UNIVERSITY OF KERALA

Revised Scheme & Syllabus of the MCA Programme

(With effect from 2015 admissions)

The major objective of the MCA programme, in addition to other academic objectives, is to create skilled man power at the level of programmer, system analyst, project manager and system manager.

The duration of the course is six semesters in 3 years. The students holding BSc in Computer Science or BCA or equivalent degree are eligible for direct entry into the 3rd semester under Lateral Entry MCA Scheme. The student has to take, generally, five theory papers and two practical courses in the first five semesters. One seminar each is included in the second and fourth semesters. In the fifth semester a mini-project work is given as one of the practical courses. In 6th semester the student has to undergo a major project work only. In each week a student is supposed to get 10 practical hours and hence in every semester a total of 160 hours of practical training in the laboratories. The contact hours for theory/ tutorial comes to around 20 hours/week. The attendance in the theory & practical is compulsory.

General:

Examinations:

University Examinations will be conducted at the end of each semester as per the scheme included in this document.

Pass Requirements and provisions for classification of successful candidates

1. A candidate shall be declared to have passed the semester examination in full if he/she secures not less than 40% marks in written examination and not less than 50% marks in written (university) plus sessional marks put together in each paper. This rule applies to practical also. For the subjects which have only sessional marks, a minimum of 50% is required for a pass; otherwise the student has to repeat that semester.

2. For a pass in main project the student has to obtain minimum 50% marks in internal evaluation and 50% marks in external evaluation. Otherwise he/she has to repeat the 6th semester.

3. If a student fails in one or more subjects, he/she needs to reappear only in those subjects. The rules for supplementary examinations will be same as that of the existing regulations.

4. Classification of (Pass) results into I Class, II Class etc shall be as per the scheme prior to 2015 admissions.

Sessional Marks:

The sessional marks are awarded based on 2 class tests and assignments/ lab reports for theory/ practical and attendance. Split up is shown below:

Theory
Attendance	20%
Assignments (minimum 2)	30%
Class tests (minimum 2)	50%

Practical:
Attendance	20%
Performance in the lab (lab reports and experiments)	40%
Lab tests (minimum 2)	40%

Mini Project
Attendance	20%
Topic	10%
Performance	30%
Evaluation	40%

Main Project
Topic	10%
Performance	40%
Evaluation	50%

For seminars, the sessional marks are based on presentation/seminar report and participation. The students are required to present the progress of the main project work twice to the Department Faculty.

Question Paper Pattern. :

The maximum mark for the theory examinations will be 100 and the time duration will be 3 hours. The question paper shall contain two parts; Part A and Part B. Part A shall be for 40 marks and shall contain 10 compulsory short answer questions. Part B shall be for 60 marks and shall contain three modules. Each module shall contain two full questions out of which the student has to answer only one question. Each full question shall be for 20 marks.

Scheme and Syllabus

Semester I

Subject Code	Name of Subject	Duration in Hours			Marks		
		L	T	P	Sessional	Written / Practical	Total
15.101	Probability & Statistics	3	1	-	50	100	150
15.102	Digital Systems	3	1	-	50	100	150
15.103	Programming in C	3	1	-	50	100	150
15.104	Microprocessor and Interfacing	3	1	-	50	100	150
15.105	Linux and Shell Programming	2	1	-	50	100	150
15.106	Communicative English	-	-	2	50	-	50
15.107	Programming in C Lab	-	-	4	50	100	150
15.108	Microprocessor Lab	-	-	4	50	100	150
	TOTAL	**14**	**5**	**10**	**400**	**700**	**1100**

Semester II

Subject Code	Name of Subject	Duration in Hours			Marks		
		L	T	P	Sessional	Written / Practical	Total
15.201	Data Structures & Algorithms	3	1	-	50	100	150
15.202	Operating Systems	3	1	-	50	100	150
15.203	Object Oriented Programming with C++	2	1	-	50	100	150
15.204	System Analysis and Design	3	1	-	50	100	150
15.205	Computer Organization	3	1	-	50	100	150
15.206	Technical Seminar	-	-	2	50	-	50
15.207	Data Structures Lab	-	-	4	50	100	150
15.208	Object Oriented Programming Lab	-	-	4	50	100	150
	TOTAL	**14**	**5**	**10**	**400**	**700**	**1100**

Semester III

Subject Code	Name of Subject	Duration in Hours			Marks		
		L	T	P	Sessional	Written / Practical	Total
15.301	Combinatorics and Graph Theory	3	1	-	50	100	150
15.302	Algorithm Analysis & Design	3	1	-	50	100	150
15.303	Computer Networks	3	1	-	50	100	150
15.304	Database Management System	3	1	-	50	100	150
15.305	Java Programming	2	1	-	50	100	150
15.306	Technical Writing in LaTEX	-	1	1	50	-	50
15.307	Database Management Systems Lab	-	-	4	50	100	150
15.308	Java Programming Lab	-	-	4	50	100	150
	TOTAL	**14**	**6**	**9**	**400**	**700**	**1100**

Semester IV

Subject Code	Name of Subject	Duration in Hours			Marks		
		L	T	P	Sessional	Written / Practical	Total
15.401	Numerical Analysis & Optimization Techniques	3	1	-	50	100	150
15.402	Principles Of Management	2	1	-	50	100	150
15.403	Computer Graphics	3	1	-	50	100	150
15.404	Elective I	3	1	-	50	100	150
15.405	Elective II	3	1	-	50	100	150
15.406	Technical Seminar	-	-	2	50	-	50
15.407	Computer Graphics Lab	-	-	4	50	100	150
15.408	Web Applications Lab	-	-	4	50	100	150
	TOTAL	**14**	**5**	**10**	**400**	**700**	**1100**

Elective I
15.404.1 Artificial Intelligence
15.404.2 Cloud Computing
15.404.3 Big Data Analytics
15.404.4 Data Warehousing & Mining
Elective II
15.405.1 Image Processing
15.405.2 Software Testing
15.405.3 Cyber Forensics
15.405.4 Distributed Operating Systems

Semester V

Subject Code	Name of Subject	Duration in Hours			Marks		
		L	T	P	Sessional	Written / Practical	Total
15.501	Software Engineering	3	1	-	50	100	150
15.502	Cryptography & Network Security	3	1	-	50	100	150
15.503	Application Programming For Mobile Devices	2	1	-	50	100	150
15.504	Object Oriented Analysis And Design	3	1	-	50	100	150
15.505	Elective III	3	1	-	50	100	150
15.506	Application Programming Lab For Mobile Devices	-	-	4	50	100	150
15.507	Mini Project	-	-	6	50	150	200
	TOTAL	**14**	**5**	**10**	**350**	**750**	**1100**

Elective III
15.505.1 Computer Vision
15.505.2 Bio Informatics
15.505.3 Machine Learning
15.505.4 Computer Aided Design For Very Large Scale Integration Systems

Semester VI

Subject Code	Name of Subject	Duration in Hours			Marks		
		L	T	P	Sessional	Project Evaluation and Viva Voce	Total
15.601	Project Design and Implementation	-	-	29	200	300*	500
	TOTAL	**-**	**-**	**29**	**200**	**300**	**500**

15.101   **PROBABILITY & STATISTICS**   **3-1-0**

Module I

PROBABILITY THEORY - Random experiment-Conditional probability – independent event . Bayes theorem-Random variable - continuous and discrete – Probability density function – Distribution function – Special distributions – discrete and continuous distributions-TWO DIMENSIONAL RANDOM VARIABLE-Joint probability density – cumulative distribution – marginal probability – conditional probability . LINEAR CORRELATION – Correlation coefficient – properties of correlation coefficient-rank correlation coefficient – Regression – equations of linear regression – bounds for probability – Tchebysheves inequality Central limit theorem

Module II

Special discrete distribution – Binomial distribution –mean , variance and central moments. Poisson-mean and variance and central moments . Hyper geometric – mean and variance. Special continuous distribution –Uniform distribution – moments . Normal distribution-standard normal distribution , - mean and variance and central moments of normal distribution-Moment generating function of $N(0,1)$ and $N(\mu ,\sigma)$.Normal distribution is the limiting case of Binomial distribution.

Module III

Tests of hypothesis- parameter and statistic-sampling distribution – Estimation and testing of hypothesis-critical region and level of significance-Errors in testing of hypothesis-one tailed and two tailed tests-procedure for testing hypothesis- confidence interval-tests of significance of large and small samples-Student's t distribution-Sndecor's F distribution.

Text Book:
1. T.Veerarajan-Probability , Statistics and Random process(Third edition ,
TataMc.Graw Hill, Chapters 1,2,4,5,8)

References:
1. Sundarapandian - Probability, Statistics and Queueing theory, PHI
2. S.M .Ross - Introduction to probability models
3. Miller and Freunnds-Richard A. Johnson - Probability and statistics for Engineers
4. Purna Chandrta Biswal – Probability and Statistics , PHI.
5. F M Dekking, C Kraaikamp – a modern introduction to probability and statistics, Springer.

15.102   **DIGITAL SYSTEMS**   **3-1-0**

Module I

Number systems – Decimal, Binary, Octal and Hexadecimal – conversion form systems to another representation of negative numbers – representation of BCD numbers – character representation – character coding schemes – ASCII – BBCDIC etc. – Algorithms for addition subtraction, multiplication and division of binary and BCD number – Addition and subtraction of octal and hexadecimal numbers. Representation of floating point numbers – precision – addition, subtraction, multiplication and division of floating point numbers.

