UNIVERSITY OFNORTH BENGAL

SYLLABUS
For
M.C.A.

(To be implemented from Session 2015-16)

Proposed Courses Structure for of Six Semester (Full Time) M.C.A Programme in Computer Science and Application

Year	Semester	Paper	Paper Type	Periods / Week	Exam. Marks	Continuing Evaluation	
						Sessional	Nature
1st Year	I	IT 11	Theory	3	75	25	Class Test
		IT 12	Theory	3	75	25	Class Test
		MT 11	Theory	3	75	25	Class Test
		BM 11	Theory	3	75	25	Class Test
		BM 12	Theory	3	50	50	Class Test
		IT 11L	Lab-I	3	50	25	Assignment
		IT 12L	Lab-II	2	50	25	Assignment
					450	**200**	**650**
	II	IT 21	Theory	3	75	25	Class Test
		IT 22	Theory	3	75	25	Class Test
		IT 23	Theory	3	75	25	Class Test
		MT 21	Theory	3	75	25	Class Test
		BM 21	Theory	3	75	25	Class Test
		IT 21L	Lab-III	3	50	25	Assignment
		IT 22L	Lab-IV	2	50	25	Assignment
					475	**175**	**650**
2nd Year	III	IT 31	Theory	3	75	25	Class Test
		IT 32	Theory	3	75	25	Class Test
		IT 33	Theory	3	75	25	Class Test
		IT 3E1	Theory	3	75	25	Class Test
		MT 31	Theory	3	75	25	Class Test
		IT 31L	Lab-V	3	50	25	Assignments
		MT 31L	Lab-V	2	50	25	Assignment
					475	**175**	**650**
	IV	IT 41	Theory	3	75	25	Class Test
		IT 42	Theory	3	75	25	Class Test
		IT 43	Theory	3	75	25	Class Test
		IT 4E1	Theory	3	75	25	Class Test
		MT 41	Theory	3	75	25	Class Test
		IT 41L	Lab-III	3	50	25	Assignment
		IT 42L	Lab-IV	2	50	25	Assignment
					475	**175**	**650**
3rd Year	V	IT 51	Theory	3	75	25	Class Test
		IT 52	Theory	3	75	25	Class Test
		IT 5E1	Theory	3	75	25	Class Test
		IT 5E2	Theory	3	75	25	Class Test
		IT 51L	Lab-III	3	50	25	Assignment
		IT 52L	Lab-IV	2	50	25	Assignment
		IT 5IL	Industrial Lecture			25	Participation and report
		IT 51S	Seminar			25	Seminar
		IT 51P	Project			25	Minor Project
					400	**225**	**625**
	VI	IT 61S	Seminar			25	Seminar
		IT 61P	Project			100	Industrial Project Defense
						125	**125**
						Total	**3350**

Note: One 'Period' is of 1 Hr. duration.

Proposed Paper Structure for of Six Semester (Full Time) M.C.A Programme in Computer Science and Application

Year	Semester	Paper	Paper Type	Exam. Marks	Continuing Evaluation	
					Sessional	Nature
1st Year	I	IT 11	Computer Concepts and Programming in C	75	25	Class Test
		IT 12	Digital Systems and Microprocessors	75	25	Class Test
		MT 11	Discrete Mathematics and Graph Theory	75	25	Class Test
		BM 11	Introduction to Management Functions	75	25	Class Test
		BM 12	Business and Technical Communication	50	50	Class Test
		IT 11L	Programming Using C Lab	50	25	Assignment
		IT 12L	UNIX and Shell Programming Lab	50	25	Assignment
				450	**200**	**650**
	II	IT 21	Data and File Structures	75	25	Class Test
		IT 22	Data Communications and Computer Networks	75	25	Class Test
		IT 23	Computer Architecture and Organization	75	25	Class Test
		MT 21	Probability and Combinatorics	75	25	Class Test
		BM 21	Accounting and Management Control	75	25	Class Test
		IT 21L	Data and File Structures Lab	50	25	Assignment
		IT 22L	Network programming Lab	50	25	Assignment
				475	**175**	**650**
2nd Year	III	IT 31	Object Oriented Paradigm Using JAVA	75	25	Class Test
		IT 32	Operating Systems	75	25	Class Test
		IT 33	Design and Analysis of Algorithms	75	25	Class Test
		IT 3E1	**Elective-1**	75	25	Class Test
		MT 31	Numerical and Statistical Computing	75	25	Class Test
		IT 31L	OOPs Using JAVA Lab	50	25	Assignments
		MT 31L	Numerical and Statistical Computing Lab	50	25	Assignment
				475	**175**	**650**
	IV	IT 41	Internet and Web Technologies	75	25	Class Test
		IT 42	Data Base Management System and RDBMS	75	25	Class Test
		IT 43	Software Engineering	75	25	Class Test
		IT 4E1	**Elective -2**	75	25	Class Test
		MT 41	Optimization Techniques	75	25	Class Test

		IT 41L	Web Design Lab	50	25	Assignment
		IT 42L	DBMS Lab	50	25	Assignment
				475	**175**	**650**
3rd Year	**V**	IT 51	Parallel Computing	75	25	Class Test
		IT 52	Application Development using .NET Framework	75	25	Class Test
		IT 5E1	**Elective -3**	75	25	Class Test
		IT 5E2	**Elective -4**	75	25	Class Test
		IT 51L	Parallel Programming Lab	50	25	Assignment
		IT 52L	.NET Framework Lab	50	25	Assignment
		IT 51 IL	Industrial Lecture		25	Participation and report
		IT 51 S	Seminar		25	Seminar presentation
		IT 51 P	Project		25	Minor Project
				400	**225**	**625**
	VI	IT 61 S	Seminar		25	Seminar
		IT 61 P	Project		100	Industrial Project Defense
					125	**125**
Total						**3350**

List of Electives

IT 3E1 Electives

E31: Automata Theory & Formal Languages
E32: Principles of Programming Languages
E33: Real Time and Embedded Systems
E34: Mobile and Pervasive Computing

IT 4E1 Electives

E41: Computer Graphics
E42: Digital Image Processing and Steganography
E43: Adhoc and Sensor Networks
E44: Human Computer Interaction

IT 5E1 Electives

E51: System Software and Compiler Constructions
E52: Information Security and Cyber Forensics
E53: Cryptography and Network Security
E54: Cloud and Grid Computing

IT 5E2 Electives

E55: AI and Expert System
E56: Data Warehousing & Data Mining
E57: Soft Computing
E58: Software Project Management and SQA

**The allotment of electives depends on the availability of teachers.

Detailed Syllabus of Compulsory Papers

Year 1: Semester 1

IT 11: Computer Concepts and Programming in C

Introduction to Computer Systems: Computer- definition, history, properties, use, basic components and structure of a computer; essential computer hardware, essential computer software; classification of Computers; Memory- use, types and hierarchy; Software- program, software, types and need

Storage Media and Operating Systems: Storage media- use, types, performance; Operating Systems- concept, role and functions, types, UNIX, Linux, Windows

Basics of Programming: Approaches to problem solving, concept of flowchart and algorithm, Termination and correctness, Algorithms to programs, Programming Environment, Specification, top-down and bottom-up development and stepwise refinement; Programming Languages- concepts, use, types; structured programming,

Introduction to C Language: Background, C Programs, Identifiers, Types, Variables, Constants, standard I/ O, structure of a C Program

Operators and Expressions: Operators- concepts, types, arithmetic, relational, logical and bitwise operators; type conversions, expressions; operator precedence and associativity; evaluating expressions, type conversion, statements,

Fundamental Data Types and Storage Classes: Data type- definition, importance and need, types; Storage Classes- concepts, types, scope and use

Arrays and Strings: Array- concepts, need, use, notations, representation, manipulating, two and multi-dimensional arrays, arrays of unknown or varying size, advantages and applications; Strings- concepts, string I/O, operations, string handling functions

Selection – Making Decisions, Looping: Selection- concepts, purpose, applying if and switch statements, nesting if and else, restrictions on switch values, use of break, continue and default with switch, multi-way selection; Looping- concept, purpose, pre-test and post-test loops, initialization and updating, event controlled and count controlled loops, For Loop , While Loop, Do-While Loop, Multiple Loop Variables, No Data Found, other statements related to looping

Functions: Concept of structured programs and design; Functions- concept, need, use, types, declaration Vs definition, scope, calling; Parameter Passing- concepts, needs, types; inter-function communication, recursion, functions with Arrays, function with variable umber of arguments, separate compilation and linkage, building your own modules.

Pointer: Introduction, declaration and initialization of pointers, pointer and address arithmetic, pointer operations and declarations, using pointers as function arguments,

Dynamic Memory Allocation: Memory allocation- concepts, type, dynamic memory allocation functions

Structure, Union and Enumeration: Concepts, purpose, declaration, assignment and use of structure, union and enumerated data types; pointers to these types of objects

File handling: File concept, functions associated to file operation, math functions

Preprocessor: Concept of macro, macro Vs functions, defining and calling macros, utilizing conditional compilation, passing values to the compiler,

Advancements in C and other related issues

References:

1. Norton, Peter; Introduction to Computers, 4th Ed., TMH
2. Brian W. Kernighan and Robert Pike; The Practice of Programming, Pearson Education, 1999
3. Jones, A., Kenith Harvow; C Programming with Problem Solving, Wiley India Pvt. Ltd
4. Kenneth, A.: C Problem Solving and Programming, PHI
5. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Ed., Pearson Education, 1988
6. Byron S. Gottfried; Programming with C.
7. Gottfried, B.: Theory and Problems of Programming in C, Schaum Series
8. Herbert Schildt, C: The Complete Reference, 4th Ed., TMH, 2000
9. Y.P. Kanetkar; Let us C
10. Y. Kanetkar; Graphics Under C
11. Stephen G. Kochan; Programming in C, 3rd Ed., Pearson Education, 2005
12. Moolish Kooper; Spirit of C
13. R. Hutchison; Programming in C
14. Gookin, Dan; C Programming, Wiley India Pvt. Ltd.
15. Balgurusamy; Programming in ANCI C
16. R.G.Dromey; How to Solve it by Computer, Pearson Education, 2007
17. H. M. Deitel and P. J. Deitel; C How to Program, 7th Ed., Pearson Education, 2013
18. Pradip Dey, Manas Ghosh; Programming in C, Oxford University Press, 2007
19. Cormen,Leiserson, Rivest, Stein; Introduction to Algorithms, McGraw Hill Publishers, 2002
20. Jeri R. Hanly, Elliot B. Ko_man; Problem Solving and Program Design in C, Pearson Education, 2006
21. Behrouz A.Forouzan, Richard F. Gilberg, Thomson; Computer Science- A Structured Programming Approach Using C, 3rd Ed., 2007

