyhedral Compiler Framework. High Level View of JVM, JVM Interpreter, Dynamic Compilation Techniques, Basic Structure of a Dynamic Compiler, Recompilation Policies.

OPTIMIZING FOR PARALLELISM AND INTERPROCEDURAL ANALYSIS: (09 hrs)

Matrix Multiply, Iteration Spaces, Data Reuse and Array Data Dependence Analysis. Finding Synchronization, Free Parallelism, Synchronization between Parallel Loops, Pipelining Locality Optimizations. Basic Concepts- Need of Interprocedural Analysis, Logical Representation of Data Flow, Simple Pointer Analysis Algorithm, Context Sensitive Interprocedural Analysis. Feedback Directed Optimization (FDO), Advantages, Challenges of FDO, Pettis Hansen Layout Algorithm, Procedure Positioning.

FUNCTIONAL AND LOGIC PROGRAMS: (09 hrs)

Functional languages - introduction to Functional Programs, basic compilation, polymorphic type checking, desugaring, Case Study of HASKELL-a functional programming language, compiling to a register-oriented architectures JavaCC.

REFERENCES:

1. A V Aho, R Sethi, J D Ullman, “Compilers: Principles, Techniques, and Tools", Pearson Edition, ISBN 81-7758-590-8.
2. Compiler Construction Using Java, JavaCC and Yacc, Anthony J. Dos Reis, Wiley ISBN 978-0-470-94959-7.
3. R Levin, T Mason, D Brown, \Lex and Yacc", O'Reilly, 2000 ISBN 81-7366-061-X.
4. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence-based Approach”, Morgan Kaufmann Publishers.
5. Steven S. Muchnick, “Advanced Compiler Design and Implementation”, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint.
6. Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Morgan Kaufmann Publishers Elsevier Science, 2004.

17MTCS204: HIGH PERFORMANCE DATABASES 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION: (09 hrs)

High performance Issues and concerns in databases, Database Tuning and Performance: benchmarking, Object Transaction Management, NOSQL Databases- Transaction Management, Performance Tuning.

QUERY OPTIMIZATION: (09 hrs)

Physical layer, Access Methods, Query Optimization, DBMS buffers, caches, and optimization high level query languages and low level primitive operations, join algorithms. MySQL Case Study.

ADVANCED CONCEPTS IN TRANSACTION MANAGEMENT: (09 hrs)

ACID properties, pessimistic locking, optimistic locking, flat transactions, nested transactions, deadlock detection and management; Recovery: write-ahead logging, shadow paging; Indexing structures: Btrees, hash files, multi-attribute indexing; Distributed databases, Schemas, Architectures, Queries, Transactions

DATA WAREHOUSING: (09 hrs)

Heterogeneous information; the integration problem; the Warehouse Architecture; Data Warehousing; Warehouse DBMS, Data Warehouse Models and OLAP operations. ETL, materialized views, Dashboards, BI Data Mining: KDD process, Data mining applications, Data mining Techniques and Algorithms

EMERGING TRENDS IN DATABASES: (09 hrs)

NOSQL databases, BIG DATA, Databases on Hadoop, Semantic databases, emerging database technology case studies, Distributed Databases: Case Studies, Parallel Databases: Case Study

TEXT BOOKS:

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan “Database System Concepts”, Fifth Edition, TMH
2. Thomas Connolly, Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management “, 3rd edition, Pearson Education, LPE

REFERENCES:

1. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”,
2. Jiawei Han, Micheline Kamber, “Data Mining”, Second Edition, Elsevier
3. Ian H. Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Second Edition, (Morgan Kaufmann Series in Data Management

17MTCS211: LABORATORY PRACTICE – II 0 0 4 2

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

Sr. No.	Assignment Title
1.	Design and Analyze a Network (problem statement can be selected by student)
2.	Build a cluster using MPI. Implement a Calculator application using MPI
3.	Reverse a sting input using Haskell Programming.
4.	Elective: Course Instructor can frame Min 2 Assignment on Elective subject. The assignments framed should be on the basis of standard research papers.

17MTCS221: MINI PROJECT 0 0 4 2

CA : 100 Marks FE : 00 Marks No. of Total Lectures = 30 Hours

- Mini-project statement should be selected based on the subjects in current semester.
- Topic should highlight/demonstrate current trends and technology.

Guidelines:

1. Students should select a problem which addresses some basic home, office or other real life applications.
2. Students should understand testing of various components.
3. Students should see that final product submitted by them is in working condition
4. Students should submit the report along with the project.

17MTCS301: SOFTWARE DESIGN PATTERNS 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

BASICS OF SOFTWARE DESIGN PATTERNS: (09 hrs)

Introduction to Software Design, Basics of Software Design Patterns, Why study Design Patterns, Elements of Software Design Pattern, Design Patterns in Smalltalk MVC, Design Patterns Description, Design Patterns Catalog organization, Using Design Patterns to solve Design Problems, Selecting a Design Pattern, Using a Design Pattern, Types of Design Patterns- Creational, Structural, Behavioral.