Module II

Postulates of Boolean algebra – Logic functions – logic gates – methods of minimization of logic functions – Karnaugh map method and tabulation method – realization using logic gates. Design of combinatorial logic circuits – adder, subtractor, binary parallel adder, decimal adder, code converter, magnitude comparator, decoder, multiplexer, demultiplexer, parity generator – design examples.

Module III

Sequential Logic Circuits – Flip flops RS, D, JK & T type – Master slave flip flop. Analysis and design of clocked sequential circuits – state diagram – state reduction and assignment – design with state equations – shift registers – serial adder – Design of synchronous and asynchronous Counters – Timing Sequences.

Text Books
 1. Morris Mano., Digital Logic and Computer Design, PHI,, 4th edition.

References:
1. Gothman W.H. Digital Electronics – An introduction to theory and practice – Prentice hall of India.
2. J. Peatman – Design of systems – Mc Graw Hill International Students edition,
3. Bartee T, Digital Computer Fundamentals, Mc Graw Hill.
4. Rajaraman. V., and T. Radhakrishnan – An introduction to digital computer design, Prentice Hall.

15.103   **PROGRAMMING IN C**   **3-1-0**

Module I

Introduction to programming languages – types of programming languages – high level – assembly language – low level language – Compilers and interpreters. Problem solving concepts– flow charts and algorithms – Features of C language.
Introduction to C programming – variables and arithmetic expressions- Formatted output- printf() - The For statement- Symbolic constants - Character input and output -   Arrays - Types, Operators and Expressions – Formatted input-scanf() – Control Flow.

Module II

Functions and program structure – function definition – function prototypes – function call – recursion – Pointers – Pointers and function arguments- pointers and arrays – character pointers and functions - Command-line arguments.

Module III

Structures – structures and functions - Array of structures – pointers to structures- self-referential structures - Unions – Bit-fields – Typedef – File Access – fscanf() –fprintf() - The C preprocessor and macro substitution. Usage of assembler in C programming envornment.

Text Books:
 1. Keringhan, Ritchie. The C Programming language,
 2. Balagurusamy – Programming in ANSI C – 5th ed- TMH
 3. Kamthane A.N., Programming with ANSI and Turbo C , Pearson Education India 2002

References:
1.   Gottfried – Programming in C (SIE) 3rd ed- TMH
2.   Venkateshmurthy, M.G., Programming Techniques through C Pearson Education India.
3.   Hanly J.R., and E.B. Koffman Problem Solving and Program Design in C   Pearson Education, 5th edition
4.   V. Rajaraman ., Computer Programming in C, PHI

15.104 **MICROPROCESSOR AND INTERFACING** **3-1-0**

Module I

Microprocessors – introduction – organization of a microprocessor based system – Introduction to 8085 ALP – 8085 programming model – instruction classification – data format and storage. Microprocessor architecture and its operations – introduction. Intel 8085 Microprocessor – Internal Architecture – timing diagram – memory interfacing – Instruction set - Addressing modes.

Module II

Intel 8085 Microprocessor – interfacing I/O – basics. Counters and time delays – stacks and subroutines. Interrupts - timing diagram – vectored interrupts – programmable interrupt controller 8259A.

Module III

Programmable interface devices – basic concepts – programmable peripheral interface 8255A – programmable keyboard display interface 8279 – programmable DMA controller 8257 -internal architecture.
Intel 8086 Microprocessor – Internal architecture- introduction to programming the 8086.

Text Books:
1. Interfacing & applications of Microprocessors – Gaonkar, Prentice Hall
2. Microprocessors and Interfacing – Douglas V. Hall, McGraw Hill.

Reference Books:
1. Microprocessors, PC Hardware and Interfacing – N Mathivanan, PHI Learning Pvt. Ltd.
2. Microprocessors and programmed logic – Kenneth L. Short, Pearson Education.
3. Microprocessor, Microcomputer and Applications, 3rd Edn – A. K. Mukopadhyaya, Narosa.
4. The 8085 microprocessor – architecture programming and interfacing, K. Udayakumar, B.S. Umashankar Pearson India.

15.105   **LINUX AND SHELL PROGRAMMING**   **2-1-0**

Module I

Introduction to Linux - History, Architecture, Comparison with UNIX, Features and Facilities of Linux, Basic commands in Linux, Files and File Structure - Linux File System, Boot block, Super block, Inode table, Data blocks, Linux standard directories. File naming Conventions, Path, Types of file names and Users, File Commands in Linux, file comparisons, Directory Commands, Text Editors-Functions of a Text Editor, vi Editor, Locating Files, File Access Permissions [FAP], Viewing and Changing FAPs. Linux Shell – Session, Standard streams, Redirection, pipes, tee, command execution, command line editing, command substitution, job control, aliases. Shell variables, exporting, output, input, shell environment variables and customization, startup scripts, command history.

Module II

Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system.
Checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel. Installing and removing packages. Backup, restore and Compress utilities - tar, cpio, dump,rsync and restore utilities.

Module III

Bash shell programming – basic concepts, expressions, decision making selections, repetition, special parameters - positional parameters, shift, argument validation, script examples.
Communication in Linux - mesg, who- T, talk, write, wall, finger, chfn, ping, traceroute utilities, email facilities . Configuration of servers- Telnet, FTP, DHCP,NFS, SSH, Proxy Server(Squid), Web server (Apache), Samba. Daemons- init, crond, atd, xinetd, inetd, the services file. named, sshd, httpd.

References

1. Operating System - Linux, NUT Press, PHI Publisher,2006 Edition

2. Red Hat Linux Bible, Cristopher Negus, Wiley Dreamtech India

3. UNIX Shell Programming by YeswantKanetkar, BPB

4. Linux Administration Handbook, EviNemeth,Garth Snyder, Trent KHein -Pearson Education.

5. Beginning Linux Programming by Neil Mathew & Richard Stones, Wiley Dreamtech India

15.106   **COMMUNICATIVE ENGLISH**   **0-0-2**

Reading- Skimming-scanning-detailed reading-predicting content-interpreting charts and tables-identifying stylistic features in texts - evaluating texts-understanding discourse coherence-guessing meaning from the context- note making / transferring information.

Word formation with prefixes and suffixes-discourse markers and their functions-degrees of comparison- expressions relating to recommendations and comparisons-active and passive voice-antonyms-tense forms- gerunds- conditional sentences-modal verbs of probability and improbability-acronyms and abbreviations - compound nouns and adjectives-spelling-punctuation.

Sentence definition-static description-comparison and contrast-classification of information-recommendations- highlighting problems and providing solutions-formal and informal letter writing-using flow-charts/diagrams paragraph writing-editing.

Defining, describing objects-describing uses/functions-comparing-offering suggestions-analyzing problems and providing solutions-expressing opinions (agreement/ disagreement) –expressing possibility/certainty – framing questions-providing answers.

Text Books:

1. " English for Engineers and Technologists ", Volume I. Authors : Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd.,
2. Sarah Freeman, Written communication in English, Orient Longman, .

15.107   **PROGRAMMING IN C LAB**   **0-0-4**

Experiments covering the topics included in the subject "Programming In C" should be done in Linux platform.

15.108   **MICROPROCESSOR LAB**   **0-0-4**

1. Programming exercises on 8085 microprocessor trainer kit or PC simulator. However if simulator is used, a demo kit must be used to demonstrate actual running of the programs. A total of 36 hours (15 programs) may be set aside for this.

2. Programming exercises in 8086 microprocessor using TASM in PC. Simple programs may be given for the student to get an idea of 8086 programming methodologies. A total of 24 hours may be set aside for this. No interfacing experiments. Eg programs - Addition of 32 bit numbers, matrix multiplication, factorial, LCM, GCD, Fibonacci, String manipulation, search, find and replace, copy operations, sorting.

15.201 **DATA STRUCTURES & ALGORITHMS** **3-1-0**

Module I

Algorithms and Analysis of Algorithms: Definition, Structure and Properties of Algorithms, Development of an Algorithm, Asymptotic Notations, Time Complexity of an Algorithm using O Notation, Polynomial Vs Exponential Algorithms, Average, Best and Worst case Complexities, Analyzing Recursive Programs, Logic characteristics of strings, physical representation for strings.
Arrays, Stacks and Queues: Array Operations, Number of Elements in an Array, Representation of Arrays in Memory, Applications of Array, Stack-Introduction, Stack Operations, Applications of Stack, Queues-Introduction, Operations on Queues, Circular Queues, Other Types of Queues, Applications of Queues.

Module II

Linked List, Linked Stacks and Linked Queues: Singly Linked Lists, Circularly Linked Lists, Doubly Linked Lists, Applications of Linked Lists, Introduction and operation Linked Stack and Linked Queues, , Dynamic Memory Management, , Applications of Linked Stacks and Linked Queues.
Graphs: Introduction, Definitions and Basic Terminologies, Representations of Graphs, Graph Traversals
Single-Source Shortest-Path Problem, Minimum Cost Spanning Trees.
Trees, Binary Trees, BST, AVL Trees and B Trees

Module III

Internal and external sorting techniques – selection, bubble, insertion, merge sorting, partition exchange sorting, heap sort. Searching – linear and binary – hashing.
External sorting – sorting with disks, sorting with tapes. Introduction to file structures:
fields, records and files, sequential file organization – variable length records and text
files, hashing techniques for direct files – inverted lists – multi lists

Text Books
1. G A V Pai – Data Structures and Algorithms: Concepts, Techniques and Applications, 2nd Edn, Tata McGraw-Hill, 2008
2. J. P. Tremblay , P. G. Sorenson – An Introduction to Data Structures with applications, 2nd Edn, McGraw Hill, Inc. New York, NY, USA.