IT 12: Digital Systems and Microprocessors

Electronic Systems: Introduction to Analog and Digital Systems, Comparison and Difference between Analog and Digital Systems, advantages of digital systems

Number systems: Foundation of number systems, Binary, octal, and hexadecimal number systems, Conversion of one Number System to another, r's and (r-1)'s complement, Arithmetic operations on Binary numbers, Representation of negative numbers, Signed Binary numbers, floating point representations;

Binary codes: Binary Coded Decimal (8421 BCD, Excess-3 BCD) , Addition of BCD numbers, Gray code, Error detecting code and correction codes, Seven-segment display code, other Alphanumeric codes (ASCII, EBCDIC, ISCII, UNICODE);

Boolean algebra and Logic Gates: Boolean Algebra: Law's, Postulates and theorems, logic functions, minimization of boolean functions using different techniques; Writing Boolean functions from truth table, different logic gates and truth tables, realizing logical expressions using different logic gates and comparing their performance, logic diagrams, converting circuits to universal logic, Sum of Product and Product of Sum, Universal logic operations

Logic Families: Classification and characteristics, Bipolar transistors characteristic and families (RTL, DTL, I^2L, HTL, TTL, ECL), MOS families (MOSFET, CMOS, BiCMOS); Tri state logic, *Design of Combinational Circuits*- designing different combinational circuits i.e. Half-adder,

Full-adder, Sequential adder, binary Parallel adder, Carry-Look-Ahead adder, Adder, Subtractor, multiplication, code conversion, Decoders and Encoders, Magnitude Comparator, Multiplexer, Demultiplexers, Parity generator and checker, Hardware aspects related to logic design: delays and hazards; *Design of Sequential Circuits*— Flip Flops and their types, Conversion of flip-flops, excitation tables, practical clocking aspects concerning flip-flops, timing and triggering; Registers and their types, Counters and their types, A/D and D/A converters, Memory Devices and their types, PLAs, PLDs and implementation of circuits using PLDs; *Control logic Design*-- Hard-wired control, micro program sequencer,

Microprocessors: Microprocessor, microcontrollers, digital signal processors, processor evolution, microprocessor architecture and its operations, memory input/output; addressing modes; instruction set, format and classification; arithmetic and data transfer instructions; subroutine call and return instruction, restart as software instruction; logic and branch operation, looping, counting and indexing, timings and operation status; stack, parallel input/output, interfacing devices, 8085/8086 based microcomputer system; 8087 coprocessor, 8051 and 8096 microcontroller; 8255 programmable peripheral interface, 8253 programmable timer, 8259 programmable interrupt controller, direct memory access and 8257 DMA controller

Assembly Language Programming: Assembler, assembly language and instructions, assembly directives, ALP

References:

1. Digital Design: M. Morris Mano and Michael D. Ciletti, Pearson Education.
2. Digital Logic and Computer Design: Morris Mano, Prentice Hall of India.
3. Modern Digital Electronics: R.P. Jain, Tata McGraw-Hill.
4. Digital Principles and Applications: Malvino and Leach, TMH
5. Digital Circuits and Design: S. Salivahanan and S. Arivazhagan, Vikas Publication.
6. Digital Integrated Electronics: Taub and Schilling, McHill
7. Engineering Digital Design: R. F. Tinder, Academic Press, Harcourt India Pvt. Ltd.
8. Introduction to Logic design: A. B. Marcovitz, Tata –McGraw-Hill Edition.
9. Fundamentals of Digital Logic with VHDL Design: B. Vranesic, Tata-Mc-Graw-Hill
10. An introduction to Digital Computer Design: Rajaraman and Radhakrishanan, PHI.
11. Microprocessor and Interfacing: D. V. Hall, TMH
12. The Intel Microprocessors: Barry B. Bray, PHI

MT 11: Discrete Mathematics and Graph Theory

Set Theory: Definition of sets, countable and uncountable sets, Venn Diagrams, proofs of some general identities on sets, Paradoxes in set theory; ordered set, hasse diagram of partially ordered set, isomorphic ordered set, well ordered set

Functions and Relations: Definition and type of functions, mappings, injection, bijection and surjection, inverse function, recursive functions, composite function, growth of functions, Definition and types of relation, properties of relations, equivalence relations and partitions, partial ordering relation, Lattices and their applications, generating functions, recurrence relations, solution of linear homogeneous and non- homogeneous recurrence relations by the method of generating functions and particular solution method

Mathematical/Propositional Logic: Mathematical reasoning, Proposition, First order logic, Basic logical operations, Tautologies, Contradictions, connectives, conditionals and bi-conditionals, well formed formulas, equivalence of formulas, Algebra of Proposition, Logical implication, Logical equivalence, duality law, Normal forms, Inference Theory for propositional calculus, Predicates, quantifiers, free and bound variables, inference theory of predicate calculus

Algebraic Structures: Goups, Rings and Fields; Group Codes; Concepts of Vector Spaces;

Graph Theory: Basic terminology of graphs, types of graphs, paths and circuits, reachability and connectedness; operations on graphs, Euler and Hamiltonian graph, matrix and storage representation, manipulation of graphs, Trees and Minimum Spanning Trees, Traveling Salesperson problem, Graph traversals- BFS, DFS and their applications.

References:

1. Trembley, J.P and R., Manohar; Discrete Mathematical Structure with Application to Computer Science, TMH
2. C. L. Liu, Elements of Discrete Mathematics, TMH, 2000.
3. J. L. Mott, A. Kandel, T.P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, PHI.
4. Narsingh Deo, Graph Theory With Applications To Engineering And Computer Science, PHI Learning
5. Chowdhary, K. R.; Fundamentals of discrete Mathematical Structures, Second Edition, PHI Learning.
6. Liptschutz, Seymour; Discrete Mathematics; TMH.
7. Kenneth H. Rosen; Discrete Mathematics and its applications; TMH.
8. R.L. Graham, D.E. Knuth, O. Patashnik; Concrete Mathematics (2nd ed.); Addison-Wesley, 1994.
9. K. H. Rosen, Discrete Mathematics and applications, fifth edition 2003, TMH.
10. W. K. Grassmann and J. P. Trembnlay, Logic and Discrete Mathematics

BM 11: Introduction to Management Functions

Introduction to Management: Management Thought; Meaning and nature of management; Functions and Principles of Management; Corporate social responsibility, Management systems and processes; Tasks and responsibilities of a professional manager; Managerial skills.

Human Resource Development: Importance and Functions, Scope of HRM, selection, appraisal, training and information systems, Human Resource Management in a changing environment,

Marketing: Understand the concept of marketing mix. These marketing mix elements consist of product policy and design, pricing, choice of marketing intermediaries, methods of physical distribution, use of personal selling, advertising and sales promotion, marketing research, and marketing organization.

Finance: Finance function (concept, scope, and its relationship with other functions) : tools of financial analysis (funds and cash flow analysis, ratio, analysis, risk-return trade-off): financial forecasting (proforma income statement and balance sheet, cash flow forecasting under uncertainty, financial planning): estimation and management of working capital (operating cycle concept, inventory, accounts receivables, cash and accounts payables, working capital requirements).

Manufacturing: Operations Planning and Control (aggregate planning, multiple product batch, production cycles, short-term scheduling of job shop, setting production rate in continuous production systems, activity scheduling in projects, introduction to project time calculations through PERT/CPM): Management of supply chain, materials management (introduction to materials management, systems and procedures for inventory management planning, and procurement of materials): quality management (quality concept and planning. standardizations, quality circles).

Strategy: Firm and its Environment: strategies and resources; industry structure and analysis; evaluation of corporate strategy; strategies for growth and diversification; process of strategic planning.

References:

1. Harold Koontz & Heinz Weirich, Management, a Global and Entrepreneurial Perspective, TMH, 2008
2. Agarwal, R.D., Organization and Management, TMH, 1986
3. Massie, Essentials of Management, 4th Ed., PHI, 1996

BM12: Business and Technical Communication

Introduction: *Means of Communication*- Meaning, definition, process, functions, objectives, importance, language as a tool of communication, essentials of good communication, communication barriers, 7Cs of communication; *Levels of communication*- Interpersonal, organizational, mass communication; flow of communication downward, upward, lateral or horizontal, art of condensation various steps.

Types of Communication: *Oral Communication*- Meaning, nature and scope, principle of effective oral communication, techniques of effective speech, media of oral communication (face-to-face conversation, teleconferences, press conference, demonstration, radio recording, dictaphone, meetings, rumour, demonstration and dramatisation, public address system, grapevine, group discussion, oral report, closed circuit tv), the art of listening, principles of good listening; *Written Communication*- Purpose of writing, clarity in writing, pricinciples of effective writing, writing techniques, electronic writing process.

Forms of Technical Communications: *Business Letters*- Need and functions of business letters, planning & layout of business letter, kinds of business letters- sales and credit letters, complaints and follow-up sales letters, letter of enquiry and reply, placing and fulfilling orders, letter of quotation, claim and adjustment letters; *Official Letters*- Circulars, notices, D.O. letters, govt. letters, letters to authorities, circular letters, application for employment and resume, job application and resumes; *Business Reports*- Essentials of effective correspondence, types, objective, purpose, significance, style & writing of reports, technical proposal, technical paper, project;

Writing Skills: *Comprehension*- reading, writing, froms, reasons for poor comprehension and developing skills; *Precy writing*- techniques writing, topic sentences and its arrangement; *Essay*- definition, writing, types, use, relevant essay writing for engineers/ professionals, dimensions of essay writing-literary, scientific, sociological; horizons of essay writing- narrative essays, descriptive essays; reflective essays, expository essays, argumentative and imaginative essays, contemporary problem solving essays

Dissertation, Project Report and Thesis Writing: Features, methods, styles & writing

Presentation Strategies: Defining purpose, audience & locale, organizing contents, preparing outline, audio-visual aids, nuances of delivery, body language, space, setting nuances of voice dynamics, time- dimension.