CREATIONAL PATTERNS & STRUCTURAL PATTERNS: (09 hrs)

Abstract Factory, Builder, Factory Method, Prototype, Singleton Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy

BEHAVIORAL PATTERNS: (09 hrs)

Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor.

DESIGN PATTERNS IN SOFTWARE ARCHITECTURE AND ADVANCES: (09 hrs)

Introduction, Patterns in Software Architecture, Enabling Techniques for Software Architecture, Non-functional Properties of Software Architecture,
Advances: Pattern-Mining, Pattern Organization and Indexing, Methods and Tools, Algorithms, Data Structures and Patterns, Formalizing Patterns

CASE STUDY: (09 hrs)

Designing a Document Editor- Design Problems, Document Structure, Formatting, Creating the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation, Future of Design Patterns

TEXT BOOKS:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of Reusable object-oriented software", Addison-Wesley, 1995.
2. Alan Shalloway, James R. Trott, "Design Patterns Explained", Addison-Wesley,2004

REFERENCES:

1. Frank Benchmann, Regine Meunier, Hans Rohnert, "Pattern Oriented Software Architecture", Volume 1, 1996.
2. Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson, "Head First Design Patterns: A Brain-Friendly Guide", 1st Edition, O"Reilly

17MTCS302: INFRASTRUCTURE AND INFORMATION STORAGE MANAGEMENT **3 0 2 4**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO STORAGE TECHNOLOGY AND STORAGE SYSTEMS ARCHITECTURE: **(09 hrs)**

Information Storage, Review of data creation, Understand the value of data to a business, Challenges in Data Storage and Management, Managing Information, Information lifecycle, Components of a Storage System Environment, Disk Drive Components, Disk Drive Performance, Logical Components of the Host, Concept of RAID and its components, RAID levels and their applications for: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Intelligent Storage System (ISS) and its components

NETWORKED STORAGE TECHNOLOGIES AND VIRTUALIZATION: **(09 hrs)**

Evaluation of networked storage, its architecture, Direct Attached Storage, components of Storage Area Networks (SAN): Fibre Channel (FC) Connectivity, FC Ports, FC Architecture, FC Topologies, Network-Attached Storage (NAS): Benefits, Components, Implementation, File Sharing and I/O Operations, Content-Addressed Storage (CAS): Features, Architecture, Examples,

Storage Virtualization: Forms of Virtualization, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization: Block-Level Storage Virtualization, File-Level Virtualization, Storage Security Framework, Storage Security Domains, Basics of Security Implementations

BUSINESS CONTINUITY AND DISASTER MANAGEMENT: **(09 hrs)**

Concept of information availability and its measurement, Business Continuity Terminology, Causes and consequences of downtime, Information Availability, backup/recovery purposes and considerations, architecture and different backup-recovery technologies, Local replication technologies and their operation, remote replication technologies and their operation.

INTRODUCTION TO INFRASTRUCTURE MANAGEMENT AND BUILDING INFRASTRUCTURE: **(09 hrs)**

Basics of Infrastructure management activities, Growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business, Building IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Infrastructure Assessment Program, Service Level Agreement, Information Technology Infrastructure Library(ITIL).

SERVICE MANAGEMENT: **(09 hrs)**

Service Delivery Processes- Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management, Service Support Processes- Configuration Management, Service desk. Incident management, Problem management, Change management, Release management.

TEXT BOOKS:

1. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition ISBN: 978-1-118-09483-9 Format: Paper Publisher: Wiley, ©2012 Publisher's web-site: http://www.wiley.com
2. Jan Van Bon, "Foundations of IT Service Management: based on ITIL", Van Haren Publishing, 2nd edition 2005

REFERENCES:

1. Building Storage Networks, Marc Farley, Tata Mcgraw Hill, Osbourne, 2001
2. Storage Networks: The Complete Reference, Tata Mcgraw Hill, Osbourne, 2003
3. Meet Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.
4. Harris Kem, Stuart Gaiup, Guy Nemiro, "IT Organization: Building a Worldclass Infrastructure", Prentice Hall, 2000

17MTCS321: TECHNICAL SEMINAR-II **0 0 4 2**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

Seminar based on state-of-the art in the selected electives/current trends/innovations/research. The presentation and the report should cover motivation, mathematical modelling, data-table discussion and conclusion. The reports should be prepared using LATEX derivative. To maintain the quality of the seminar work it is mandatory on the seminar guides to maintain a progressive record of the seminar contact hour of 1 hour per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table (as additional teaching load); such record of progressive work shall be referred by the examiners during evaluation.

17MTCS322: DISSERTATION PHASE-I **0 0 4 2**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

Motivation, Problem statement, survey of journal papers related to the problem statement, problem modelling and design using set theory, NP-Hard analysis, SRS, UML, Classes, Signals, Test scenarios and other necessary, problem specific UML, software engineering documents. Student should publish one International Journal Paper (having ISSN Number and preferably with Citation Index II); or paper can be published in reputed International Journal recommended by the guide of the Dissertation and in addition to above the term work shall include the paper published, reviewers comments and certificate of presenting the paper in the conferences . To maintain the quality of the dissertation work it is mandatory on the dissertation guides to maintain a progressive record of the dissertation contact of 1 per week which shall include the dissertation discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student.