References
1. Thomas H. Corman, Charles E. Leiserson and Ronald L. Rivest.,
Introduction to Algorithms., Prentice Hall of India., 3rd Edition
2. Samanta – Classic Data Structures, PHI, 2nd Edition
3. A N Kamthane – Introduction to Data Structures in C, Pearson Education,2005
4. Seymour Lipschutz – Data Structures, 6th Edn, 9th Reprint 2008, Tata McGraw-Hill

15.202   **OPERATING SYSTEMS**   **3-1-0**

Module I

Introduction : Basic concepts – user view & system view – Computer System organization – Computer System architecture - OS structure – batch processing - multiprogramming - time sharing - OS operations. Distributed systems - Multiprocessor system - real time embedded systems. Computing environments – traditional – client server – peer to peer – web based computing.
Operating system services – User OS interface, System calls – types, System programs, OS structure – simple – layered, virtual machine – introduction only, system boot.
Process management – process concept – states – PCB – threads introduction – process scheduling – queues – schedulers – long, short & medium – context switch. Operations on processes – process creation and termination.
Process scheduling – pre-emptive and non-pre-emptive – scheduling criteria – scheduling algorithms – different types - algorithm evaluation - deterministic modelling only.

Module II

Interprocess communication – shared memory – message passing.
Process Co-ordination - Synchronization - the critical section problem – Petersons solution – Synchronization hardware – Semaphores – usage and implementation – the bounded buffer problem.
Dead locks – system model & characterization – methods for handling deadlocks - prevention - avoidance - bankers algorithm - detection - Recovery from dead lock.
Memory management - Preliminaries – address binding – logical and physical address space - Swapping - Contiguous memory allocation – fragmentation - paging – with TLB – protection – hierarchical page table structure – segmentation – hardware.
Virtual memory concepts - demand paging - page replacement – different types – frame allocation – algorithms – thrashing.

Module III

Storage management - File concepts – attributes – operations – types – structure – access methods. Directory and disc structure –overview – directory schemes – single level – two level – tree structured – acyclic and general graph directories. File system mounting. Protection – types of access – access control.
File system – structure and implementation. Directory implementation – File allocation methods – Free space management using link list only.
Secondary storage structure – Overview – disk structure - disk scheduling - FCFS, SST, C-SCAN - selecting a disk scheduling algorithm.

Text Books :

 1. A. Silberchatz. et.al., Operating System Concepts, A John Wiley .2009

References :

  1.   Hanson, P.B., Operating System Principle, Ane's publication.
  2.   Dhamdhare – Operating System, A Concept based approach- 2nd edition, TMH
  3.   Tanenbaum – Modern Operating System – PHI
  4.   Deitel. H.M., Operating system principles, Pearson EducationBhatt – Introduction to   Operating   Systems,   concepts   and   practice,   2nd   edition,   PHI

15.203   **OBJECT ORIENTED PROGRAMMING WITH C++**   **2-1-0**

Module I

Fundamentals of object-oriented Design: Data Abstraction, Encapsulation, classes, Inheritance and Polymorphism, class Hierarchies. C++ enhancements to C : Default Function Arguments, Placement of variable declarations, the scope resolution operation, the "Const" Qualifier, References: References as Aliases, references and pointers similarities and differences, references as function parameters, references as return values. Introduction to classes: Declaring and using classes, class members, Creation and destruction of objects, constructors and destructors- accessing data members

Module II

Returning a reference, "Const" objects and member function., inline functions, Classes and dynamic memory allocation: New, delete operators, "this" pointer. Static members, friends, array of class objects. Function overloading, constructor overloading, Operator overloading : Overloading unary operator, overloading binary operator, data conversion

Module III

Inheritance and polymorphism: Derived class and base class, derived class constructors, overriding member functions, public and private inheritance, virtual functions, polymorphism, multiple inheritance, classes within classes., abstract classes, Generic functions, generic classes, exception handling, File processing – formatted – unformatted and random files. Microsoft foundation classes: Strings, data structure.

Text Books
1.   Robert Lafore., Object Oriented Programming in Microsoft C++– Pearson Education, 4th Edition
     .

References:
1.   Balaguruswamy., Object Oriented Programming with Microsoft C++, TMH, 4th Edition
2.   Rohit Khurana – Object Oriented Programming with C++ - Vikas, 2008
3.   Savitch – Problem Solving with C++, Pearson Education, 6th Edition
4.   Ravichandran., Object Oriented Programming in C++ , TMH, 3rd Edition
5.   Kamthane, Object oriented Programming with ANSI and Turbo C++., Pearson Education
6.   Venugopal, Rajkumar, Ravishankar- Mastering C++, TMH, 2010
7.   Jana - C++ and Object Oriented Programming, PHI
8.   Dietel, Dietel – C++, How to Program, PHI

15.204   **SYSTEM ANALYSIS AND DESIGN**   **3-1-0**

Module I

Overview of system analysis and design — business system concepts, categories of information systems, system development strategies, implementation and evaluation, tools for system development. Reasons for project proposals — managing project review and selection, preliminary investigation, scope of study, conducting the investigation, testing project feasibility, handling infeasible project. Tools for determining system requirements — activities in requirements determination, fact finding techniques, tools for documenting procedures and decisions, structured analysis development strategy — features of data flow strategy, features of a data dictionary, recording data descriptions

Module II

Application prototype development strategy — purpose of application prototyping, steps in prototype method, use of prototypes, tools for prototyping, prototype strategies. Analysis to design transition - specifying application requirements, objectives in designing an information system, what features must be designed? Output objectives, type of output, how to present information, designing printed output, designing visual display output. Design of input and control — objectives of input design, capturing data for input, input validation, checking the transaction, validation, checking the transaction data, modifying the transaction data.

Module III

Design of online dialogue — how is online different? Purpose and characteristics of interface, designing dialogue and dialogue strategies, data entry dialog, basic file terminology, data structure diagrams, types of files, methods of file organization System engineering and quality assurance — design objectives, program structure charts, design of software, top down structure of modules, coupling, cohesion, span of control, module size, shared modules. Managing system implementation — training, training system operators, user training, training methods, conversion methods, post implementation review, review methods. Hardware and software selection — hardware selection, determining size and capacity requirements, computer evaluation and measurement, plug compatible equipment, financial factors, maintenance and support, software selection, evaluation of software, software contracts.

Text book:

1. James A. Senn, Analysis and Design of Information Systems, Second edition, McGraw Hill International Edition,

References:

1. Hussain, K.M., and Dona Hussain, Information System Analysis, Design & Implementation Tata McGraw Hill, New Delhi, 1995.
2. Elias M. Award , System Analysis and Design, , Second Edition, Galgotia Publishing Ltd., New Delhi, 1995
3. Don Yeates, System Analysis and Design, McMillan India(Ltd),1996.
4. Hawryszkiewycz, I.T., Introduction to System Analysis and Design, 3rd Edition, PHI, 1997
5. Rajaraman V., Analysis and Design of Information Systems, PHI
6. Gupta A.K. & Sarkar S.K., System Analysis, Data Processing and Quantitative Techniques, Galgotia., 1997

15.205   **COMPUTER ORGANIZATION**   **3-1-0**

Module I

Basic Structure of digital computer - functional units - basic operational concepts - bus structures - software. Memory locations and addresses – Instructions and instruction sequencing – basic instruction types – Instruction execution and straight line sequencing – branching - Addressing modes, assembly language.
Basic I/O operations, stacks, subroutines – nesting and processor stack – parameter passing.

Module II

Basic processing unit – fundamental concepts - execution of a complete instruction – multiple bus organization - sequencing of control signals – Hardwired control and micro-programmed control. Pipelining – basic concepts only.
I/O organization – Accessing I/O devices, Interrupts – handling - use of interrupts in operating systems, DMA. Interface circuits – parallel port – serial port. Standard I/O interfaces – PCI – SCSI and USB in brief.

Module III

Memory organization – basic concepts, semiconductor RAM memories - memory system considerations – semiconductor ROM memories - speed, size and cost. Cache memory – mapping functions – replacement algorithms, multiple module memories and interleaving. Virtual memory – paging and segmentation.
Computer peripherals – input devices – output devices, and storage devices, RAID.

Text Books

1.   Hamachar, Vranesic & Zaky, Computer Organization. McGraw Hill Publishing Company.5th ed, 2002.

References:

1.   Pal Chaudhari., Computer Organization and Design,., PHI.,
2.   Govindarajalu, Computer Architecture and Organization – Design principles and Applications– Tata McGraw Hill.
3.   David A. Patterson, John L. Hennessey – Computer Organization and Design, Elsevier.

15.206   **TECHNICAL SEMINAR**   **0-0-2**

The students are required to present seminar for 20 minutes duration which includes 5 minutes interaction with audience. Recent topics which are relevant to the field of computer technology should only be chosen. Contents should primarily be based on technical papers from recent publications appeared in proceeding of international conferences and journals such as IEEE, ACM, Elsevier and Springer.