References:

1. The Chicago Manual of Style, 13th Edition, PHI, 1989
2. Gowers, Ernest, The Complete Words, Penguin, 1973
3. Ludlow, R., and Panton, F., The Essence of Effective Communication, PHI, 1995

4. R. P. Sinha, Current English Grammar and Usage with composition, Oxford Univ. Press
5. John Eastwood, Oxford Practice Grammar, Oxford Univ. Press
6. R.W. Burchfield, Fowler's Modem English Usage, Oxford Univ. Press
7. Munter, M., Business Communication: Strategy and Style, PHI, 1987
8. K. K. Sinha, Business Communication, Galgotia Publishing Company
9. R.C. Sharma, Krishna Mohan, Business Correspondence and Report Writing, TMH
10. V.N. Arora and Laxmi Chandra, Improve Your Writing, Oxford Univ. Press
11. Menzel, D.H., Jones, H.M., Boyd, L.G., Writing a Technical Paper, McGraw Hill, 1961
12. Strunk, W., White. E.B., The Elements of Style, 3rd Ed., McMillan, 1979
13. Munter, M., Business Communication: Strategy and Style, PHI, New Jersey, 1987
14. Tubian, K.L., A Manual for Writen of term Papers, Thesis and Dissertation, Univ. of Chicago Press, 1973

IT 11L: Programming Using C Lab

The experiments including the following and alike should be practiced:

1. Non-iterative control structures
2. Using single and multi dimensional arrays
3. Pointer data type
4. Iterative control structures and arrays
5. Programs using functions- recursive, non-recursive and Library functions
6. Functions with parameters
7. Programs using structures, nested structures and union
8. Programs for passing aggregate data types as parameters between functions
9. Functions with arrays - structures as arguments
10. Character and String Handling Libraries
11. Files – Sequential access and random access
12. Preprocessor directives for other features like macros - conditional compilation
13. Programs for dynamic memory allocation and de-allocation
14. Programs for self-referential structure – Implementing linked list etc.

IT 12L: UNIX and Shell Programming Lab

Students should use shell script in various applications including the followings:

1. Write a shell script that accepts the name of a text file and finds: No. of sentences, No. of words, No. of words having more than five characters, No. of words that start with a vowel, No. of articles in the text file etc.
2. Write a shell script that presents a multiple choice question, gets the user's answer, and reports back whether it is right or wrong. Finally it shall display the score.
3. Write a shell script that accepts a matrix and finds and prints the row and column totals Modify the calendar so that it knows about weekend: On Friday, tomorrow include Saturday, Sunday and Monday, Modify calendar to handle leap years. Calendar should know about our college holidays. How would you arrange it.
4. Write shell script which simulates the important DOS commands with various switches.
5. Write a shell script that receives a file name and informs whether it exists or not.
6. If it exists, then it shall give the details of its access permission, its size etc.

7. Write a program using proper system calls to exchange data between you program and a specified file.
8. Write a shell script which will accept input and then check if the input is a directory file and is readable and writeable. If so then all ordinary files under the directory should be listed out one by one and for each ordinary file that is writeable, the user should be asked if the file is to be deleted or not. If yes, then the deletion should be done else next files processed. At the end of execution of the script, should display the following messages: Ordinary files deleted from the directory, Ordinary files remaining in the directory.
9. Write a Program that passes some amount of data from the client to the server using

a. message Queues
b. files

10. Write a program that enables you to run two or more shells on a single terminal.
11. Write a program to implement character or file I/O device driver for any device.

Year 1: Semester 2

IT 21: Data and File Structures

Introduction to Basic Data Structures: From problems to programs, recap of concepts of array and pointers with its advantages and limitations, basic terminology, elementary data organization, concept of abstract data types (ADTs); introduction to stacks, queues, linked lists and binary trees, data structure operations, introduction to algorithm, complexity and time-space trade-off,

Linear Data Structures:

Linked list- Introduction, representation and implementation of singly linked lists, two-way header list, traversing and searching of linked list, overflow and underflow, insertion and deletion to/from linked lists, algorithms, doubly linked list, linked list in array, polynomial representation and addition, generalized linked list, garbage collection and compaction.

Stacks- Introduction, graph as ADT, Array and linked list representation and implementation, operations associated with stacks, application of stack- conversion of infix to prefix and postfix expressions, evaluation of postfix expression using stack.

Queues: Introduction, graph as ADT, Array and linked representation and implementation, operations associated with queues- create, add, delete, full and empty; circular queue, deque, priority queue, applications of queues

Non-linear Data Structures:

Graphs- Introduction, terminology, graphs & multi-graphs, directed and undirected graphs, Graph as ADT, Array and linked representation and implementation, adjacency lit and matrices, graph traversal, connectedness and components, articulation points and bi-connected components, spanning trees, minimum cost spanning trees, single-source and all-pairs shortest path problem, graph matching

Trees- Introduction, terminology, trees as ADT, binary trees and its array and linked representation, complete binary tree, extended binary trees, binary search tree (BST), insertion and deletion in BST, AVL trees, B and B^+ trees, traversing binary trees, threaded binary trees, traversing threaded binary trees, huffman algorithm, algebraic expressions,

Searching: Introduction, importance and significant, application domain, linear and binary search, internal and external searching, comparison and analysis

Sorting: Introduction, sorting schemes i.e. insertion, bubble, shell, heap, merge sort, quick sort, bin sorting, sorting on different keys, internal and external sorting schemes, practical consideration for internal sorting; Applications of string algorithms-pattern matching ,text editor etc

File Organizations and File Operations: Introduction, sequential, indexed sequential, direct, inverted, multi-list, directory systems, indexing using b-tree, b+ tree and their variants, hashing, hash table and implementation, hash functions, extendible hashing, collision resolution strategies, basic file system operations i.e. create, open, close, extend, delete, read-block, write-block, protection mechanisms, ISAM.

Physical Devices: Characteristics of storage devices such as disks and tapes, I/O buffering.

Memory Management: Garbage collection algorithms for equal sized blocks, storage allocation for objects with mixed size, buddy systems, dictionary implementation, application of data structures and recent advances

References:

1. Y. Langsam, M. Augenstin and A. Tannenbaum, Data Structures using C and C++, Pearson Education Asia, 2nd Ed., 2002
2. Ellis Horowitz, S. Sahni, D. Mehta Fundamentals of Data Structures in C++, Galgotia Publications, New Delhi
3. Samanta, Classic Data Structures, PHI
4. S. Lipschutz, Data Structures Mc-Graw Hill International Editions, 1986
5. Jean-Paul Tremblay, Paul. G. Soresan, An introduction to data structures with Applications, TMH, 1984
6. A. Michael Berman, Data structures via C++, Oxford University Press, 2002
7. M. Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, 2002
8. M.T. Goodrich, R. Tamassia and D. Mount, Data Structures and Algorithms in C++, John Wiley & Sons, Inc., 2004
9. M.J. Folk, B. Zoellick and G. Riccardi, File Structures: An Object Oriented Approach With C++, 3rd Ed., Addison- Wesley, 1997
10. Robert L. Kruse and A.J. Ryba, Data structures and program design in C++, PHI, 1998
11. B. Stroupstrup, The C++ Programming Language, Addison Wesley, 2004
12. D. E. Knuth, Fundamental Algorithms, Vol. I, Addison Wesley, 1997

IT 22: Data Communications and Computer Networks

Introduction to Communication Systems: Analog and digital signals and communications, communication channel, data communications and networking, data transmission concepts and terminology, theoretical basis of data communication; modulation and demodulation, interfaces and modems, DTE- DCE Interface, bandwidth, channel, baud rate of transmission, asynchronous and synchronous transmission, transmission modes and medium, broadband and baseband transmission, problems with digital transmission, Transmission impairments, Attenuation, Distortion, Noise, Data rate limits for noisy and noiseless channels, Performance criteria of a communication system;

Encoding and Decoding: Data encoding and modulation techniques, line and block coding, scrambling techniques, pulse code modulation, variable length codes , transmission errors and error handling mechanisms, Error detection codes, information theory, measure of information, entropy, Discrete and Continuous channel, Shannon's encoding algorithms, Shannon-Hantly theorem, Data compression;

Bandwidth utilization techniques: Multiplexing concepts; frequency, time and wave division multiplexing, spread spectrum concepts, baseband data transmission and pulse shaping, Inter Symbol Interface (ISI), Dubinary Baseband PAM, signaling schemes, Equalisation, Synchronisation Scrambler and Unscrambler; Band-pass data transmission system ASK, PSK, FAK, DPSK & PSK, MSK modulation schemes; coherent and Non Coherent detector, Probability of Error (PE), performance analysis and comparison; synchronous and asynchronous transmission, serial interface, circuit switching, packet switching, hybrid switching,

Introduction to Computer Network: Need of computer networking, topology, protocols, architecture of computer network, need of layered architecture, types of computer networks, OSI and TCT/IP reference model, Novel Netware, telephone networks, mobile networks, example networks

Physical Layer: Transmission media - guided media, twisted pair cable, coaxial cable and fibre optic cable, unguided media, different propagation modes, radio waves, terrestrial microwaves, satellite communication; concept of spreading spectrum, frequency hopping spread spectrum and Direct sequence spread spectrum; physical layer issues and devices, Error detection and correction- LRC, VRC, CRC, checksum and hamming Code, HDLC, interconnection of LANs; repeaters, bridges, routers; ATM cell-switching

Data Link Layer: Link Layer Services, Error detection and Correction Techniques, Multi Access Protocols, Link Layer Addressing, Ethernet, Hubs, Switche, Point to Point Protocol, Asynchronous Transfer Mode, Multiprotocol Label Switching;

Host-to-host communication: RS-232 over serial line, handshaking and error handling, circuit switching, packet switching, message switching, cell switching, reliable transmission - stop-and-wait, sliding window; logical connections; Multiple co-located hosts: addressing, LAN access methods; CSMA/CD, Ethernet, Token passing, Token Ring, FDDI, wireless LANs; Simple performance models; WAN access methods – PPP

Network Layer: Introduction, Virtual Circuit and Datagram Networks, IP Addressing, Subnetting, Routing Algorithms (Link State, Distance Vector, Hierarchical), Routing in the Internet (RIP, OSPF, BGP), Broadcast and Multicast Routing Algorithms, Routers, ICMP, IPv6 ;

Transport Layer: Introduction to Transport Layer Services, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection Oriented Transport: TCP, Principles of Congestion Control, TCP, Congestion Control, Sockets, Quality of services (QOS);