17MTCS421: DISSERTATION PHASE-II **0 0 28 14**

CA : 100 Marks FE : 200 Marks No. of Total Lectures = 210 Hours

Selection of Technology, Installations, UML implementations, testing, Results, and performance discussions using data tables per parameter considered for the improvement with existing known algorithms and comparative graphs to support the conclusions drawn. Student should publish one International Journal Paper (having ISSN Number and preferably with Citation Index II/Scopus/SCI/WoS); or paper can be published in reputed International Journal recommended by the guide of the Dissertation and in addition to above the term work shall include the paper published, reviewers comments and certificate of presenting the paper in the conference.

The project report to be prepared with the approval of Guide using appropriate documentation tool (LATEX) with the following points:

- Motivation,
- Problem statement,
- Literature Survey,
- Analysis & Modelling,
- SRS,
- UML Diagrams,
- Test scenarios
- Experimental Results and
- The other necessary, problem specific software engineering documents.

Student should refer standard journal papers such as IEEE, ACM, Springer Elsevier, etc,

Students must have:

- **Paper Publication of the research work in standard journals with the approval of Guide.**
- **Paper Presentation in standard International Conferences with the approval of Guide.**

7MTCS131: INFORMATION RETRIEVAL AND DATA MINING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION: (09 hrs)

Introduction to data mining, Data mining functionalities, clustering - k means algorithm, classification - decision tree, Baysian classifiers, Outlier analysis, association rules - apriori algorithm, Introduction to text mining, Implementing Clustering - k means algorithm, Analysis of Decision tree.

INFORMATION RETRIEVAL: (09 hrs)

Introduction -History of IR- Components of IR, Open source Search engine Frameworks, The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus Web Search, and Components of a Search engine- Characterizing the web. Boolean and vector-space retrieval models- Term weighting ,TF-IDF weighting- cosine similarity ,Preprocessing ,Inverted indices ,efficient processing with sparse vectors ,Language Model based IR ,Probabilistic IR –Latent Semantic Indexing ,Relevance feedback and query expansion.

WEB SEARCH & CRAWLING: (09 hrs)

Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement, search engine optimization/spam, Web Search Architectures, crawling, meta-crawlers- Focused Crawling, web indexes, Near-duplicate detection, Index Compression, XML retrieval.

LINK ANALYSIS AND SPECIALIZED SEARCH: (09 hrs)

Link Analysis –hubs and authorities ,Page Rank and HITS algorithms -Searching and Ranking ,Relevance Scoring and ranking for Web ,Similarity , Hadoop & Map Reduce ,Evaluation ,Personalized search ,Collaborative filtering and content-based recommendation of documents and products.

DOCUMENT TEXT MINING: (09 hrs)

Information filtering; organization and relevance feedback, Text Mining -Text classification and clustering, Categorization algorithms: naive Bayes; decision trees; and nearest neighbor, clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

TEXT BOOKS:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press
2. Ricardo Baeza -Yates and Berthier Ribeiro – Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books

REFERENCES:

1. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley
2. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.
3. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press
4. Ophir Frieder “Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series “, 2nd Edition, Springer

17MTCS132: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

EXPERT SYSTEMS: (09 hrs)

Structure of a rule-based expert system, Fundamental characteristics of an expert system , Forward chaining and backward chaining inference techniques , demonstration / application of rule-based expert system, Conflict resolution ,Advantages and disadvantages of rule-based expert systems, Uncertainty management in rule-based expert systems, Introduction, or what is uncertainty? Basic probability theory, Bayesian reasoning, Bayesian accumulation of evidence, Bias of the Bayesian method Certainty factors theory and evidential reasoning, an application of certainty factors.

FUZZY AND FRAME BASED EXPERT SYSTEMS: (09 hrs)

Fuzzy rules, Fuzzy inference, Building a fuzzy expert system, Frame-based expert systems, Introduction, or what is a frame? Frames as a knowledge representation technique, Inheritance in frame-based systems, Methods and demons, Interaction of frames and rules, Buy Smart: a frame-based expert system.

EVOLUTIONARY COMPUTATION: (09 hrs)

Introduction, or can evolution be intelligent? Simulation of natural evolution, Genetic algorithms, Why genetic algorithms work, Case study: maintenance scheduling with genetic algorithms, Evolution strategies , Genetic programming.

ARTIFICIAL NEURAL NETWORKS: (09 hrs)

Artificial neural networks , Introduction, or how the brain works , The neuron as a simple computing element , The perceptron, Multilayer neural networks, Accelerated learning in multilayer neural networks, The Hopfield network, Bidirectional associative memory.

KNOWLEDGE ENGINEERING & MACHINE LEARNING: (09 hrs)

Introduction to Machine Learning, Supervised, unsupervised methods , Knowledge engineering and data mining, Introduction to machine learning approaches - k-means, Naïve Bayes, Self Organizing Maps.