15.207   **DATA STRUCTURE LAB**   **0-0-4**

Implementation and applications of data structures like arrays of records, stack, queue, tree, linked list, graph etc and experiments on sorting and searching should be done.

15.208   **OBJECT ORIENTED PROGRAMMING LAB**   **0-0-4**

Experiments to implement function overloading, operator overloading, constructor overloading, multiple inheritance, multilevel inheritance, friend functions, virtual functions, templates, streams etc should be done.

15.301   **COMBINATORICS AND GRAPH THEORY**   **3-1-0**

Module I
Fundamental principles of counting , permutation and combinations , binomial theorem , combination with repetition , principle of inclusion and exclusion , derangements , generating functions , the exponential generating function , recurrence relations-first order and second order- non homogeneous recurrence relations , method of generating functions

Module II
Introduction to graph – definition –sub graph-path cycles-matrix representation-graph isomorphism – Euler tour- planar graph-Euler's formula-bipartite graph – application of kuratowski's theorem (proof not required)cutest dual of a graph- Hamiltonian path and cycles-sufficient condition for the existence of Hamilton cycles-graph colouring, chromatic polynomials and map colouring

Module III
Tress-definition and properties-DFS algorithm (application only no need of proof) BFS algorithm (application only – no need of proof) biconnected components and articulation points-Dijkstra's shortest path algorithm, minimal spanning tree-Kruskal and prims algorithm, max-flow-min-cut theorem (proof not required)

Text book:
1. Discrete and Combinatorial Mathematics, An applied Introduction,3/e, Ralph
   P.Grimaldi, Pearson Education
        Module I :-Sections:1.1 to 1.4,8.1,8.2,8.3,9.1,9.2,9.4,10.1,10.2,10.3,10.4
        Module II:-Sections: 11.1 to 11.6
        Module III:-Sections: 12.1, 12.2, 12.3, 12.5, 13.1, 13.2, 13.3

References:
1. Clark J Holten .D A, A first look at Graph Theory .Allied Publishers (World Scientific, New Delhi)
2. Corman T.H, Leisersion C.E & Rivest RL, Introduction to Algorithms , Prentice Hall of India
3. Mott.J.L.Kendel A & baker T P. Discrete Mathematics for Computer Scientists and 3. Mathematicians ,2/e, Prentice Hall of India
5. Liu.C.L, Elements of Discrete Mathematics,2/e,Mc Graw Hill Singapore
6. Rosen K.H , Discrete Mathematics and its applications , 3/e , Mc Graw Hill Singapore
7. Balakrishnan R, Ranganathan, A text book of Graph theory, Springer International edition
8. Yadav S K, Elements of Graph Theory, Ane's student edition,

15.302   **ALGORITHM ANALYSIS & DESIGN**   **3-1-0**

Module I

Algorithm Analysis – Time Space Tradeoff – Asymptotic Notations – Conditional asymptotic notation – Removing condition from the conditional asymptotic notation - Properties of big-Oh notation – Recurrence equations – Solving recurrence equations – Analysis of linear search - Divide and Conquer: General Method – Binary Search – Finding Maximum and Minimum Merge Sort

Module II

Greedy Algorithms: General Method – Container Loading – Knapsack Problem. Dynamic Programming: General Method – Multistage Graphs – All-Pair shortest paths – Optimal binary search trees – 0/1 Knapsack – Travelling salesperson problem.

Module III

Backtracking: General Method – 8 Queens problem – sum of subsets – graph coloring – Hamiltonian problem – knapsack problem. Graph Traversals – Connected Components – Spanning Trees – Biconnected components – Branch and Bound: General Methods (FIFO & LC) – 0/1 Knapsack problem – Introduction to NP-Hard and NP-Completeness.

Text Books:
1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007. (For Units II to V)
2. K.S. Easwarakumar, Object Oriented Data Structures using C++, Vikas Publishing House pvt. Ltd., 2000 (For Unit I)

References:
1. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, "Introduction to Algorithms", Second Edition, Prentice Hall of India Pvt. Ltd, 2003.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education, 1999.

15.303   **COMPUTER NETWORKS**   **2-1-0**

Module I

Introduction-Data communication and network, Protocol and Standards, Network model-OSI model, TCP/IP protocol suite
Physical Layer: Data transmission-Analog & digital Transmission-Transmission impairment-Transmission media: wired transmission- wireless transmission
Data link Layer: Error Detection and Correction-Flow control and error control-HDLC.

Module II

Network layer: Connecting Devices Addressing-classless and classfull addressing-internet protocol: IPV4 and IPV6-Address mapping: ARP –RARP-Error reporting: ICMP-Routing protocols

Module III

Transport layer: UDP-addressing-UDP operation. TCP-TCP services& Features-TCP segment-TCP connection-Error control and flow control-Congestion control
Application Layer: DNS-Distribution namespaces-Name Resolution. HTTP-Architecture-HTTP Transaction. DHCP-Address allocation packet format. Real time data transfer-RTP, RTCP, VoIP

Text Books:

1.   Data Communication and networking Fourth ed. Behrouz A Forouzan
2.   Data and Computer Communication Eighth Ed William Stallings

Reference:
1.   Larry L. Peterson and Bruce S. Davie, "Computer Networks – A Systems Approach", The Morgan Kaufmann publishers.
2.   Michael Duck and Richard Read, "Data Communications and Computer Networks -
For   Computer   Scientists   and   Engineers",   Pearson   Education   Limited.

| 15.304 | DATABASE MANAGEMENT SYSTEM | 3-1-0 |

Module I

Purpose of Database system - Advantages of DBMS over File Processing System –View of Data - Data Abstraction - Data Independence – Data models – Database languages – Database Administrator – Database users – DBMS system structure. ER model basic concepts – Attributes and its types – Entity and Entity set – Relationship & Relationship set - Mapping Constraints – Keys – ER Diagram – Weak entity sets.

Module II

Structure of Relational Database - Relational Algebra - Extended Operations – Tuple relational Calculus & Domain Relational Calculus – Aggregate Functions- Modification of the database-Views – SQL- Triggers-Integrity Constraints - Object Oriented Database - Object Relational Database. -– Functional dependencies – Normal forms based on primary keys-General definitions of second and third normal forms-Boyce codd normal form-fourth and fifth normal forms.

Module III

Storage and File Structure - Indexing & Hashing – Transaction - Concurrency Control - Recovery System- Parallel Database – Distributed Database.
Transaction management –properties of transactions- - concurrency control- serializability – locking methods- time stamping methods- database recovery techniques (recovery techniques based on deferred and immediate update ,shadow paging) introduction to object oriented DBMS and distributed DBMS – emerging trends.
Database security - Security requirements ,reliability And integrity, sensitive data.

Text Books:
1. Henry F. Korth and Abraham Silbershatz- Database System Concepts- 6th Edn, McGraw Hill, 2010.
2 Ramez Elmsri and Shakant B. Navathe- Fundamentals of Database Systems- 3rd ed., Pearson Education. 2000.

References:
1. Thomas Connolly and Carolyn Begg - Database systems, 4th edition – Pearson Education, 2009
2. Charles P. Pfleeger, Shari Lawrence Pfleeger - Security in Computing -3rd edition – Pearson education.
3. C. J Date - An Introduction to Database Systems, 8th Edn, Pearson Education, 2006

15.305   **JAVA PROGRAMMING**   **2-1-0**

Module 1

Introduction – Genesis of Java, Java features, Java Terminology : Application, Applet, Bytecode, Servlet, Javascript, JDK, JRE and JVM. An overview of Java: Object-oriented Programming, The three OOP Principles - encapsulation, inheritance, polymorphism. A First Simple program.

GUI with Java: The Applet class:- Basics, applet architecture, Life cycle methods, HTML Applet tag, passing parameters to applets, applet context. Event Handling: Delegation Event Model using important Event Classes and Listener Interfaces, Handling Mouse and Keyboard events Adaptor Classes, Inner Classes - Anonymous. Using AWT Controls, Layout Managers, and Menu. AWT: Working with Graphics and Color- graphics drawing lines, rectangles, polygons, ellipses and circles, arcs, Imaging: Creating, Loading and displaying images, Image observer interface. Window fundamentals- Class Hierarchy, Frame, Creating a windowed application.

Module 2

Data Types Variables and Arrays, Operators, String Handling Fundamentals- Special string operations, character extraction, string comparison, searching strings, modifying a string, Control Statements, Introducing Classes, Closer look at Methods and Classes, Inheritance, Packages and Interfaces, Exception Handling.

Module 3

Multithreaded Programming, I/O :- Basics, Reading Console Input, Writing console output, PrintWriter class, Reading and writing files. Simple Type Wrappers. Database connectivity, Networking- Basics, networking classes and interfaces, InetAddress, TCP/IP client sockets, URL connection, TCP/IP Server sockets.