Application Layer: Web and HTTP, Application protocols for email, FTP, web, DNS, security threats and solutions; Domain Name Space (DNS), Electronic Mail (SMTP, MIME, IMAP, POP3), IPv6; ATM; Multimedia applications and its impact on networking, Cryptology Basics

References:

1. A. S. Tanenbaum, Computer Networks; Pearson Education Asia, 4th Ed., 2003
2. Behrouz A. Forouzan, Data Communication and Networking, 3rd Ed., TMH, 2004
3. Peterson & Davie, Computer Networks: A Systems Approach, Harcourt.
4. Bertsekas and Gallagher Data Networks, PHI
5. William Stallings, Data and Computer Communications, 9th Ed., PHI, 2004
6. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 5th Ed., Morgan Kaufmann Publishers, 2012
7. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6th Ed., Addison-Wesley, 2008
8. W. Tomasi, Introduction to Data Communications and Networking, Pearson Education, 2007
9. S. Haykin, Digital Communications, John Wiley & Sons, Inc., 2005
10. P.C. Gupta, Data Communications and Computer Networks, PHI,2006

11. Unix Network Programming: Networking APIs: Sockets and XTI, (Volume 1) by W. Richard Stevens, 2nd Ed., PHI, 1999

IT 23: Computer Architecture and Organization

Fixed point Arithmetic: Arithmetic and logical operations of signed numbers and their implementation, Concepts of floating point numbers and operations, Bit-slice processors and Emulation

Principles of Computer design: Basic concepts, Instruction Set Architechture, Hardware System Architechture, Classifications of Computer Architecture: von Neumann's classification, Flynn's classification, Machine language instructions, Instruction formats, Instruction cycle and execution cycle, sequencing, Addressing modes, instruction types, Instruction set selection, Stacks, Queues, Subroutines (Example instruction set may be used: INTEL/ARM/ MOTOROLA/others),

Register Transfer and Micro Operation: Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Arithmetic Logic, Shift Microoperation, Arithmetic Logic Shift Unit, Design of Fast adders, Arithmetic Algorithms (addition, subtraction, Booth Multiplication).

Hardwired Control: Concepts, Data path and control path design, Fetching and storing word from/in main memory, Register transfers, Operations, execution of a complete instruction Hardwired control

Micro-programmed control: outline of microprogrammed control organization, control word, microprogram, next address generator (sequencer), control address register, control memory and control data register, advantages over hardwired control, address sequencing, mapping and associated hardware.

RISC Vs CISC, Pipelining in CPU design, Superscalar processors, Concepts of pipelining

I/O organization: Input-output processing, bus interface, Programmed data transfer; I/O interrupts-advantage over programmed transfer, DMA transfer, Performance evaluation - SPEC marks, Transaction Processing benchmarks.

Memory: Basic concepts, memory system, storage technologies, memory array organization, RAM, ROM – different types, characteristics, cache memories, memory hierarchy, virtual memory, address translation, secondary memories, interleaving, cache and virtual memories and architectural aids to implement these, input-output devices and characteristics.

References:

1. Mano, M, Computer System and Architecture, (3rd Ed.), PHI, 1994
2. Pal Chauduri, P., Computer Organisation and Design, PHI, 1994
3. Rajaraman,V., and Radhakrishnan, T., Introduction to Digital Computer Design" (4th Ed.), PHI, 1997
4. Stallings. W, Computer Organization and Architecture, 2nd Ed., PHI,
5. C. Hamacher, Z. Vranesik, S. Zaky , Computer Organization, McGraw Hill
6. John P. Hayes, Computer Architecture and Organization, McGraw Hill
7. Tannenbaum, Structured Computer Organization, PHI
8. Vravice, Zaky & Hamacher, Computer Organization, TMH

MT 21: Probability and Combinatorics

Probability: Sample space, Events, Axioms, Conditional probability, Bayes rule, Random variables: Discrete and continuous, Distribution and density functions, Marginal and conditional distributions, Stochastic independence.

Expectation: Expectation of a function, Conditional expectation and variance, Moment generating function, Cumulant generating functions, Characteristic functions, Distributions, Discrete and continuous distributions.

Combinatorics: Counting techniques, Permutations and Combinations, the inclusion-exclusion principle, Probabilistic methods in Combinatorics, Combinatorics from generating functions, Pigeonhole principle

References:

1. Liu, C.L., Introduction to Combinatorial Mathematics, McGraw Hill. 1996
2. Ross, S., A First Course in Probability, Collier Macmillan, New York, 1976
3. R.P. Grimaldi, B. V. Ramana, Discrete and Combinatorial mathematics: An applied introduction, Pearson Education, 2007
4. Richard A Brnaldi, Introductory Combinatorics, Pearson Education, 2004

BM 21: Accounting and Management Control

Basic Accounting and conventions underlying preparation of Financial Statements: Balance sheet highlighting accounting equation, profit and loss statement; accounting processes; basic accounts, trial balance and financial statements; issues such as provisions for bad debts tax, dividends, losses such as bad debts, missing information, classification effect, cost of assets, rentals, etc.

Income Measurement: Revenue; recognition and matching costs and revenues; inventory valuation, Depreciation Accounting; Intangible Assets Accounting; Understanding published annual accounts including funds flow statement.

Basic Cost Concepts: Introduction; cost classification; allocation, appointment and absorption; cost centers

Cost Analysis for Managerial Decisions: Direct costing, break-even analysis; relevant costs; pricing; pricing-joint costs; make or buy; relevant fixed costs and sunk costs, cost Analysis for Control-standard costing; variances; material, labour, overhead, sales, and profit.

Standard Cost Accounting: Budgeting and control; elements of budgeting; control of manufacturing and manufacturing expenses; performances appraisal, evaluation of cost control systems.

Introduction to Management Control Systems: Introduction, Goals, Strategies, and Key Variables; Performance Measures; Responsibility Centers and Transfer Price; Investment Centers; Reporting Systems; Management by Objectives; Budgeting and Control; Organizational Relationships in Control; Control Dynamics; Top Management and Control; Strategic and Long-Range Planning; Control of Service Organizations; Control of Projects; Control of Non-Profit Organizations; Control of Multinational Companies.

References:

1. Bhattacharya, S.K., and Dearden, John, Accounting for Management, PHI
2. Chadwick, The Essence of Financial Accounting, PHI
3. Chadwick, The Essence of Management Accounting, PHI
4. Homgren, Sundem and Selto, Introduction to Management Accounting, 9th Ed., PHI,

5. Welch, Hilton and Gordon (5th ed), Budgeting: Profit Planning and Control, 5th Ed., PHI

IT 21L: Data and File Structures Lab

Students should practice design and implementation including the followings and alike using C/C++:

1. Classes and Objects and Interfaces.
2. Exception handling with user defined Exceptions.
3. String Handling (String Class objects - String Manipulation functions).
4. Streaming
5. Multiple Threads Creation, Thread Synchronization using any application.
6. Reading and Writing Objects using Serialization.
7. Creation of User Interfaces using SWING.
8. Creation and Manipulation of generic objects.
9. Implementation of any Information System using JDBC.
10. Database Connectivity using Java Bean.
11. Abstract Data type Implementation of List - Stack and Queues.
12. Array and Linked List implementation of Stack, Queue, Circular Queue.
13. Set ADT- Bit Vector Implementation
14. Tree Representation and Traversals (preorder, inorder, postorder)
15. Graph Representations and Traversals
16. Shortest Path Implementation.
17. Spanning Tree Implementation.
18. Sorting Algorithms.
19. Searching Algorithms.
20. File structure relater programming

IT 22L: Network programming Lab

Configuration of networking in Linux using ifconfig, route, bind, etc.; configuration of firewall and masquerading in Linux; network trouble-shooting and performance monitoring using netstat, ping, tcpdump, etc.

Configuration and performance measurement of commonly-used Linux servers such as E-Mail (sendmail, pop3/imap) and Web (Apache).

Communication Protocol, Internet protocols, Novell, network system, System network architecture. UUCP.IPX/SPX for LANs, Protocol comparisons.

Socket Programming: TCP and UDP, peer-to-peer applications; reliable communications using unreliable datagrams; client-server using RPC; concurrent servers using threads or processes, Winsock Programming

Application Development: Design of file transfer protocol, remote login protocol etc., using socket interface

Berkeley sockets: Overview, Unix domain protocols, Socket addresses, Socket system calls Reserved ports, Passing file descriptors, I/O asynchronous and Multiplexing, socket implementation.

Winsock programming: Using the windows socket, API Window sockets and blocking I/O, Other windows extensions. Network dependent UNRI() DLL, Sending and receiving data over connections, Termination.

Novel IPX/SPX- Novel's windows drivers, Netware C interface for windows, IPX/SPX procedure. Datagram communication, Connection oriented communication with SPX, IPX/SPX implementation of DLL,

Programming applications: Time and date routines, Ping, Trivial file transfer protocol, Remote login.

References:

1. Davis, R., Windows Network Programming, Addison Wesley, Reading, M.A., 1993
2. Steven, R., Unix Network Programming, PHI, 1994
3. Linux Network Administrators Guide, URL: http://tldp.org/LDP/nag2/index.html.
4. W. Richard Stevens, Unix Network Programming, PHI, 1990
5. Bill Rieken and Lyle Weiman, Adventures in UNIX Network Applications Programming, John Wiley & Sons, 1992

Year 2: Semester 3

IT 31: Object Oriented Paradigm Using JAVA

Basics of Java: Introduction, History and Features of Java, Internals of Java Program, Difference between JDK,JRE and JVM, Internal Details of JVM, Variable and Data Type, Unicode System, Naming Convention.