TEXT BOOKS:

1. Stuart Russell and Peter Norvig (1995), “Articial Intelligence: A Modern Approach”, Third edition, Pearson, 2003.
2. Parag Kulkarni and Prachi Joshi, “Artificial Intelligence Building Intelligent Systems”, PHI learning Pvt. Ltd., ISBN 978-81-203-5046-5, 2015.
3. Jiawei han, Micheline Kamber, "Data Mining: Concepts and systems", Morgan Kaufmann Publishers

REFERENCES:

1. Elaine Rich and Kevin Knight “Artificial Intelligence”, Tata McGraw Hill, 1991
2. Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley, 1992
3. Machine Learning,Tom Mitchell,McGraw Hill, 1997,ISBN: 978-0-070-42807-2

17MTCS133: DISTRIBUTED OPERATING SYSTEMS 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO DISTRIBUTED SYSTEMS: (09 hrs)

Goals, Types of Distributed systems, Architectural styles, System architectures, Architectures versus middleware, Processes, Threads in Distributed Systems, Role of Virtualization in Distributed Systems, Clients, Server design issues, Code migration, Communication ,Types of Communication, Remote procedure call, Parameter Passing, Asynchronous RPC, Message-oriented communication, Stream-oriented communication, Multicast communication, Naming.

SYNCHRONIZATION: (09 hrs)

Clock synchronization, Physical Clocks, Global Positioning System, Clock Synchronization Algorithms, Logical clocks, Lamport's Logical Clocks, Vector Clocks, Mutual exclusion, Centralized algorithm, Decentralized algorithm, Distributed algorithm, Token ring algorithm, Global positioning of nodes, Election algorithms, Traditional election algorithms, Elections in wireless environments, Elections in large-scale systems, Distributed Mutual Exclusion, Distributed Deadlock detection, Agreement Protocols.

CONSISTENCY AND REPLICATION: (09 hrs)

Introduction, Reasons for Replication, Replication as Scaling Technique, Data-centric consistency models: Continuous Consistency, Consistent Ordering of Operations; Client-centric consistency models, Eventual Consistency, Monotonic Reads, Monotonic Writes, Read Your Writes, Writes Follow Reads, Replica management, Replica-server placement, Content replication and placement, Content Distribution, Consistency protocols, Continuous Consistency, Primary-Based Protocols, Replicated-Write Protocols, Cache-coherence protocols, Implementing client-centric consistency.

FAULT TOLERANCE AND SECURITY: (09 hrs)

Introduction to fault tolerance, Process resilience, Reliable client-server communication, Reliable group communication, Distributed commit, Recovery, Introduction to security, Secure channels, Access control, Security management.

DISTRIBUTED FILE SYSTEMS: (09 hrs)

Architecture, Processes, Communication, Naming, Synchronization, Consistency and replication, fault tolerance, Security, Case Study- Grid Computing, SOA, Green Computing.

TEXT BOOKS:

1. Distributed System Principles and Paradigms – Andrew S. Tanenbaum, PHI
2. Distributed O.S Concepts and Design - P.K.Sinha, PHI

REFERENCES:

1. Advanced concepts in Operating Systems - Mukesh Singhal & N.G.Shivaratri, TMH

17MTCS231: DIGITAL IMAGE PROCESSING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION: (09 hrs)

Fundamental steps of image processing, components of an image processing of system, the image model and image acquisition, sampling and quantization, station ship between pixels, distance functions, scanner.

STATISTICAL AND SPATIAL OPERATIONS: (09 hrs)

Grey level transformations, histogram equalization, smoothing & sharpening-spatial filters, frequency domain filters, homomorphic filtering, image filtering & restoration:-Inverse and weiner filtering. FIR weiner filter, Filtering using image transforms, smoothing splines and interpolation.

MORPHOLOGICAL AND OTHER AREA OPERATIONS: (09 hrs)

Basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms, extension to grey scale images. Segmentation and Edge detection region operations, basic edge detection, second order detection, crack edge detection, gradient operators, compass and laplace operators, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds.

IMAGE COMPRESSION: (09 hrs)

Types and requirements, statistical compression, spatial compression, contour coding, quantizing compression, image data compression-predictive technique, pixel coding, transfer coding theory, lossy and lossless predictive type coding. Basics of color image processing, pseudocolor image processing, color transformation, color smoothing and sharpening, color segmentation, color image compression, compression standards.

IMAGE TRANSFORMS: (09 hrs)

Fourier, DFT, DCT, DST, Haar, Hotelling, Karhunen -Loeve, Walsh, Hadamard, Slant. Representation and Description - Chain codes, Polygonal approximation, Signatures Boundary Segments, Skeltons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, PCA.

TEXT BOOKS:

1. Digital Image Processing – by Rafael.C.Gonzalez & Richard E.Woods, 3rd edition, Pearson Education, 2008.
2. Digital Image Processing, M.Anji Reddy, Y.Hari Shankar, BS Publications.
3. Fundamentals of Digital Image Processing – by A.K. Jain, PHI.

REFERENCES:

1. Digital Image Processing – William K, Part I - John Wiley edition.
2. Digital Image Processing using MATLAB – by Rafael.C.Gonzalez, Richard E.Woods, & Steven L.Eddins, Pearson Education, 2006
3. Digital Image Processing, Kenneth R. Castleman, Pearson Education, 2007

17MTCS232: NEURAL NETWORK AND FUZZY LOGIC 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION: (09 hrs)

Characteristics of Neural Networks, Biological neuron, Artificial neuron, Neuron modeling, Learning rules-Single layer-Multi layer feed forward network, Back propagation-Learning factors.