Text Book:

1.   Herbert Schildt- The Complete Reference, Java2, TMH, 5th edition

Reference Books:

1.   Balagurusamy- Programming with Java- TMH, 4th Edition
2.   Java Programming – Black Book – Dreamtech Press
3.   Andrew Cobley, The Complete Guide to Java, , Comdex
4.   H. M. Dietel & P. J. Deitel, Java: How to program, PHI

15.306   **TECHNICAL WRITING IN LATEX**   **0-1-1**

Module I

Introduction about LaTex:What is LaTex-Importance of LaTex.Installation of LaTex using net installer wizard. Creating first document-Understanding LaTex compilation-Formatting words, lines and paragraphs-titling document-writing special characters-using line breaks

Module II

Designing pages:writing books with chapters-creating table of contents-designing headers and footers-designing chapters and sections-creating lists-creating tables-inserting images-setting labels and references-generating index-creating list of figures and tables-typing math formulas-usage of hyperlink and bookmarks-bibliography

Module III

Troubleshooting: understanding and fixing errors. packages-Geometry, Hyperref, amsmath, amssymb, algorithms,algorithmic graphic, color, tilez listing Classes: article, book, report, beamer, slides. IEEtran. Writing question paper,Writing articles/ research papers,Presentation using beamer

Text Books:
1.   LaTex Beginners Guide- Stefan Kottwitz
2.   A guide to LaTex-Helmut Kopka,Patrick W Daly

15.307 **DATABASE MANAGEMENT SYSTEMS LAB** **0-0-4**

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION,INTERSECT,Constraints.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date).
5. i)Creation of simple PL/SQL program which includes declaration section, executable section and exception –Handling section
   ii)Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT
   in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Program development using creation of package specification, package bodies, private objects, package variables and cursors and calling stored packages.
11. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
12. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers.

Text Books:

1. ORACLE PL/SQL by example. Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rd Edition
2. ORACLE DATA BASE LOG PL/SQL Programming SCOTT URMAN, Tata Mc-Graw Hill.
3. SQL & PL/SQL for Oracle 10g, Black Book, Dr.P.S. Deshpande

15.308   **JAVA PROGRAMMING LAB**   **0-0-4**

Experiments to implement packages, interfaces, multithreading, streams, AWT, applets, TCP and UDP sockets, database connectivity etc should be done.

15.401   **NUMERICAL ANALYSIS & OPTIMIZATION TECHNIQUES**   **3-1-0**

Module 1

Errors In Numerical Calculations Types Of Errors-Significant Digits-Programming Errors-Numerical Solution Of Non Linear Equations-Bisection Method-Regula Falsi Method-Newton Raphson Method –Fixed Point Method Of Iteration – Rates Of Convergence Of These Methods-Solutions Of Algebraic Equations-Guass Elimination Method-Relaxation Method-Gauss Seidel Iteration Method-Gauss Jordan Method-Polynomial Interpolation – Lagrange's Interpolation Polynomial-Divided Differences-Newton's Divided Difference Interpolation-finite Differences-Operators Δ, ∇ , e, δ Gregory-Newton Forward And Backward Difference Interpolation Polynomials-Central Differences.

Module 2

Mathematical Formulation Of Linear Programming problem-Formulation Of LPP-Graphical Solution Of LPP – Canonical And Standard Form Of LPP-Simplex Method-Big M Method- Two Phase Method-Principle Of duality-Dual Simplex Method.

Module 3

Transportation Problem-Initial Basic Feasible Solution-North West Corner Rule-Vogel's Approximation Method –Tests For Optimality-Unbalanced Transportation Problem-Assignment Problem-Travelling Salesman Problem-Network Scheduling-Rules Of Network Construction – Critical Path Method-PERT.

Text Books:

1.   Sastry S.S., Numerical Analysis, Prentice-Hall India (module I), 4th edition

2.   Kanthi Swarup, P.K.Gupta,Man Mohan, Operations research , Sultan Chand & Sons.(module II), 5th edition

Reference books:

1.   R Panneerselvam – Operations research, 2nd edition, PHI

2.   Froberg, Introduction to Numerical Analysis-Second Edition , Addition Wesley

3.   Gerald and Wheatley , Applied Numerical Analysis, Pearson Education Asia, Sixth Edition

4.   S . S Rao, Optimization Theory and Applications, Wiley Eastern

5.   Grawin W. W , Introduction of Linear Programming , McGraw Hill

6.   Kalyamoy Deb – Optimization for engineering design, algorithms and examples, PHI

7.   Q S Ahamed, Z Khan, S A Khan- Numerical and Statistical Techniques, Ane's Books 2009

8.   B N Mishra, B K Mishra, Optimization Linear Programming, Ane's Books,2009

15.402   **PRINCIPLES OF MANAGEMENT**   **2-1-0**

Module I

Definition of Management — Functions of Management – Fayol's Principles of Management. - Organization - Classical theories of organization(Classical Organization Theory, Neo-Classical Theory and Systems Theory) Planning:- Nature, Scope, Objectives and Significance of Planning, Types of Planning, Process of Planning. Mathematical Models for Planning – Deterministic and Probabilistic Models (Only Theory – No Problems). Forecasting:- Business Forecasting, Steps in Forecasting, Techniques for forecasting(Only Theory – No Problems). Decision Making:- Concept, Stages in Decision-making, Simon's Decision Making Process, Techniques of Decision making. Corporate Planning and strategy.

Module II

Organizing : - Definition of Organization, Organization Structure – Types of organization structure. Formal and Informal Organization, Committees. Span of Control, Concepts of Authority and responsibility , Delegation of Authority. Types of authority relationships, Line and staff relationship. Theories of Motivation (Maslow's Need Hierarchy Theory, McGregor's Theory X and Theory Y, Herzberg's Motive-Hygiene Theory, Alderfer's ERG Theory). Group Dynamics, Group Behavior. Communication:- Communication Process, Importance of Communication, Channels of Communication, Flow patterns of Communication, Communication Media, Barriers to Communication. Transactional Analysis. Control: - Definition, significance and characteristics of Control, Process of control, Kinds of control, Control techniques used for managerial control.

Module III

Staffing : - Manpower planning —its use and benefits, problems and limitations, manpower inventory, manpower forecasting, job descriptions, manpower skills analysis and practices in the Indian industry. Recruitment — job specification, selection process, psychological testing, interviewing techniques, transfer, promotion and its policies, induction placement, exit interview and stay interview. Training and development: - objectives and policies, planning and organizing the training department; training manager and his job, on and off the job training techniques. Career planning, objectives of performance appraisal and its methods.

Text Books:

1.Chhabra T. N., Principles and Practice of Management., Dhanpat Rai & Co Pvt. Ltd.
Mahajan J.P., Management : Theory and Practice., Ane's Books Pvt. Ltd.

References:

1.Harold Koontz ., Principles of Management., Tata Mc Graw Hill Publications.
2.Heinz Weihrich, Harold Koontz., Essentials for Management : An International Perspective., Tata Mc Graw Hill Publications.
3.Stephen P. Robbins, Mary Coulter., Management., Prentice Hall of India.
4.Moshal., Principles of Management., Ane's Books Pvt. Ltd.
5.Maynard's Industrial Engineering Hand Book., Mc Graw - Hill Standard Hand Books.
6.Ellen A. Benowitz., Cliffs Quick Review Principles of Management., Hungry Minds, Inc, New York.

15.403   **COMPUTER GRAPHICS**   **3-1-0**

Module I
Basic concepts in Computer Graphics - Types of Graphic Devices - Interactive Graphic inputs - Basic Raster Scan Graphics - Line Drawing Algorithms - Circle Generation Algorithms - Scan Conversion - frame buffers - solid area scan conversion - polygon filling.

Module II
Two dimensional transformations - Homogeneous coordinate systems - matrix formulation and concatenation of transformations - Windowing concepts - two dimensional clipping, 3D transformations and clipping.

Module III
Introduction to graphics in three dimension - plane projections - vanishing points - specification of a 3D view - introduction to Bezier curves, B-Splines and surfaces - - hidden line elimination - shading - Graphical User Interfaces. Introduction to Open GL and animations.

Text Books :
1.Donald Hearn and M. Pauline Baker., Computer Graphics – C Version., Pearson Education,, 2nd edition

References :
1.Sinha, Udai – Computer Graphics – TMH, 2010
2.David F. Rogers, Procedural Elements for Computer Graphics –McGraw Hill
3.Johm F. Kodgel Buford, Multimedia systems , Pearson Education/Addison Wesley.
4.Tay Vaughan, Multimedia making it works, 6th ed., TMH, 2004
5.William M. Newman and Robert F. Sproull. Principles of Interactive Computer Graphics, McGraw Hill
6.Desai – Computer Graphis, PHI

15.406   **TECHNICAL SEMINAR**   **0-0-2**

The students are required to present seminar for 20 minutes duration which includes 5 minutes interaction with audience. Recent topics which are relevant to the field of computer technology should only be chosen. Contents should primarily be based on technical papers from recent publications appeared in proceeding of international conferences and journals such as IEEE, ACM, Elsevier and Springer. All slides should have uniform format, preferably in LaTEX.

15.407 **COMPUTER GRAPHICS LAB** **0-0-4**

Topics covered in the subject 15.403 should be given as experiments Line drawing algorithms, circle drawing, 2d and 3d transformations, polygons, hatching, filling, animations and 3d graphics in OpenGL

15.408   **WEB APPLICATIONS LAB**   **0-0-4**

Students have to do experiments based on Internet technologies. Principles of Database Management, E-commerce and Security have to be included. Experiments like the flowing should be done in this lab. Implement Web applications using, HTML and JSP and PHP and deploy. Test the application on an Application Server. Debug Web applications locally and remotely. Develop applications in a team environment. Retrieve data from database using SQL and exchange information in XML format.

15.404.1   **ARTIFICIAL INTELLIGENCE**   **3-1-0**

Module 1
Introduction to artificial intelligence – architecture of artificial intelligence system. Problem Solving :- problems and problem spaces, problem definition – production system – control strategies – search strategies – problem characteristics – production system characteristics.
Problem solving Methods :- Forward, backward reasoning, problem graphs – matching Heuristic functions – weak methods – measure of performance and analysis of search algorithm. Game Playing :- Min max search procedure – Alpha – Beta cut offs.