OOPS Concepts: Object and Class, Method Overloading and Overriding, Constructor, static variable, method and block, this keyword, Inheritance, Aggregation and Composition, Covariant Return Type, super keyword, Instance Initialize block, final keyword, Runtime Polymorphism, static and dynamic binding, Abstract class and Interface, Downcasting with instance of operator, Package and Access Modifiers, Encapsulation, Object Cloning, Java Array, Call By Value and Call By Reference, strictfp keyword, Creating API Document, Advantage of OOPs

String Handling: Introduction, Immutable String, String Comparison, String Concatenation, Substring , Methods of String class, StringBuffer class, StringBuilder class, Creating Immutable class, toString method, StringTokenizer class,

Exception Handling: Introduction, try and catch block, Multiple catch block, Nested try, finally block, throw keyword, Exception Propagation, throws keyword, Exception Handling with Method Overriding, Custom Exception

Nested Classes: Introduction, Member Inner class, Annonymous Inner class, Local Inner class, static nested class, Nested Interface

Multithreading: Introduction, Life Cycle of a Thread, Creating Thread, Thread Schedular, Sleeping a thread, Joining a thread, Thread Priority, Daemon Thread, Thread Pooling, Thread Group, ShutdownHook, Performing multiple task by multiple thread, Garbage Collection, Runnable class
Synchronization: Synchronization : What and Why?, synchronized method, synchronized block, static synchronization, Deadlock, Inter-thread Communication, Interrupting Thread

Input and output: FileOutputStream & FileInputStream, ByteArrayOutputStream, SequenceInputStream, BufferedOutputStream & BufferedInputStream, FileWriter & FileReader, CharArrayWriter, Input from keyboard by InputStreamReader, Input from keyboard by Console, Input from keyboard by Scanner, PrintStream and PrintWriter class, Compressing and Uncompressing File, Reading and Writing data simultaneously, DataInputStream and DataOutputStream, StreamTokenizer class

Serialization: Serialization & Deserialization, Serialization with IS-A and Has-A, transient keyword

AWT and Event Handling: AWT Controls, Event Handling by 3 ways, Event classes and Listener Interfaces, Adapter classes, Creating Games and Applications

Swing: BasiIT of Swing, JButton class, JRadioButton class, JTextArea class, JComboBox class, JTable class, JColorChooser class, JProgressBar class, JSlider class, Digital Watch, GraphiIT in swing, Displaying Image, Edit Menu for Notepad, Open Dialog Box, Creating Notepad, Creating Games and applications

Layout Managers: BorderLayout, GridLayout, FlowLayout, BoxLayout, CardLayout

Applet: Life Cycle of Applet, GraphiIT in Applet, Displaying image in Applet, Animation in Applet, EventHandling in Applet, JApplet class, Painting in Applet, Digital Clock in Applet, Analog Clock in Applet, Parameter in Applet, Applet Communication, Creating Games

Reflection API: Reflection API, newInstance() & Determining the class object, javap tool, creating javap tool, creating appletviewer, Accessing private method from outside the class

Collection: Collection Framework, ArrayList class, LinkedList class, ListIterator interface, HashSet class, LinkedHashSet class, TreeSet class, PriorityQueue class, ArrayDeque class, Map interface, HashMap class, LinkedHashMap class, TreeMap class, Hashtable class, Comparable and Comparator, Properties class etc.

JDBC: JDBC Drivers, Steps to connect to the database i.e. Access, Oracle, MySQL, DriverManager; Connection, Statement and ResultSet interface; PreparedStatement, ResultSetMetaData, DatabaseMetaData, Storing and Retrieving image, Storing and Retrieving file, Stored procedures and functions, Transaction Management, Batch Processing, JDBC New Features

Java New Features: Assertion, For-each loop, Varargs, Static Import, Autoboxing and Unboxing, Enum Type, Annotation etc.

Internationalization: Internationalization, ResourceBundle class, I18N with Date, I18N with Time, I18N with Number, I18N with Currency

References:

1. Cay S. Horstmann & Gary Cornell, Core Java Volume I, 7th Ed., Sun Microsystems Press Java Series, 2006
2. Cay S. Horstmann and Gary Cornell, Core Java Volume II - Advanced Features, 8th Ed., PHI, 2008
3. Cay Horstmann, Computing Concepts with Java Essentials, 5th Ed., John Wiley & Sons, 2006
4. Herbert Schildt, Java: The Complete Reference, 8th Ed., TMH, 2011
5. Balaguruswamy E, Programming with Java: A Primer, TMH
6. Bruce Eckel, Thinking in Java, Pearson Education, 2006
7. Daniel Liang, Introduction to Java Programming, 5th Ed., Prentice Hall, 2005
8. Patrick Naughton, The JAVA handbook, TMH
9. H. M. Deitel and P. J. Deitel, Java How to Program, 9th Ed., Prentice Hal, 2012

IT 32: Operating Systems

Introduction to OS: OS- Definition, concepts, evolution, types, views, components and structure, services; computer system operation; System Calls- concept, types and traps; system programs and virtual machines.

Process Management: Processor- as resource, utilization; multi-processing and time sharing; Process and Thread- concepts, definition, views, states and transitions, operations, scheduling; Schedulers- purpose, levels, short-term, middle-term and long term schedules; context switching, state information, cooperating processes; Process and Thread Scheduling- concepts, criteria, algorithms; process management and services needed; Multithreading.

Process Coordination: Shared Resources- concepts, need, examples, allocation and scheduling; Process Synchronization- concept, importance, critical section problem and solutions; synchronization HW and SW approaches; semaphore, critical region and monitors; classical problems of process synchronization and solutions; Deadlock-concept, why and when, characterization, method of deadlock handling; deadlock detection, avoidance, prevention and recovery policies;

Memory Management: Motivation; need of primary and secondary memory management, code compilation and memory relocation, linking and loading; Primary memory management- logical and physical address space, memory allocation policies and their critiques; internal and external fragmentation; Memory Management Strategies- swapping, contiguous allocation, paging, segmentation; Virtual Memory- concept, need and purpose; demand paging; page replacement policies and issues, page fault and thrashing, design issues for paging systems,

Storage management: File- concept, view, types, operations, access methods and rights; File Systems- secondary storage and disc structure, Inode or FAT structure, file control blocks, impact of block size; contiguous, chained and indexed allocations; allocation policies and their impact, free space management and recovery; Disk- concept, structure, attachment, scheduling and management; Swap-Space management, RAID, disk reliability; Distributed File Systems- Design, implementation, trends

I/O Systems: I/O- HW, device controllers, interface, kernel, operation and management; devices and modes, programmed and memory I/O, polling; interrupt mode, types, priority, vectors and servicing; direct memory access (DMA); Principles of I/O Software- Goals, interrupt handlers, device drivers and interrupt handling, buffer management, User space I/O software; related issues

OS Protection and Security: Protection- goal, need, principles, domains, techniques; access matrix and control an issues; Security- problem, threats, domain, authentication, policies, techniques; revocation of access rights, language based protection, OTP, encryption, design considerations for security and protection; internet and general network security

RTOS: Real time Systems, classification and Architecture, Micro kernels Characteristics, scheduling in RTOS, rate monotonic scheduling, priority inversion, RTOS for hand-held devices.

OS Tools: Search, sort tools, commands to sort with their options; AWK tool; productivity tools, Make tool, Other useful tool i.e. Tar and other utilities, file compression tools, profiling tools; Version control tool i.e. sccs, cvs etc, OS primer, editor tools.

CASE STUDY: History, Design Principles, System Components, Kernel Modules, Environmental subsystems, Process Management, Scheduling, Memory management, File systems, Input and Output, Inter-process Communication, Network Structure, Security in MS-DOS, WINDOWS, UNIX and LINUX, MULTICS and other operating systems

Reference:

1. Abraham Siberschatz and Peter Baer Galvin, Operating System Concepts, 5th Ed., Addision-Wesley
2. Milan Milankovic, Operating Systems, Concepts and Design, McGraw-Hill
3. H M Deital, P J Deital and D R Chofines, Operating Systems, Pearson Education, 2004

4. Richard Peterson, Linux: The Complete Reference, Osborne McGraw-Hill
5. Andrew S. Tanenbaum, Modern Operating Systems, Second Edition, Addison Wesley, 2001
6. Gary Nutt, Operating Systems, Second Edition, Addison Wesley, 2001
7. D. M. Dhamdhere, Operating Systems: A Concept Based Approach, TMH, 2007

IT 33: Design and Analysis of Algorithms

Introduction: Framework for Algorithms Analysis, Asymptotic Notations, Basics, Euclid's algorithm, Problem, Instance, RAM model, RAM model

Asymptotic complexity: Some stylistic issues Analysis of Algorithms, O(log n) bit model , Principles of Algorithm Design, Finding Maximum and Minimum

Algorithm Design Techniques: Introduction to Iterative techniques, Divide and conquer, dynamic programming, greedy algorithms.

Divide and Conquer Technique: Introduction, Binary Search, Merge Sort, Quick Sort, Multiplication of Large Integers, Sorting, Median Finding, Surfing Lower Bounds, Closest Pair, Strassens Matrix Multiplication algorithm.

Dynamic Programming: Combinatorial Search, Longest common subsequence, 0-1 Knapsack Problem, Matrix chain multiplication or Optimal search trees, A machine scheduling problem, shortest path, Travelling salesman problem.

Greedy Algorithms: Introduction, Set of Intervals, Minimum spanning tree, Union find, Set cover, Knapsack problem, Fractional Knapsack, Huffman Coding, Pattern Matching

Searching and Sorting Techniques: Review of elementary sorting techniques-selection sort, bubble sort, insertion sort; more sorting techniques-quick sort, heap sort, merge sort, shell sort; external sorting; Comparison Tree, Lower bound on comparison-based sorting, Sorting in Linear Time, Counting Sort, Radix Sort.

Lower bounding techniques: Decision Trees, Adversaries.

Number Theoretic Algorithms: GCD, Addition and Multiplication of two large numbers, polynomial arithmetic, Fast-Fourier Transforms.

Graphs: Analysis of Graph algorithms Depth-First Search and its applications, minimum Spanning Trees and Shortest Paths.

String Processing: KMP, Boyre-Moore, Robin Karp algorithms.

Introduction to randomized algorithms: Random numbers, randomized Qsort, randomly Built BST, Advanced Techniques to analyze algorithms: Use and study advanced data structures unionfind (Disjoint Set Structure), Fibonacci heaps.

Complexity Analysis: Complexity measures, Worst, Best and Average Case, Upper and Lower bounds, Order Notations, Introduction to Branch and Bound and backtracking techniques.

NP-Completeness: Classes of Problems, Easy and Hard Problems, The classes P, NP, NP-hard and NP-complete, Proving NP-completeness, Examples of NP-complete problems such as 3SAT, CLIQUE, VERTEX COVER etc., Matching and Flows, Search/Decision, SAT, Independent Set, 3VC, Exact Cover, Multi Set, Subset Sum & Partition, Hamiltonian Circuit, Concept of Reduction, Approximation Algorithms, Approximation Algorithms for NP , Amortised Analysis, Backtracking: n-queens problem; Parallel Algorithms- Basic techniques for sorting, searching and merging in parallel, Point location, Convex hulls and Voronoi diagrams.

References:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, Indtroduction to Algoritms, PHI, 2006
2. Sahni and Horowitz: Fundamentals of Computer Algorithms
3. J. Kleinberg and E. Tardos, Algorithms Design, Pearson Education, 2006
4. S. Baase, Computer algorithms: Introduction to Design and Analysis, Addison Wesley, 1999
5. A. V. Levitin, Introduction to the Design and Analysis of algorithms, Pearson Education, 2006
6. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995
7. Teofilo F. Gonzalez, Handbook of NP-Completeness: Theory and Applications, Chapman & Hall, 2009
8. Vijay V. Vazirani, Approximation Algorithms, Springer-Verlag, France, 2006
9. S. Rajasekharan and John Reif, Handbook of Parallel Computing: Models, algorithms and applications, Chapman and Hall/CRC, 2007
10. Gareth A. Jones and Josephine M. Jones, Elementary Number Theory, Springer, 1998

IT 3E1: Elective-1

Select one from the list of IT3E1 electives and follow the specific syllabus.

MT 31: Numerical and Statistical Computing

Solution to Transcendental and Polynomial Equations: Iterative methods, bisection method, secant method, Newton-Raphson method, regula-falsi method, fixed point method, methods for finding complex roots.

Numerical Difierentiation and Integration: Numerical Integration: Newton-Cotes formulae, trapezoidal rule, Simpsons rule, Gaussian quadrature; Numerical Solutions of Ordinary Difierential Equations: Picards and Taylors series, Eulers and Runge-Kutta (RK), Predictor-correctors, Milne-Simpsons methods.

Simultaneous Linear Equations: Solutions of system of Linear equations, Gauss Elimination method, Gauss Jacobi and Gauss Seidel iterative methods, pivoting, Ill Conditioned system of equations,

Interpolation: Polynomial interpolation , Newtons forward and backward formula, Central Difference Formulae: Gauss forward and backward formula, Sterlings, Bessels, Everetts formula, Lagranges Interpolation, Newton Divided difierence formula, Hermits Interpolation for unequal intervals.

Basic Statistics: Theory of sampling, Measures of central tendencies, Measures of dispersion, Frequency distributions, Moments, Correlation coefficient, Regression analysis, Time series and forecasting, Statistical Quality control methods- Factor analysis,.

Curve Fitting and Approximations: Method of least squares, fitting of straight lines, polynomials, exponential curves etc., Approximation of functions by Chebyshev polynomials.

Test of Significance: Chi-Square Test, t-test and F-test.

References:

1. E. Balaguruswamy, Numerical Methods, THM
2. John H. Mathews, Numerical Methods for Mathematics and Engineering, PHI
3. T. Veerarajan and T. Ramachandran, Theory and Problems in Numerical Methods, THM

4. N. Dutta, Computer Programming and Numerical Analysis, University Press
5. Rajaraman V., Computer Oriented Numerical Methods, PHI
6. Affi, A. A., Statistical Analysis: A Computer Oriented Approach, Academic Press, New York, 1979
7. Hogg. R. V. Et. Al., Introduction to Mathematical Statistics, American Publishing, New York. 1980
8. Jain, Iyengar and Jain, Numerical Methods for Scientific and Engineering Computations, New Age Int.
9. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 7th Ed., New Age International Publishers, 2007
10. Gupta S. P. and Kapoor, V. K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
11. K. E. Atkinson, W. Han, Elementary Numerical Analysis, 3rd Ed., Wiley, 2003
12. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, 2007

IT 31L: Oops Using JAVA Jab

Design and Implement java programs that deals including the following types:

1. Classes and Objects and Interfaces
2. Exception Handling with user defined Exceptions
3. String Handling (String Class objects - String Manipulation functions)
4. Streaming (Image File Handling using Byte Streams - Text File Manipulation using Character Streams)
5. Multiple Threads Creation
6. Implementation of Thread Synchronization using any application
7. Reading and Writing Objects using Serialization
8. Creation of User Interfaces using SWING
9. Creation of Smileys Drawings Cartoons Symbols - Simple animations using Java Graphics
10. Usage of Recursion
11. Creation and Manipulation of generic objects
12. Implementation of any Information System using JDBC
13. Database Connectivity using Java Bean
14. Remote Method Access using RMI Implementation
15. Database access using Hibernate

MT31L: Numerical and Statistical Computing Lab

Students should practice programs including the following and alike using suitable programming languages:

1. Implementation of different numerical methods/techniques.
2. Computer generation of random numbers with different distributions.
3. Writing a questionnaire analysis program for data from surveys.
4. Analysis of significance of the results of survey.
5. Curve fitting to experimental data.
6. Programs to obtain frequency charts for large data sets and fitting a distribution.
7. Use of a statistical package to perform factor analysis and tests of significance.

Year 2: Semester 4

IT 41: Internet and Web Technologies

Internet and Web: Introduction and Evolution of Internet, WWW, Understanding Browsers, Internet protocols and applications i.e. FTP, Telnet, Email, Chat etc.; Semantic Web Information System, Quality Evaluation and Web Engineering and Application Development, Web Design and Development issues, challenges, Web Design Methods; Web Protocols: TCP, IP and HTTP, SMTP, POP3, FTP; Measuring and Evaluating Web Application

Static Web Design with HTML: Introduction, Evolution, Features of HTML, Filenames in HTML, Tools required, Tags and their Types, Attributes, Comments, Structures of HTML tag, Rules for writing a HTML program, starting a HTML document i.e. How to open Notepad, How to open HTML page, Editing the HTML program, Building web pages with different HTML tags, Frames, forms etc, *HTML Editors and Tools*- Use of different HTML editors and tools like Microsoft Front Page, Dreamweaver etc., Designing Web Application with Web ML and Web Ratio; *Graphical and Animation Tools*- Use of Different graphical and animation tools like Abode Photoshop, Gif Animator, Macromedia flash etc.

Introduction to DHTML, ITS and XML: Introduction, Creating interactive and dynamic web pages, Cascading Style Sheets, Types of Style Sheets (Inline, Internal and External), Class Selector, ID Selector, Absolute Relative Positioning, Inline menu, DIV + ITS Layout Design, PSD to ITS Conversion , transition from HTML to XML, structuring with schema DTD, XML schemas, building blocks of XML document; creating elements, attributes and entities; Validating XML, XML Schema, XML Processing DOM, SAX, Presental XSL, Transformation XSLT, XPath, XLink, XQuery, XML Security and meta framework, XML signature, XML Encryption, SAML, XKMS, AJAX, RSS, JSON, WS-Security, RDF, semantic Web service, Transforming XML with XSL, Integrating XML with database

Client side scripting: JavaScript, JavaScript Objects, DOM, Java Script, ASP.NET, VB Script

Server Side Scripting: Overview of servlets, Servlet API, Servlet life cycle, Servlet based Web Application, Servlet configuration, Running Servlet with database connectivity, Servlet support for cookies, Session tracking; BasiIT of ASP, JSP, PHP, ASP.NET, Comparison of ASP, PHP and JSP technologies

JAVA GUI and Database Connectivity: Generic classes, Generic methods, Applets, Applet life cycle methods, Applets based GUI, GUI components, Basic of Swings, Accessing database with JDBC, basiIT.

Enterprise Application Development: Three Tier Architecture, Working With MVC, JCP, J2EE, Overview of Java beans, XML Based APIs, Application Servers, Presentation Tier and EIS Tier, Java Mail, JMS, Java Transactions, JNDI, Java Authentication and Authorization Services, Java Cryptography

Hosting Website & Security: Hosting a Website, Web Security and issues, Firewalls, cyber laws

Database Integration: Designing the Databases and linking the web pages with the database using PHP

Advanced Topics: *SOA*-SOA BasiIT, Principles, Evolution and implementation; *Components and Frameworks*- Service and Data Tier, EJB Architecture, Session Beans, Entity Beans, Message Driven Beans, J2EE Connector Architecture, Web Services, J2EE Web Services, Patterns, Presentation, Service Tier and Data Tier Patterns, J2ME, Struts, Hibernate, Spring;

Web Services and Service Composition- *Web Clients*- Browsers, cookies, spiders, search engines and agents, Web Proxies; *Web Services*– Definition, Design and modeling of web services, Web Services and EAI, Web Services Technologies, web services Architecture, WS-Addressing, Routing, Security, Policy, Web Service invocation framework, Service Coordination and Composition protocols

References:

1. A Navarro, Mastering XML, BPB
2. Achyut S Godbole and Atul Kahate, Web Technologies, TMH
3. Ann Navarro, Effective Web Design, BPB publications.
4. C. Xavier, Web Technology and Design, TMH
5. David A Chappell, Tyler Jewell, Java Web Services
6. David Busch, Cascating Style Sheets complete, McGrawHill
7. Freunk p.coyle, XML, web Services and the Data Revolution, Pearson, 2002
8. Ivan Bayross, Sharanam Shah, PHP 5.1 for Beginners (Book/CD-Rom), 2006
9. Ivan Bayross, Web Enabled Commercial Application Development using HTML, DHTML, JavaScript, Perl, CGI, BPB
10. P. J. Deitel and H. M. Deitel, Internet and World Wide Web: How to Program, 4th Ed.,
11. Patrick Naughton and Herbertz Schildt, Java-2 The complete Reference, TMH
12. Raj Kamal, Internet and Web Technologies, TMH
13. Robert W. Sebesta, Programming with World Wide Web, Pearson Education, 2008
14. Sandeep Chatterjee and James Webber, Developing Enterprise web services: An Architect's Guide, PHI, 2004
15. Scott Robert Ladd, Dynamic HTML complete, McGrawHill

IT 42: Data Base Management System and RDBMS

Introduction to DBMS: Database- users, purpose, characteristics, components and system models, and architecture; abstraction and data integration, views of data, data modeling for a database, overview of relational, network, hierarchical data models, relation, schema-instance distinction, attribute, keys, and other relational constraints, various levels of data definition and abstraction, data independence, advantages and challenges of dbms