LEARNING: (09 hrs)

The Perceptron and its learning law, Adaptive networks, Supervised Learning Neural Networks, Radial basis function networks, Modular neural networks, Neuro-dynamic programming and reinforcement learning, Competitive learning.

FUZZY SYSTEMS: (09 hrs)

Classical sets, Fuzzy sets, Fuzzy relations, Fuzzification, Defuzzification, Fuzzy rules.

FUZZY SETS: (09 hrs)

Fuzzy sets; fuzzy rules and fuzzy reasoning, temporal fuzzy logic, fuzzy systems, fuzzy associative memories, fuzzy rule generation using neural net approaches, fuzzy inference systems, fuzzy neural networks.

APPLICATIONS: (09 hrs)

Applications of Neural Networks and Fuzzy Systems, Pattern classification, Associative memories, combinatorial optimization, Applications in decision making.

TEXT BOOKS:

1. B. Kosko , (1994), 'Neural Networks and Fuzzy Systems: A dynamical systems approach to machine intelligence,' Prentice Hall India.
2. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, John Willey and Sons, West Sussex, England, 2005.

REFERENCES:

1. Haykin, ―Neural Network a comprehensive Foundation‖, PHI
2. James A Freeman, David M Skapura, ―Neural Networks-Algorithms, Applications and Programming Techniques,‖ Person Education
3. S.V. Kartalopoulas , 'Understanding Neural networks and Fuzzy Logic,' IEEE Press and Prentice Hall India.
4. Klir G.J. &Folger T.A., “Fuzzy sets, Uncertainty and Information”, Prentice –Hall of India Pvt. Ltd., New Delhi, 2008.

17MTCS233: MOBILE AND PERVASIVE COMPUTING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

SATELLITE SYSTEMS & BROADCAST SYSTEMS: (09 hrs)

History & Applications of Satellite Systems, Basics of Satellite Systems, Routing, Localization, Handover, Overview of Broadcast Systems, Cyclical repetition of data, Digital audio broadcasting, Digital video broadcasting, Convergence of broadcasting and mobile communications.

MOBILE NETWORK LAYER: (09 hrs)

Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimizations, Reverse tunneling, IPv6, IP micro-mobility support, Dynamic host configuration protocol, Mobile ad-hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Alternative metrics, Overview ad-hoc routing protocols.

MOBILE ADHOC NETWORK: (09 hrs)

MANET Characteristics, Classification of MANETS, Technologies for MANET networks, Routing, Proactive routing protocols, reactive routing protocols, Comparision between DSR and AODV, Tools and Techniques for Dynamic Reconfiguration and Interoperability of Pervasive Systems.

PERVASIVE COMPUTING AND ITS SIGNIFICANCE: (09 hrs)

Research Trends in Pervasive Computing and Networking, Mobile Agent Technology: Introduction, Mobile Agent Security, Mobile Agent Platforms, Sensor Networks : Introduction, Sensor Network Applications, Dynamic Reconfiguration of Sensor Networks, Collaboration and Interoperability Among Sensor Networks, Applications : A Pervasive System for Volcano Monitoring, A Pervasive Computing Platform for Individualized Higher Education.

PERVASIVE LEARNING TOOLS AND TECHNOLOGIES: (09 hrs)

Introduction, Pervasive Learning: A Promising Innovative Paradigm, Historical Development of Computing and IT in Education, Past Experience and Issues, Practice and Challenge at Waseda E-School, Emerging Technologies and Systems for Pervasive Learning: Emerging Computing Paradigms for Education, Pervasive Learning Support Systems and Technologies, Integration of Real-World Practice and Experience with Pervasive Learning: Ubiquitous Learning, UPS (Ubiquitous Personal Study), Nature of Pervasive Learning and Provision of Well-Being in Education: Ubiquitous and Pervasive, The Possible Trend of Pervasive Technology in Education, Standards and Implementation of Pervasive Computing Applications.

TEXT BOOKS:

1. Garg, Kumkum, "Mobile Computing", Pearson Education India, 2010
2. Jochen H. Schiller,"Mobile Communications", 2nd Edition, Addison-Wesley, 2003
3. MOHAMMAD S. OBAIDAT, MIESO DENKO AND ISAAC WOUNGANG, "PERVASIVE COMPUTING AND NETWORKING", Wiley Publication

REFERENCES:

1. Asoke K. Talukdar, "Mobile Computing", 2ndEdition, Tata McGraw-Hill Education, 2010
2. Raj Kamal, "Mobile Computing", 2nd Edition, Oxford Higher Education/Oxford University Press, 2014

17MTCS331: SOCIAL NETWORK ANALYTICS 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

GRAPH THEORY AND SOCIAL NETWORK: (09 hrs)

Graphs basic definitions, strong and weak ties, homophily, positive and negative relationships.

NETWORK MODELS: (09 hrs)

Poisson Random Networks, Exponential Random Graph Models, Growing Random Networks, Preferential Attachment and Power Laws, Hybrid models of Network Formation.