Module II
Knowledge Representation :- Representation using predicate logic, introduction to predicate calculus – Resolution – Resolution in propositional and predicate logic – uniform algorithm – Question – Answering. Natural deduction. Knowledge representation using other logic. Structure representation of knowledge.
Planning :- Natural language understanding – perception learning – Introduction to AI languages.

Module III
An overview of expert systems. Type of expert systems, their components and architecture. Knowledge acquisition, inter knowledge – Heuristics – Knowledge representation – production based system, frame based system.
Inference :- backward chaining, forward chaining, rule value approach, Fuzzy reasoning – certainty factors – Constructing an expert system – Languages and tools – Typical expert system examples.

Text books:
1. Elaene Rich and Kevin Knight – Artificial Intelligence – Mc Graw Hill, 3rd edn, 2008

References:
1. Stuart Russel and Peter Norvig., Artificial Intelligence a Modern Approach, 2nd ed., Pearson Education 2003.
2. Luger., Artificial Intelligence 5th ed., Pearson Education, 2005
3. Paterson, "Artificial Intelligence & Expert systems", PHI, 2009
4. Akerkar – Introduction to Artificial Intelligence, PHI
5. Pattersen – Introduction to Artificial Intelligence and Expert Systems, PHI

15.404.2   **CLOUD COMPUTING**   **3-1-0**

Module 1

Fundamental Cloud Computing - Cloud Computing Mechanisms - Cloud Computing Architecture - Understanding Cloud Computing - Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges - Fundamental Concepts and Models - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models

Module 2

Cloud-Enabling Technology - Broadband Networks and Internet Architecture - Data Center Technology - Virtualization Technology - Web Technology - Multitenant Technology - Service Technology - Fundamental Cloud Security - Basic Terms and Concepts - Threat Agents - Cloud Security Threats - Cloud Infrastructure Mechanisms - Logical Network Perimeter - Virtual Server - Cloud Storage Device - Cloud Usage Monitor - Resource Replication - Ready-Made Environment

Module 3

Cloud Security Mechanisms – Encryption – Hashing - Digital Signature - Public Key Infrastructure (PKI) - Identity and Access Management (IAM) - Single Sign-On (SSO) - Cloud-Based Security Groups - Hardened Virtual Server Images - Fundamental Cloud Architectures - Advanced Cloud Architectures - Specialized Cloud Architectures

Text Books
1. Cloud computing Concepts, Technology & Architecture – Thomas Erl published May 2013

References

1. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, & IaaS) - Michael J. Kavis published January 2014
2. Cloud Computing Protected: Security Assessment Handbook - John Rhoton Published Published January 2013
3. Building the Infrastructure for Cloud Security - Raghuram Yeluri Published March 2014

15.404.3   **BIG DATA ANALYTICS**   **3-1-0**

Module 1

Introduction to Big Data Platform – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Module 2

Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods.

Module 3

Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Applications.

Text Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

References:

1. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
2. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

15.404.4   **DATA WAREHOUSING & MINING**   **3-1-0**

Module 1
Introduction: Data mining Introduction. Data - Data mining Functionalities – Classification of Data mining systems – Issues in Data mining – Data Preprocessing. Introduction to Data Warehouse & OLAP – Data Warehousing – Multidimensional data models –data ware house architectures – Implementation – Data Warehousing to Datamining- Data Cube Computation Methods- Data mining primitives – Datamining query languages – Architectures of data mining systems

Module 2

Association Rule Mining And Classification **-**Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction

Module 3

Cluster Analysis - Types of Data – Categorization of Major Clustering Methods - K- means – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods –Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis Data Mining Applications.

Text Books:
1. Jiawei Han & Micheline Kamber - Data Mining Concepts & Techniques –- 2ed – Elsevier
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.

Reference:
1. G.K. Gupta – Introduction to Data Mining with case Studies, PHI, New Delhi – 2006.
2. A. Berson & S.J. Smith – Data Warehousing Data Mining, COLAP, TMH, New Delhi – 2004
3. H.M. Dunham & S. Sridhar – Data Mining, Pearson Education, New Delhi, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining", Person Education, 2007.

15.405.1   **DIGITAL IMAGE PROCESSING**   **3-1-0**

Module 1

Introduction - Examples of Fields that Use Digital Image Processing - Fundamental Steps in Digital Image Processing - Components of an Image Processing System - Elements of Visual Perception - Light and the Electromagnetic Spectrum - Image Sensing and Acquisition - Image Sampling and Quantization - Some Basic Relationships between Pixels – Intensity Transformations and Spatial Filtering - Some Basic Intensity Transformation Functions - Histogram Processing - Fundamentals of Spatial Filtering – Smoothing Spatial Filters

Module 2

Filtering in the Frequency Domain - Preliminary Concepts - Sampling and the Fourier Transform of Sampled Functions – Discrete Fourier Transform (DFT) of One Variable - Extension to Functions of Two Variables -Some Properties of the 2-D Discrete Fourier Transform - The Basics of Filtering in the Frequency Domain - Image Smoothing Using Frequency Domain Filters - Image Sharpening Using Frequency Domain Filters – Image Restoration and Reconstruction - Noise Models - Restoration in the Presence of Noise Only - Periodic Noise Reduction by Frequency Domain Filtering - Image Reconstruction from Projections - Wavelets and Multi resolution Processing -Wavelet Transforms in One Dimension - The Fast Wavelet Transform - Wavelet Transforms in Two Dimensions

Module 3

Image Compression - Some Basic Compression Methods - Digital Image Watermarking - Morphological Image Processing - Erosion and Dilation - Opening and Closing - Some Basic Morphological Algorithms –Image Segmentation - Point, Line, and Edge Detection - Thresholding - Region-Based Segmentation -Segmentation Using Morphological Watersheds – Representation and Description - Representation - Boundary Descriptors - Regional Descriptors - Object Recognition - Patterns and Pattern Classes - Recognition Based on Decision-Theoretic Methods - Structural Methods.

Text books:
1. Rafael C Gonzalez and Richard E.woods, "Digital Image Processing",3/e,Addition – Wesley.
2. Tinku Acharya and Ajoy K.Ray, "Image Processing- Principles and applications", John Wliey & Sons,2005.
3. Anil K Jain, "Fundamentals of Digital Image Processing", PHI, New Delhi, 1995.

References:
1. Kenneth R Castleman, "Digital Image Processing", PHI, 1995.
2. William K Pratt, "Digital Image Processing", Wiley India 2/e.
3. Sid Ahmed M A, "Image Processing Theory, Algorithm and Architectures", McGrawHill,1995.
4. R.M. Haralick, and L.G. Shapiro, Computer and Robot Vision, Vol-1, Addison - Wesley,1992.
5. S Jayaraman,S Esakkirajan,T Veerakumar,"Digital Image Processing",TMH,2009

15.405.2   **SOFTWARE TESTING**   **3-1-0**

Module I

Need for Testing—Psychology of testing—Testing economics—white box testing , Black box testing, Grey box Testing—Retesting regression Testing—Verification and Validation Testing Strategies—Levels of Testing—Unit, Integration ,System Testing, Acceptance Testing. Test case Design—Statement Coverage—Branch Coverage—Condition Coverage—Decision / Condition Coverage—Multiple Condition Coverage—Data Flow Coverage—Mutation Testing

Module II

Test Case Designs. Boundary Value analysis—Equivalence Partitioning—Cause Effect Graphing, Error Guessing, Logic Based Testing. Special Topics: Syntax testing—Finite State Testing Logic Based Testing Domain Test Planning—Test Plan Documentation—Test Estimation—Test Schedule —Test monitoring and Control—standards for Testing.

Module III

Introduction of Object Oriented Testing—Automated Tools for Testing—Tool Selection and Implementation—Test case generators—GUI Testing—Testing Web enabled Application.

Text Books:
1.   Glenford J.Myers," The Art of Software Testing" John Wesley & Sons, 2 edn. 2004.
2.   Boris Beizer, "Software Testing Technologies" 1st edition Dreamtech 2000.
3.   Yogesh Singh, "Software Testing", Cambridge University Press.

References:
1.   Roger S.Pressman," Software Engineering, A practitioners approach" 6th edition, Mc Graw Hill
2.   William E.Lewis, "Software Testing and continuous quality improvement", Auerbach Publications.

| 15.405.3 | **CYBER FORENSICS** | 3-1-0 |

Module I

Introduction to Computer Forensics- Computer Forensics Fundamentals – Story of Forensics, Rules of Computer Forensics, Types of Computer Forensics Technology – Types of Vendor and Computer Forensics Services -Data Recovery – Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication

Module II

Analysis and validation- Forensic Analysis, File Carving- Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events— Information Warfare Arsenal- Validating Forensics Data –Data Hiding Techniques –Performing Remote Acquisition.
Network Forensics –Email Investigations – E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking-Cell Phone and Mobile Devices Forensic- Cyber Forensics Tools

Module III

Cyber attacks-Hijacked Session Attacks, Operating System Attacks ,Polymorphism, Steganography, Reversing the Steganographic process, Anti Forensics, Cloaking Techniques: Data hide and seek, Renaming Files, Manipulating File Systems, and Data Hiding on NTFS.
Cyber Security- Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls, Security Standards, Assessing Threat Levels, Forming an Incident Response Team, Reporting Cyber crime, Reverse Engineering & Cracking Techniques and Financial Frauds.