Database Design: Importance, problems with schema designs; Entity- types, set, attribute and key, relationships, relation types, roles and structural constraints; Functional Dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, Minimal covers, Lossy and Non-loss Decomposition, Motivation for normal forms, 1NF, 2NF, 3NF , Dependency Preservation and BCNF, Algorithms for 3NF and BCNF normalization, Multi-valued Dependencies and 4NF, Join dependencies and definition of 5NF; ERD, Extended Entity Relationship model Relational Model, lossless join and dependency preserving decomposition, conversion of ER diagrams to relations, integrity constraints, Mapping and Participation Constraints, Aggregation, Converting the database specification in E/R notation to the relational schema

Relational Model, Languages and Systems: Relation Algebra- Evaluation, algebra Expressions, model; ER to relational mapping; Basic Operators- Selection, Projection, Cross product; Various types of joins, Division, Example queries; Relational Calculus- domain & tuple

calculus; SQL- Introduction, features, queing; Embedded and Dynamic SQL; Creation and Basic Query Structure; Data definition in SQL, DDL, DML, DCL; Update behaviors, Views and Triggers, Basic and nested queries, Aggregation functions group by and having clauses, Nested Subqueries and Sets, Introduction to Oracle Architecture, PL/SQL, IBM DB2 case study-Architecture of DB2, EER to Relational mapping, Translating SQL into relational algebra

Transactions Management: Transaction- concepts, needs, states, features, properties, recover; Heuristics in query optimization, Selectivity and cost estimates in query optimization, Semantic query optimization, Conflicts and Aborts, Serial and concurrent schedules, Serializability and testing, Recoverable and non-recoverable schedules, Cascading rollbacks, Cascadeless schedules; Two Phase Commit, Log based Recovery, Checkpoint/Save Points, Concurrency, Serialized and non-serialized schedules, Testing for serializability , Need for Concurrency ,Concurrency issues ,Concurrency control, Lock compatibility matrix, Locking and serializability, Lock based Protocols, Two Phase Locking, Time Stamp based Protocol, Deadlocks and starvation , deadlock handling, Recovery Isolation Levels, Recoverable Schedule etc, SQL Facilities for Concurrency, Classification of failures, System Recovery, Media Recovery, Log based recovery, shadow paging, buffer management, SQL Facilities for recovery, OLTP environments,

Database recovery, Security and Authentication: Recovery concepts, Deferred updates technique, Immediate update technique, Shadow paging, ARIES recovery algorithm, Discretionary access control, Mandatory access control and multi-level security, Statistical database security

Advanced Topics: Distributed databases and issues{ Data fragmentation, replication and allocation in distributed databases, Types of distributed database systems Query processing in distributed databases, Concurrency control and recovery in distributed databases; NoSQL{ CAP Theorem and BASE Properties, Types of NoSQL Systems; Dimensionality reduction techniques; Active database concepts, Temporal databases, Spatial databases, multi-media databases, Graph Databases, Big Data;

References:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, TMH, 2011
2. C. J. Date, A. Kannan, S. Swamynathan, An Introduction to Database Systems, 8th Ed., Pearson Education, 2006
3. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Fifth 8th Ed., Pearson, 2008
4. Bipin Desai, An Introduction to database systems, Galgotia Publications, 1991
5. Raghu Ramakrishnan, Database Management Systems, 4th Ed., TMH, 2010
6. G.K.Gupta,Database Management Systems, TMH, 2011
7. Jim Melton, Alan Simon, Understanding the new SQL: A complete Guide, Morgan Kaufmann Publishers, 1993
8. A.K.Majumdar, P. Bhattacharya, Database Management Systems, TMH, 1996
9. R. Ramakrishnan and J. Gehrke, Database Management Systems, 3rd Ed., McGraw Hill, 2005
10. Philip Lewis, Arthur Berstein and Michael Kifer, Databases and Transaction Processing-An application oriented approach, Addison Wesley, 2002
11. P. Rob and C. Coronel, Database Systems: Design, Implementation, and Management, 7th Ed., Thomson Learning, 2006
12. S.K. Singh, Database Systems Concepts, Design and Applications, Pearson Education 2006
13. Hector Garcia-Molina, Jefirey D.Ullman and Jennifer Widom, Database System Implementation, PHI, 2005

14. Peter Rob and Carlos Coronel, Database Systems: Design, Implementation, and Management, 7th Ed., Thomson Learning, 2006
15. I. Bayross, Commercial Application Development Using Oracle Developer, 2000

IT 43: Software Engineering

Introduction to Software Engineering: Program Vs. Software, definition, origin, importance, evolution, paradigm, principles, characteristiIT of software engineering, software crisis, product and process

Software Processes: SW process and phases, different SDLC models, risk-driven, evolutionary and prototyping approaches, Fourth Generation Techniques, Agile methods, Software Components and CBSD.

Requirement Engineering: Role and skills of system analyst, requirement gathering techniques, problem analysis and tools, feasibility study, software requirements and types, requirement engineering process, elicitation, requirements definition, requirement review and verification, static and dynamic requirement specifications, characteristiIT of a good SRS, prototype outline for SRS-IEEE

System Architecture & Design: Various Design Concepts, notations, importance and design process, Design Tools and Techniques, Prototyping, Design Heuristic, Abstraction, Modularity, Cohesion, Coupling, Documentation, Designing for reuse, Design Patterns, design for change, subsystems, Concurrency, Software Architecture, The 4+1 View of Software Architecture, Design Quality attributes; Enterprise Architecture, Architectural frameworks, IEEE 1471, ISO 42010, Product line architectures, Architecture Evaluation; SOAD- Introduction, importance, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, Functional modeling- Data flow diagrams, Specifying operations, Project Dictionary, limitations of SOAD- towards OOAD; OOAD & UML-UML as a language, UML notations; Object Modeling, Dynamic modeling; User Interface Design- Elements of good design, Design issues, Features of a modern GUI, Menus, scrolling, windows, Icons, Panels, Error messages, etc.

Coding: Programming Languages and types, selection of programming languages, coding standards, guidelines, practices, programming styles, structured and object oriented programming, Information Hiding, Selection of suitable database system, reusability, extensibility, robustness, code documentation, static analysis, symbolic execution, code quality and efficiency

Software Testing: Introduction, software bugs, error, fault, failure, cost of bugs, objectives and purpose of testing, taxonomy of software testing, verification and validation, test case, test data suit preparation, test coverage; testing methodology- functional and structural testing, static and dynamic testing, data testing, state testing, formal reviews, code review checklist, data coverage, code coverage; testing approaches- black box testing techniques, equivalence class partition and boundary value analysis, white box testing techniques, domain and path testing, component testing; level of testing- unit testing, component testing, integration testing, system testing, alpha testing, beta testing, acceptance testing; testing types- configuration testing, compatibility testing, foreign language testing, usability testing, security testing, website testing; automated testing and test tools- benefits of automation and tools, viewers and monitors, drivers, stubs, stress and load tools, analysis tools; test documentation- goal of test planning, test phases, test strategy, resource requirements.

Software Maintenance: Software maintenance and its need, Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering, Maintainability, Documentation to facilitate maintenance

System Documentation: User Manual User Profile, Contents of a User Manual, Student is urged to install and use a software using its user manual and report the strengths and weaknesses of that user manual.

Software Configuration Management- Base Line, SCM process, Version Control, Change Management, Software Configuration Items

Computer Aided Software Engineering- CASE, Tools for Project management Support, Analysis & design, Programming, Prototyping, Maintenance, advantages, limitations, Future of CASE

References:

1. Roger S. Pressman, Software Engineering: A Practitioners Approach, 7th Ed., TMH, 2009
2. Ian Sommerville, Software engineering, 9th Ed., Pearson Education, 2010
3. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Ed., Narosa publications, 2011
4. Watts S. Humphrey, A Discipline for Software Engineering, Pearson Education, 2008
5. James F. Peters and Witold Pedrycz, Software Engineering, Engineering Approach, Wiley-India, 2007
6. Stephen R. Schach, Software Engineering, 7th Ed., TMH, 2006
7. Ivar Jacobson, Object Oriented Software Engineering, Pearson Education,1992
8. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers
9. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
10. Douglas Bell, Software Engineering for Students, 4th Ed., Addison-Wesley, 2005
11. Booch, G., Object Oriented Analysis and Design, 2nd edition, Benjamin/Cummins Publishing Co .. Redwood City, CA, U.S.A., 1994
12. Rumbaugh, J., Et al, Object Oriented Modeling and Design, PHI, 1991
13. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice.
14. Beizer, B., 'Software Testing Techniques", 2nd Ed., Van Nostrand Reinhold. New York. 1990

IT 4E1: Elective -2

Select one from the list of IT4E1 electives and follow the specific syllabus.

MT 41: Optimization Techniques

Linear Programming: Formulation, Graphical solution, Central problem of linear programming various definitions, statements of basic theorems and properties, Simplex method - Two-phase method, revised simplex method, primal and dual simplex method, sensitivity analysis transportation problem and its solution, assignment problem and its solution.

Non-Linear Programming: Constrained Problems, Equality constraints, Lagrangean Method, Inequality constraints Karush-Kuhn-Tucker (KKT) conditions, Quadratic Programming

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

Dynamic Programming: Dynamic programming, Principle of optimality, Forward and backward recursion Applications of dynamic programming, Problem of dimensionality.

Simulation Modeling: Monte Carlo Simulation, Types of Simulation, Elements of Discrete Event Simulation, Generation of Random Numbers, Applications to Queuing systems.

Queueing Theory: Characteristics of queueing systems, steady state MIMIt, MlMit/K and MIMIC queueing models, Markovian Queues - Steady state analysis of Single and Multi-server Models, Littles Formula, Finite and Infinite capacity models, Machine Interference Model, Self-service Queue.