INFORMATION DIFFUSION ON NETWORK: (09 hrs)

Empirical Background, Information Cascades, Random Network Models of Contagion, SI Model, SIR Model , SIS model, SIRS Model.

LEARNING ON NETWORKS : (09 hrs)

Bayesian Learning on Networks, The DeGroot Model of Learning on a Network, Convergence of Beliefs, The Wisdom of Crowds, How Influence depends on Network Position.

GAMES ON NETWORKS: (09 hrs)

Network Games, Peer Influences: Strategic Complements and Substitutes, the Relation between Network Structure and Behavior, A Linear Quadratic Game, Repeated Interactions and Network Structures.

TEXT BOOKS:

1. Networks, Crowds, and Markets (2010) by D. Easley & J. Kleinberg (online textbook)
2. Introduction to Social Networks Methods (2005) by R. Hanneman & M. Riddle (online textbook)

REFERENCES:

1. Kadushin, C. (2012). Understanding social networks: Theories, concepts, and findings. Oxford University Press.
2. Prell, C. (2011). Social network analysis: History, theoryand methodology. Sage.
3. Scott, John. Social network analysis. Sage, 2012. (Google eBook)
4. Wasserman, S. (1994). Social network analysis: Methods and applications (Vol. 8). Cambridge university press. (Google eBook)

17MTCS332: BIOINFORMATICS 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO BIOINFORMATICS AND DATA GENERATION: (09 hrs)

History of Bioinformatics, bioinformatics and its relation with molecular biology, Introduction to Data Mining, Applications of Data Mining to Bioinformatics Problems and Applications of Bioinformatics, Examples of related tools(FASTA, BLAST, BLAT, RASMOL) and software(RASMOL,Ligand Explorer).

BIOLOGICAL DATABASE AND ITS TYPES: (09 hrs)

Introduction to data types and Source, Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases : Nucleic acid databases (NCBI, DDBJ, and EMBL),Protein databases (Primary, Composite, and Secondary),Specialized Genome databases: (SGD, TIGR, and ACeDB),Structure databases (CATH, SCOP, and PDBsum)

BIOCOMPUTING: (09 hrs)

Introduction to String Matching Algorithms, BLAST & FASTA Sequence Comparison and Alignment Tools, Use of Biochemical Scoring Matrices, Automated Gene Prediction, Introduction to Gene Arrays, Analysis of Gene Arrays.

DATA STORAGE AND RETRIEVAL AND INTEROPERABILITY: (09 hrs)

Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, ASTA, PDB, SwissProt).Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search.The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

SYSTEMS BIOLOGY: (09 hrs)

Current Advancements in Bioinformatics: Introduction to System Biology, Structural Biology, Structural bioinformatics, Chemoinformatics, Immunoinformatics, Introduction, History, Associated disciplines, Markov chain, Machine Learning Methods, Hidden Markov models, Applications of HMM in gene identification and Profiles HMMs.

TEXT BOOKS:

1. Claverie, J.M. and Notredame C. 2003 Bioinformatics for Dummies. Wiley Editor.
2. Baldi, P. and Brunak, S. 1998 Bioinformatics. The MIT Press.
3. Setubal, J. and Meidanis, J. 1996 Introduction to Computational Molecular Biology. PWS Publishing Co., Boston.

REFERENCES:

1. Lesk, A.M. 2002 Introduction to Bioinformatics. Oxford University Press.
2. Mont, D.W., Bioinformatics: Sequence and Genome Analysis.
3. Evens, W.J. and Grant, G.R., Statistical Methods in Bioinformatics: An Introduction.

17MTCS333: GREEN COMPUTING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

FUNDAMENTALS OF GREEN COMPUTING: (09 hrs)

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics. Initiatives and Standards:Global Initiatives: United Nations, Basel Action Network, Basel Convention, North America: The United States, Canada, Australia, Europe, WEEE Directive, RoHS, National Adoption, Asia: Japan, China, Korea.

GREEN ASSETS AND MODELING: (09 hrs)

Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration - Green Enterprise Architecture, Environmental Intelligence,Green Supply Chains,Green Information Systems: Design and Development Models.

GREEN IT SERVICES: (09 hrs)

Terminal servers, Power management, Operating system support, Power supply, Storage, Video card, Display, Tools for monitoring. A model for sustainable software engineering, Role of generic knowledge base in enhancing sustainability, sustainability relevant criteria, sustainable development.

GREEN COMPLIANCE: (09 hrs)

Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap, Green Compliance: Protocols, Standards, and Audits ,Emergent Carbon Issues: Technologies and Future.

CASE STUDIES: (09 hrs)

The Environmentally Responsible Business Strategies (ERBS) ,Case Study Scenarios for Trial Runs Case Studies -Applying Green IT Strategies and Applications to a Home Hospital, Packaging Industry and Telecom Sector.

TEXT BOOKS:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011
2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

REFERENCES:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.
3. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
4. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

17MTCS334: CLOUD COMPUTING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

CLOUD COMPUTING FUNDAMENTALS: (09 hrs)

Definition of Cloud Computing, features, multitenancy, cloud types, Cloud deployment models, Benefits, challenges and risks of cloud computing, cloud cube model, Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, Case Studies: Google App Engine, Salesforce.com, Microsoft Azure.