Text books:

1. John R. Vacca, "Computer Forensics", Firewall Media.

References:
1. Chad Steel, "Windows Forensics", Wiley India.
2. Majid Yar, "Cybercrime and Society", Sage Publications.
3. Robert M Slade, "Software Forensics", Tata McGrawHill.
4. .Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols",Wiley Publications.
5. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition
6. Albert J.Marcella, Jr. Doug Menendez, "Cyber Forensics", Second Edition, Auerbach Publications.
7. Anthony Reyes & Jack Wiles, "Cybercrime and Digital Forensics", Syngress.

15.405.4 **DISTRIBUTED OPERATING SYSTEMS** **3-1-0**

Module I

Distributed computing system -fundamentals – evolution – models – advantages. Distributed operating system – design issues. Introduction to Distributed computing environment.
Communication in distributed systems - Message passing – features – issues – synchronization – buffering.
RPC – model – transparency of RPC – implementation – RPC messages.

Module II
Distributed shared memory – general architecture – design and implementation – granularity – structure – consistency models – advantages of DSM.
Synchronization – clock synchronization – algorithms – event ordering – mutual exclusion – deadlocks in distributed systems – handling – prevention – avoidance – detection.

Module III
Resource management – features of a good global scheduling algorithm – task assignment approach – load balancing approach – load sharing approach.
Process management – process migration.
Distributed file systems – desirable features of a good distributed file system – file accessing models – file sharing semantics – file caching schemes.

Text Books:

1. Distributed Operating Systems – Concepts and Design, Pradeep K. Sinha, Prentics Hall India.

Reference Books:

1. Distributed Systems: Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, Prentice Hall.

15.501   **SOFTWARE ENGINEERING**   **3-1-0**

Module I

Software- software characteristics, applications. Software engineering a layered technology – processes, methods and tools,generic view. Software process models – prototyping models, incremental models, spiral model, waterfall model. Capability maturity model (CMM), ISO 9000. Phases in Software development – requirement analysis. Planning phase – project planning objective, software scope, empirical estimation, models, COCOMO, single variablemodel, staffing and personal planning.

Module II

Risk management – risks, identification, risk projection, project planning and risk management. software configuration management –SCM, Baselines,software configuration items, SCM process . Design phase – design objective, principles, data flow analysis, topdown, bottom up strategies, design methodology. Coding – programming practice, verification, size measures, complexity analysis, coding standards. Testing – fundamentals, white box testing, control structure testing, black box testing, basis path testing, Levels of testing- unit, integration, system and acceptance testing. Maintenance phase – management of maintenance.

Module III

Dependability - critical systems - availability and reliability - safety - security – critical systems specifications - critical system development - verification and validation - planning - software inspection - automated static analysis software testing - defect testing - integration testing - object-oriented testing - testing workbenches - critical system validation - software evolution – legacy systems - software change – software maintenance - architectural evolution – software re-engineering – data re-engineering.

Text books:

1. R. S. Pressman, "Software Engineering – A practitioner's approach", 6th ed., McGraw Hill, 2008.

References:

1. Ian Sommerville, Software Engineering, 7/e, Pearson Education Asia Ed.
2. Gahezzi et. al., FUNDAMENTALS OF SOFTWARE ENGINEERING, 2nd Edition, PHI, 2009
3. Jalote P., An Integrated Approach to Software Engineering, 3rd Edn, Springer, 2009
4. Rajiv Mall – Fundamentals of Software Engineering, PHI

15.502   **CRYPTOGRAPHY & NETWORK SECURITY**   **3-1-0**

Module I
Introduction:- Goals of Security, types of attacks, services and mechanism, different techniques. Mathematics involved – integer arithmetic, modular arithmetic, matrices, linear congruence, algebraic structures,$GF(2^n)$ fields. Symmetric key ciphers – Kerckhoff's principle, substituition ciphers, transposition ciphers, stream and block ciphers,modern block ciphers, modern stream ciphers, DES- structure and analysis, multiple DES, security, AES- transformations, key expansion, ciphers, analysis.

Module II
Asymetric key cryptography – RSA cryptosystem, RABIN cryptosystem, ELGAMAL cryptosystem, elliptic curve cryptosystem. Message integrity, Random oracle model, message authentication, hash functions, digital signature, entity authentication, Key management.

Module III
Network security: At application layer – Email, PGP, S/MIME. At transport layer – SSL architecture, handshake protocol, changecipherspec protocol, Alert protocol, Record protocol, SSL message format, Transport layer security. At network layer – modes, security protocols, security associations, security policy, Internet key exchange, ISAKMP.

Text Book:
1. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw-Hill Publishing.

Reference:
1. Manuel Mogollon, "Cryptography and Security Services – Mechanisms and Applications", Cybertech Publishing.
2. William R. Cheswick, Steven M. Bellovin, Aviel D. Rubin, "Firewalls and Internet Security", Addison-Wesley.

15.503   APPLICATION PROGRAMMING FOR MOBILE DEVICES   2-1-0

Module I
Android Concepts- Components,Intents,Zygote,Components Life-Cycle,Manifest file,Processes and Threads,RPC,Development tools-SDK,Eclipse,User Input-input methods.
Android Architecture,Startup-init,kernel,Android Stack-Native libraries,Android Runtime,Delvik VM,Android Java-JNI,Application framework, App development.

Module II
Blackberry OS Fundamentals- History of Blackberry OS, Architecture, Memory management, Interrupts, Multi-tasking.
Coding with blackberry JDE- Fundamentals of Blackberry App, Screen and user interfaces,Storing data,Threads. Simple App Development.

Module III
iOS6 – Architecture- Frameworks- SDK-Cocoa touchLayer-MVC Architecture - Basics of Objective C.

Text Books
1. Android Application Development For Dummies-Donn Felker-Wiley publishing inc.
2. iOS6 Application Development For Dummies-Wiley publishing inc.
3. Blackberry Application Development For Dummies-Karl G Kowalski- Wiley publishing inc.
4. Android for programmers-Pearson Education

References
1. Learning iOS-OReilly
2. Learning Android-Oreilly
3. Web resources - www.developer.blackberry.com
4. Web resources - www.docs.blackberry.com

15.504   **OBJECT ORIENTED ANALYSIS AND DESIGN**   **3-1-0**

Module I
Introduction: Requirements determination – requirements specifications – feasibility analysis – final specifications – hardware and software study – system design – system implementation –System evaluation – system modification. Role of systems analyst – attributes of a systems analyst – tools used in system analysis. Feasibility analysis: Deciding project goals – examining alternative solutions – cost – benefit analysis – quantifications of costs and benefits – payback period – system proposal preparation for managements – parts and documentation of a proposal – tools for prototype creation.
Tools for systems analysts: Data flow diagrams – case study for use of DFD, good conventions – leveling of DFDs –leveling rules – logical and physical DFDs – software tools to create DFDs

Module II
Structured systems analysis and design: Procedure specifications in structured English – examples and cases – decision tables for complex logical specifications – specification oriented design vs procedure oriented design. Data oriented systems design: Entity relationship model – E-R diagrams – relationships cardinality and participation – normalizing relations – various normal forms and their need – some examples of relational data base design. Data input methods: Coding techniques – requirements of coding schemes – error detection of codes –validating input data – input data controls interactive data input. Designing outputs: Output devices – designing output reports – screen design – graphical user interfaces – interactive I/O on terminals.

Module III
Object oriented systems modeling:. Methodologies-Patterns-Frameworks-The unified approach-Unified Modeling Language-Static and Dynamic models –UML diagrams- UML class diagrams, use case diagram –UML dynamic modeling- Packages and model organization-UML Extensibility-UML meta-models. Object Analysis: Classification-Approaches for identifying classes-Noun phrase approach-Common class patterns approach-Use-case driven approach- Object oriented design axioms and corollaries-designing classes, methods and protocols- Access layer: Object storage and object interoperability-DBMS concepts- Logical and physical database organization –Designing access layer. View Layer: Designing Interface Objects- User interface design as a creative process – Designing view layer classes- Macro level process-Micro level process-Prototyping the user interface

Text Books:
1.   Ali Bahrami, "Object Oriented System Development", McGraw Hill, 2008
2.   V Rajaraman, "Analysis and design of information systems", Prentice Hall of India.

References:
1. James A. Senn, Analysis and Design of Information Systems, Second edition, McGraw Hill International Edition,
2. Hoffer, George, Valacich – Modern System Analysis and Design – Pearson Education, 3rd Edition 2009
3.Stephen Schach, Object-Oriented and Classical Software Engineering, McGrawHill,2008
4. Grady Booch, James Rumbaugh, Ivar Jacobson, - "The Unified ModelingLanguage User Guide" – Peason Edn, 2008.
5. Simon Bennett,Steve McRobb,Ray Farmer, Object-Oriented Information Systems Analysis and Design Using UML, , McGrawHill
6. "UML In an Instant" Thomas A. Pender Wiley – Dreamtech India Pvt. Ltd.

| **15.505.1** | **COMPUTER VISION** | **3-1-0** |

Module I

Digital Image Formation and low-level processing- Overview and State-of-the-art, Fundamentals of Image Formation, Transformation-Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

Module II

Feature Extraction Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Gaussian derivative filters and DWT.

Module III

Pattern Analysis Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semisupervised; Classifiers: Bayes, KNN, ANN models, Motion Analysis:- Background Subtraction and Modeling, Optical Flow

Text Books:
1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

References:
1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision,Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

15.505.2   **BIO INFORMATICS**   **3-1-0**

Module I

Bioinformatics and Computational Biology, Nature & Scope of Bioinformatics. The central dogma of molecular biology and bio-sequences associated with it, RNA classification – coding and non coding RNA- mRNA, tRNA, miRNAand sRNA ,RNAi
Bio-sequence file formats; Bio-databases –primary, secondary and treasury. DNA, RNA and protein databases. Data base searches – text based and sequence based; Sequence-based Database Searches: what are sequence-based database searches, BLAST and FASTA algorithms, Various versions of basic BLAST and FASTA, Use of these methods for sequence analysis including the on-line use of the tools and interpretation of results.

Module II
Sequence alignment – local/global, pairwise/multiple, sequence alignment, scoring methods. Needleman and Wunsch algorithm, global and local alignments.
Protein and RNA structure prediction, polypeptic composition, secondary and tertiary structure, algorithms for modeling RNA and protein folding, structure prediction, proteomics, protein classification, experimental techniques, ligand screening, post-translational modification prediction
Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. Differences between distance & similarity matrix.

Module III
Functional genomics: application of sequence based and structure-based approaches to assignment of gene functions - e.g. sequence comparison, structure analysis (especially active sites, binding sites) and comparison, pattern identification, etc. Use of various derived databases in function assignment, use of SNPs for identification of genetic traits.
DNA microarray: understanding of microarray data and correlation of gene expression data to biological processes and computational analysis tools (especially clustering approaches).

Text Books:
1. D. E. Krane and M. L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003.
2.   Chandra V., Nair, V K, Sugunan V S, Shiny S K, "Informatics Bioinformatics", Academica Publishers, 2010
3. Shuba, Rhys Price, Paul Thymann and Anne Haake, " Bioinformatics", TMH, 2010

References:
1. Andreas Baxevanisand Francis Ouellette, "Bioinformatics- A practical guide to the Analysis of Genes and proteins", Wiley India, 2010
2. Jean-Michel and Cedric Notredam, "Bioinformatics – A begeners guide", Wiley India, 2010
3. Rastogi et. al. Bioinformatics: Methods and Applications Genomics, Proteomics and Drug Discovery, PHI

15.505.3   **MACHINE LEARNING**   **3-1-0**

Module I

Introduction to learning. Types of Learning, Rote learning, Learning by parameter adjustment, Learning by general problem solving, Concept learning, Learning by analogy. Introduction to machine learning, Why machine learning. Types of problems in machine learning, History of machine learning, Aspects of inputs to training, Learning systems, Machine learning as a classifier, Intelligent agents, Machine learning applications. Evaluation of machine learning algorithms.
Association Learning, Basics of Association , Apriori Algorithm , Eclat Algorithm , FP Growth Algorithm, Tertius Algorithm.

Module II
Neural Networks. Artificial Neural Nets, ANN Basics, ANN - Learning Process , Types of Networks, Perceptron, Multilayer Perceptron, Error back Propagation Algorithm, RBF Networks
Statistical Learning, Stochastic Processes, Markov Process, Hidden Markov Models, Three Basic Problems for HMMs, Forward - Backward Procedure , Viterbi Algorithm, Baum-Welch Algorithm, Linear Classifiers , Quadratic Classifiers, Decision Trees, C 4.5 Algorithm, ID3 Algorithm, Random Forest, Bayesian Networks, Bayesian Networks Learning, Limitation of Bayesian Networks, Expectation Maximization (EM), EM Algorithm, Self Organising Maps, Learning Process of SOM, Adaptive Resonance Theory, Important ART Networks, ART Architecture, ART Algorithms

Module III
Supervised Learning, Support Vector Machines, Inductive Logic Programming, Generic ILP Algorithm, Principal Approaches to ILP, Characteristics of ILP System, Case Base Reasoning, How CBR Works?, Case Representation, CBR Issues, Ensemble Classifiers, AdaBoost algorithm, Bayes Optimal Classifier , Nearest Neighbourhood techniques, Fuzzy Network, Fuzzy Systems, Info Fuzzy Networks, Fuzzy Neural Systems
Unsupervised learning. Clustering, K-Means Clustering , Fuzzy Clustering, Hierarchical Clustering , Agglomerative and Divisive Clustering, Hierarchical Agglomerative Clustering, Cluster Similarity, Reinforcement Learning, Markov Decision Problem, Q-learning, Q-Learning Algorithms, Temporal Difference Learning, On-Policy and Off-Policy Learning, Advantages of TD Prediction Methods, Learning Automata.

Text Book
1. Chandra V, Hareendran A, "Artificial Intelligence and Machine Learning", PHI,2014.

References

1. Anderson J.A., "An Introduction to Neural Networks", PHI, 1999.
2. Hertz J. Krogh, R.G. Palmer, "Introduction to the Theory of Neural
3. Computation", AddisonWesley, California, 1991.
4. Stephen Marsland Machine Learning: An Algorithmic Perspective, CRC Press, 2009
5. Stuart Russell and Peter Norvig "Artificial Intelligence: A Modern Approach, *Peason Education* 3rd Edn., 2011.
6. Shakhnarovish, Darrell, and Indyk,, "Nearest-Neighbor Methods in Learning and Vision". *MIT Press*, 2005.

15.505.4   **COMPUTER AIDED DESIGN FOR VLSI**   **3-1-0**

Module I

Overview of Digital Design with Verilog HDL – typical design flow, Hierarchical Modeling Concepts – Design methodologies - modules – instances – simulation, Basic Concepts – lexical conventions – data types. Modules and Ports – port declaration – port connection rules – inputs – outputs – inouts - width matching – unconnected ports – connecting ports to external signals.

Module II

Gate-Level Modeling – gate types – gate delays – rise, fall and turn off delays – minimum/typical/maximum values, Dataflow Modeling – continuous assignments – delays – expressions, operators and operands – operator types – examples. Behavioral Modeling – structured procedure – procedural assignments – timing control – conditional statements – multiway branching – loops – sequential and parrellel blocks.

Module III

Tasks and Functions – task declaration and invocation – functional declaration and invocation. Useful Modeling Techniques – procedural continuous assignments – overriding parameters – conditional compilation and execution – time scales – system tasks. Timing and Delays – types of delay models – path delay modeling – timing checks – delay back annotation. Switch-Level Modeling – elements – examples. Logic Synthesis with Verilog HDL – impact – verilog HDL synthesis – synthesis design flow – verification of gate-level netlist – examples of sequential circuit synthesis.

Text Books:

1. Verilog HDL, A guide to digital design and synthesis, Samir palnitkar, Sunsoft press.

References :

1. The Verilog® Hardware Description Language, Donald Thomas, Philip Moorby, Springer Science & Business Media
2. Verilog Digital System Design, Zainalabedin Navabi, McGraw Hill Professional.
3. Modeling, Synthesis, and Rapid Prototyping with the Verilog HDL, Michael D. Ciletti, Prentice Hall, 1999.
4. Verilog HDL synthesis: a practical primer, Jayaram Bhasker, Star Galaxy Pub., 1998.

Assignments: To be mainly programming in nature. Students to be guided to design combinational and sequential circuits in Verilog®. Also design of small processors can be given. Free tools are available like iverilog for Verilog® HDL development.

15.506   APPLICATION PROGRAMMING LAB FOR MOBILE DEVICES   0-0-4

Students have to develop Android application in Eclipse. Development of applications in iOS, Windows (Mobile) and Blackberry OS can also be carried out.

| **15.507** | **MINI PROJECT** | **0-0-6** |

A   mini-project should be done by the students based on concepts they have already learnt in the first two years of the MCA programme. It may be based on database concepts, object oriented concepts, image processing, computer vision, optimization tools, compiler design, etc.

Objectives of the mini project:

Working on Mini project is to get used to the larger project, which will be handled in the 6th semester

The project work constitutes an important component of the MCA programme of KU and it is to be carried out with due care and should be executed with seriousness by the students. The objective of this mini project is to help the student develop the ability to apply theoretical and practical tools/techniques to solve real life problems related to industry, academic institutions and research laboratories.

Guidelines:

A student is expected to devote about 1-2 months in planning, analyzing, designing and implementing the project. The initiation of project should be with the project proposal that is to be treated as an assignment:

Mini-project evaluation:

The evaluation of the mini-project will be based on the project reports submitted by the student, a presentation and a demonstration.

15.601   **PROJECT DESIGN AND IMPLEMENTATION**   **0-0-29**

Students are advised to carry out the project work in-order to understand systematic and good software development methodologies either in their institution or in an industry including R&D institutions for duration of a full semester and submit a detailed project report. The Master's level projects should be done individually.

Guidelines:

A student is expected to devote about 4-6 months in planning, analyzing, designing and implementing the project. The initiation of project should be with the project proposal which is to be treated as an assignment.

Project evaluation:

The evaluation of the project will be based on the project reports submitted by the student, a presentation and a demonstration at the evaluation time. The students are also advised to publish a technical paper, based on the work carried out in the project, either in international or national conference, which carries 5% weightage of the total marks for external evaluation, i.e., 15 marks out of 300 marks (communication of the technical paper to the conference can also be taken into account).