VIRTUALIZATION: (09 hrs)

Introduction to Virtualization, Server virtualization, Storage virtualization, Network virtualization , virtual private network, role of virtualization in cloud computing, Virtual machines, Virtual machine monitors , Performance and Security Isolation, Full virtualization and para virtualization, Hardware support for virtualization, types of hypervisors, Case study: Xen, KVM, VMWare, Hyper-V.

CLOUD STORAGE INFRASTRUCTURES: (09 hrs)

Direct-Attached Storage (DAS) architecture, Storage Area Network (SAN) attributes, components, topologies, connectivity options and zoning. FC protocol stack, addressing, flow control. Networked Attached Storage (NAS) components, protocols, IP Storage Area Network (IP SAN) iSCSI, FCIP and FCoE architecture. Content Addressed Storage (CAS) elements, storage, and retrieval processes. server architectures- Stand-alone, blades, stateless, clustering, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo.

CLOUD SECURITY: (09 hrs)

Multitenancy issues, Cloud security threats and risks, attacks in cloud environment, virtual machine security: hypervisor attack, guest-hopping attack, DDoS attacks, packet sniffing, man-in-the-middle attack, data privacy and availability in cloud computing

QOS AND CLOUD APPLICATIONS: (09 hrs)

Autoscaling, Load balancing, Performance tuning in cloud computing, disaster recovery, Amazon Web Services: Amazon EC2 and S3, Openstack, Eucalyptus.

TEXT BOOKS:

1. Gautam Shroff, “Enterprise Cloud Computing Technology Architecture Applications”, Cambridge University Press; 1 edition, 2010.
2. Greg Schulz, “Cloud and Virtual Data Storage Networking”, Auerbach Publications [ISBN: 978-1439851739], 2011.
3. Kris Jamsa, “Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more”, Jones & Bartlett Student Edition

REFERENCES:

1. Dan C. Marinescu, "Cloud Computing - Theory and Practice", 1st Edition, Morgan Kaufmann is an imprint of Elsevier, 2013,
2. Dr. Kumar Saurabh,”Cloud Computing”, Wiley Publication
3. Lizhe Wang, “ Cloud Computing:Methodology, System and Applications”, CRC Press
4. Venkata Josyula,”Cloud computing – Automated virtualized data center”, CISCO Press
5. Yohan Wadia, "The Eucalyptus Open-Source Private Cloud". Last Accessed on: http://www.cloudbook.net/resources/stories/the-eucalyptus-open-source-privatecl

17MTCS335: NATURAL LANGUAGE PROCESSING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

NLP TASKS AND LANGUAGE MODELING: (09 hrs)

Introduction, Propositional logic, Formal Computational Semantics, Lexical Resources, words and transducers, n-grams.

PREPROCESSING AND WORD SENSE DISAMBIGUATION: (09 hrs)

Speech processing, Phonetic Analysis, Prosodic Analysis, Text Data Pre-processing, categorizing and tagging words, Part-of-Speech Tagging, different types of taggers, machine-readable dictionaries, word-sense disambiguation.

SYNTAX AND PARSING: (09 hrs)

Collocations and Information Retrieval, phrase chunking, statistical parsing, parsing with context-free grammars, probabilistic context-free grammars, dependency grammar, Feature-based grammar, co-reference resolution.

CLASSIFIERS: (09 hrs)

Supervised Classification, Markov Models, Maximum Entropy Models, Decision trees, Naïve Bayes Classifiers, Modeling linguistic patterns.

APPLICATIONS: (09 hrs)

Text Summarization, Question Answering, Discourse Analysis, Sentiment Analysis, Machine Translation, and Natural Language Generation, Automatic Speech Recognition.

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Prentice Hall; 2nd edition
2. Chris Manning and Hinrich Schuetze, "Foundations of Statistical Natural Language Processing", The MIT Press.

REFERENCES:

1. Emily M. Bender, "Linguistic Fundamentals for Natural Language Processing: 100 Essentials", Morgan & Claypool Publishers
2. Steven Bird, "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit", O'Reilly Media.
3. Frederick J. Damerau, Nitin Indurkhya, "Handbook of Natural Language Processing", Second Edition

17MTCS336: SOFT COMPUTING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO SOFT COMPUTING: (09 hrs)

Soft Computing Constituents – From Conventional AI to Computational Intelligence, Introduction to Neural Networks, Fuzzy Set Theory, Genetic Algorithms, Soft Computing characteristics, Machine Learning Basics.

FUZZY SET THEORY: (09 hrs)

Basics of Fuzzy Sets: Definitions and Operations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Interface Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

GENETIC ALGORITHMS: (09 hrs)

A Brief History of Evolutionary Computation, Biological Terminology, Search Spaces and Fitness Landscapes, Elements of Genetic Algorithm, Building Block Hypothesis, A simple Genetic Algorithm, Comparing Genetic Algorithms with Traditional Optimization and Search Methods, Computer Implementation of a Genetic Algorithm: Data Structures, Reproduction, Crossover, and Mutation, A Time to Reproduce and to Cross, Fitness Function, Codings, Genetic Operators, Applications of Genetic Algorithm.

NEURAL NETWORKS: (09 hrs)

Machine Learning using Neural Network, Adaptive Networks: Architecture, Feed Forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks, Learning from Reinforcement, Unsupervised Learning Neural Networks, Advances in Neural Networks.

HYBRID SYSTEMS: (09 hrs)

Neuro-Fuzzy Systems: Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling, Fuzzy-Genetic Systems, Neuro-Genetic Systems.

TEXT BOOKS:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Sof Computing",Prentice-Hall of India, 2003
2. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.

REFERENCES:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2007
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

17MTCS337: WIRELESS SENSORS NETWORK 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

CHARACTERISTICS OF WSN: (09 hrs)

Characteristic requirements for WSN -Challenges for WSNs–WSN vs Adhoc Networks-Sensor node architecture–Commercially available sensor nodes–Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

MEDIUM ACCESS CONTROL PROTOCOLS: (09 hrs)

Fundamentals of MAC protocols -Low duty cycle protocols and wakeup concepts -Contention - based protocols-Schedule-based protocols-SMAC-BMAC-Traffic-adaptive medium access protocol (TRAMA)-The IEEE 802.15.4 MAC protocol.

ROUTING AND DATA GATHERING PROTOCOLS: (09 hrs)

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping, Data centric Routing, SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing, Rumor Routing COUGAR, ACQUIRE, Hierarchical Routing, LEACH, PEGASIS-Location Based Routing– GF, GAF, GEAR, GPSR – Real Time routing Protocols–TEEN, APTEEN, SPEED, RAP-Data aggregation, data aggregation operations, Aggregate Queries in Sensor Networks, Aggregation Techniques –TAG, Tiny DB.

EMBEDDED OPERATING SYSTEMS: (09 hrs)

Operating Systems for Wireless Sensor Networks, Introduction-Operating System Design Issues-Examples of Operating Systems, TinyOS, Mate, MagnetOS, MANTIS, OSPM, EYES OS, SenOS – EMERALDS, PicOS, Introduction to Tiny OS–NesC–Interfaces and Modules-Configurations and Wiring-Generic Components, Programming in Tiny OS using NesC, Emulator TOSSIM.

APPLICATIONS OF WSN: (09 hrs)

WSN Applications, Home Control, Building Automation, Industrial Automation, Medical Applications, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Case Study: IEEE 802.15.4 LR, WPANs Standard, Target detection and tracking, Contour/edge detection, Field sampling.

TEXT BOOKS:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

REFERENCES:

1. K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325349
2. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd

17MTCS338: SOFTWARE RISK AND DISASTER MANAGEMENT 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

RISK CULTURE AND MANAGEMENT PROCESS: (09 hrs)

Introduction of Risk, Risk-Driven Project Management, Controlling the Process, Environment and Risk-Maturity in Risk Culture, Risk Scale, Preparing for Risk, Risk Management Paradigms, Five Models of Risk Management, Thinking about Less Risky alternatives, Risk Management at Different Levels, Risk Escalation, Risk Models, Risk Intelligence, Software Risk Management steps.

DISCOVERING RISK AND ASSESSMENT: (09 hrs)

Identifying software risk, Classification of Risks, Risk Taxonomy, Risk Mapping, Statements, Risk Reviews, Risk Ownership and stakeholder management, Risk Assessment Approach, Risk Assessment tools and techniques, Risk Probability, impact, exposure, matrix and Application Problem, Self-assessment checklist.

RESPONDING TO RISKS AND TRACKING: (09 hrs)

Special Treatment for Catastrophic risks, Constraint Risks, Risk Mitigation Plan Case Study, Contingency Plans, Implementing Risk Response, Tracking Risk Response and Hazards, Trigger Levels, Tracking Project Risks and Operational Risks, Learning by Tracking and Risk Tracker Tool.

BUSINESS CONTINUITY: (09 hrs)

Concept of information availability and its measurement, causes and consequences of downtime, concept of RTO, and RPO, single points of failure in a storage infrastructure and solutions for its mitigation, backup/recovery purposes and considerations, architecture and different backup/recovery topologies; Local replication technologies and their operation, remote replication technologies and their operation, emerging technologies like de duplication, offsite backup.

BACKUP AND RECOVERY: (09 hrs)

Backup Purpose, Backup Considerations, Backup Granularity, Backup Methods, Backup Topologies, Backup in NAS Environments, Backup Technologies, Concepts in Practice: EMC NetWorker.

TEXT BOOKS:

1. C. Ravindranath Pandian, "Applied Software Risk Management: A guide for Software Project Managers", Auerbach Publications, 2007.
2. EMC Educational Services, Information Storage and Management, Wiley India.

REFERENCES:

1. John Mcmanus, "Risk Management in Software Development Projects", Elsevier Butterworth-Heinemann, First Edition, 2004.
2. Jan Van Bon, "Foundations of IT Service Management: based on ITIL", Van Haren Publishing, 2nd edition 2005.