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

Inventory theory: Costs involved in inventory problems, single item deterministic models-economic lot size models without shortages and with shortages having production rate infinite and finite

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

References:

1. Gillet, B. E., Introduction to Operations Research: A Computer Oriented Algorithmic Approach, TMH, 1990
2. Gross D., and Harris. C. M ., Fundamentals of Queueing Theory, John Wiley and Sons, New York, 1980
3. Hillier F., and Lieberman. G. J., Introduction to Operations Research, Holden Day, New York, 1985
4. Karnbo, N. S., Mathematical Programming Techniques, McGraw Hill, New York. 1985
5. Kanti Swarup, Gupta, P.K., and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi, 1990
6. Mital K. V., Optimization Methods In Operations Research and System Analysis, New Age International (P) Ltd., New Delhi, 1992
7. Saffer, L.R., Fitter J.B., and MeyerW.L., 'The Critical Path Method, McGraw Hill, New York, 1990
8. Taha, H. A., Operations research- An Introduction, Ninth Edition, Pearson Education, New Delhi, 2010
9. Gupta P.K. and Hira, D.S., Operations Research,Revise Edition, S. Chand & Company Ltd., 2012
10. Ravindran A., Don T. Phillips and James J. Solberg, Operations Research, 2nd Ed., Wile India Edition, 2006
11. Sharma J. K., Operations Research, Third Edition, Macmillan Publishers India Ltd., 2009
12. G. Hadley, Linear programming, Narosa Publishing House, New Delhi, 1990

IT 41L: Web Design Lab

Students are to practically implement the applications including the following and alike:

1. Web programming with HTML tags, ITS for styling, Page layout
2. Develop webpage using JavaScript for client side programming and HTML forms
3. Using The DOM and the JavaScript object models

4. Website optimization: crunching HTML, using ITS to replace HTML and light-weight graphiIT to speed up websites
5. Creating XML file with XML DTD and XML schema, SAX, XSL
6. Web site creation with PHP for server side programming for storing current date-time using cookies and for storing page views using sessions
7. Web application development using Servlet/ PHP/ JSP/ ASP.NET
8. Working with PHP and MySQL.
9. Constructing dynamic server-side web pages using JSF and integrate the Web application with any of the other Java2 Enterprise Edition application server methodologies such as Enterprise Java Beans, JavaMail, and SOAP.
10. Developing Java Enterprise Applications Using EJB3 Session beans, entity beans and message-driven beans.
11. Working with JNDI, JDBC and JMS.
12. Application development using J2ME.
13. Creation of web pages having dynamic contents and validation using Java script.
14. Creation of XML file and validation using XML schema and generation of XML using tools.
15. Simple xml based applications using DOM, SAX and XSL.
16. Basic Java programming covering objects, inheritance, polymorphism, interfaces, packages and exception handling.
17. String handling programs and regular expression programs.
18. Creation of applet based GUIs.
19. Application involving applet based GUI, JDBC, Servlet, JSP/PHP, cookies and session tracking.
20. Designing typical website for different types of organizations

IT 42L: DBMS Lab

Study features of a commercial RDBMS package such as Oracle, Foxpro, MS Access and Structures Query Language (SQL) use with the RDBMS. Laboratory exercises should include defining scheme for applications, creation of a database, writing SQL queries to retrieve information from the database. Use of host language interface with embedded SQL. Students should learn to use the forms and report writer packages available with the chosen RDBMS product. Students are also to be exposed to front-end development tools, ODBC; Internet based access to databases and database administration.

Experiments in the Following Topics:

1. Data Definition - Manipulation of Tables and Views.
2. Database Querying Simple queries - Nested queries - Sub queries and Joins.
3. Triggers.
4. Transaction Control.
5. Embedded SQL.
6. Database Connectivity with Front End Tools.
7. Front End Tools / Programming Languages.
8. High level language extensions - PL/SQL Basics.
9. Procedures and Functions.
10. Database Design and Implementation i.e. Accounting for a shop, Database manager for a magazine agency or newspaper agency, Ticket booking for performances, Preparing greeting and birth day cards, Personal accounts - insurance, loans, mortgage payments etc., Doctor's diary, billing, Personal bank account, Class marks management, Hostel accounting, Video tape library, History of cricket scores, Cable transmission program manager, Personal library.

Year 3: Semester 5

IT 51: Parallel Computing

Review of Sequential Computing: *Uniprocessor Architecture*- The CPU, Memory, I/O and Networking, Design Tradeoffs; *Enhancing Uniprocessor Performance*- Increasing Processor Clock Frequency, Parallelizing ALU Structure, Using Memory Hierarchy, Pipelining, Very Long Instruction Word (VLIW) Processors, Instruction-Level Parallelism (ILP) and Superscalar Processors, Multithreaded Processor, Performance bottlenecks of sequential computing,

Introduction to Parallel Computing: Motivation, What is Parallel Computing and Why to Use? Concurrent, Parallel, Distributed computing, interacting with hardware- Composite Capabilities, How Do Languages and Environments Assist with These Tasks? Applications of Parallel Computing, RAM and PRAM model, PRAM pseudo code, Data vs. Task parallelism,

Parallel Computers Architectures: Modifications to the Von-Neumann Model, Memory Barriers, Memory Hierarchy and organization, Different types of memory access-UMA and NUMA, Shared memory, distributed memory and distributed shared memory architectures, Cache Coherence and Memory Consistency, classification of parallel computers, Flynn's Classical Taxonomy, ILP, Multi-threaded architectures and TLP, Pipeline Parallelism, I/O Operations; Overheads- Hardware System Architecture, Costs of Operations; Parallel Architecture Design Tradeoffs and Future Directions, SIMD Processors, Systolic Processors, Cluster Computing, Grid and Cloud Computing, Multicore Systems, GPU computing, Synchronization and Mutual Exclusion; Scalability and Load Balance,

Interconnection Networks: Introduction, Communication between Parallel Processors, Classification of Interconnection Networks by Logical Topologies, Interconnection Network Switch Architecture, Routing Mechanisms for Interconnection Networks,

Performance Analysis and Tuning: Measuring Benefits of Parallel Computing, Performance, Performance MetriIT, Scalability and Scalability MetriIT, Speed up, Amdahl's law, Gustafson–Barsis's Law, efficiency, Scalability, Granularity, Latency, Bandwidth, Throughput, Cache, false sharing, Performance Analysis Tools- Tau.

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, CharacteristiIT of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, templates, Basic parallel programming techniques-loop splitting, spin locks, contention barriers and row conditions, Variations in splitting, self and indirect scheduling. Data dependency-forward and backward, block scheduling.

References:

1. B. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2nd Ed., PHI, 2005
2. Michael J. Quinn. Parallel Programming in C with MPI and OpenMP. TMH, 2004
3. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Introduction to Parallel Computing, 2nd Ed., Pearson ducatio, 2003
4. M. Sasi Kumar, Dinesh Shikhare P. Raviprakash, Introduction to Parallel Processing, PHI
5. V. Rajaraman And C. Siva Ram Murthy, Parallel Computers – Architecture and Programming

6. Peter S. Pancheo, An Introduction to Parallel Programming, 2011
7. Brawer, S., Introduction to parallel programming, Academic Press, New York, 1989
8. Bruce P. Lester. The Art of Parallel Programming, 2nd Ed., 1st World Publishing, 2006
9. Kenneth A. Berman and Jerome L. Paul. Algorithms: Sequential, Parallel, and Distributed, Thomson Course Technology, 2005

IT 52: Application Development using .NET Framework

.NET FRAMEWORK: *Introducing .NET-The Big Picture*- Characterize the .NET Paradigm, Describe Web Services; *Building .NET-The Framework Components*- Describe the .NET Framework, Describe the Common Language Runtime (CLR), Compare the .NET Class Framework to a Language-Specific Class Library, Decide When to Use .NET Windows Forms, Describe the Uses of Web Forms and Web Services, Identify When to Use Console Applications**;** *Managing .NET-The Common Language Runtime Components*- Identify the Components of the CLR, Describe Microsoft Intermediate Language (MSIL), Distinguish between the .NET Compilers, Describe How the CLR Manages Memory**;** *Taking Advantage of the Common Language Runtime*- Re-use Code, Describe Multiple Language Support in .NET, Explain Cross-Language Interoperability, Explain Garbage Collection, Describe Structured ErrorHandling**;** *Unifying .NET-The Class Framework*- Describe the .NET Class Framework, Describe the Purpose of Namespaces, To Use or Not to Use Inheritance, Differentiate Between Interfaceand Inheritance-Based Polymorphism

VB.NET: *Introduction*- VB.net, Elements, Types, Windows programming, Menus and Dialog Boxes, Using ADO.NET, Features of ADO.NET, Accessing Data with ADO.NET, Developing Components in Visual Basic .NET; *Deploying Applications*- Overview of XML, Introduction to web services, Describing Assemblies, Deploying Applications

C#.NET: *Introduction*- The Creation of C#, The Evolution of C#, Language and Syntax Enhancements, C# Language Fundamentals, ARRAYS, Decision making, Loops, Methods; *Using Object-Oriented Programming in C# .NET* - Object Oriented Concepts, Boxing 3.3 Delegates 3.4 Events 3.5 Interfaces; *Using Forms:* Windows Forms, Input, Output, and Serialization, Processes, App Domains, Contexts, Threading, Type Reflection, Late Binding, Attribute-based programming.

ASP.NET: *History of ASP.NET*- Getting Started with ASP.NET, ASP.NET Features, Building an ASP.NET Web Site, Creating Web Controls, Creating Web Forms; *Designing Web Site with Master Pages* - Server Controls, CSS for ASP.NET 3.5, Creating Consistent Looking Web Sites; *Introduction to Event Handlers*- Control Events and Event Handlers, Validation Controls, ADO.NET ; *Accessing LINQ Controls*- LINQ, ASP.NET – Security, ASP.NET - Data Caching, ASP.NET - Multi Threading, ASP.NET – Configuration; *Introduction to ASP.NET MVC*- The MVC Pattern, Web Standards and REST, Architecture, Disadvantages, ASP.NET MVC vs. Web Forms; *Essential Language Features*- Automatically Implemented Properties, Using Object and Collection Initializes, Entity Framework, Lambda Expressions; *Building the Model*- Microsoft Data Access Options, Repository Pattern, Validation and Business Rule Logic, Familiarizing yourself with ASP.NET MVC classes(namespace); *Routes and URLs*- Introduction to Routing, Defining Routes, Constraints, Areas, Ignoring Routes; *Controllers*- Controller and ControllerBase, Action Methods, Working with Parameters, Action Result Types, HTTP Verbs, Asynchronous Actions, ViewData and TempData, Model Binders ; *Views and View Templates*- Defining Views, ASP.NET View Engine, Razor View Engine, ViewData, Strongly-Typed Views, Using a ViewModel, Remote Validator; *HTML*- Helper Methods, Strongly-Typed Helpers, Html.ActionLink & HTML Forms, List Controls, WebGrid, Validation; *Partials and Master Pages*- Master Pages & User Controls, Partial and RenderPartial, Action and

RenderAction; *Securing MVC applications*- Securing your MVC Application, Walkthrough: Using Forms Authentication in ASP.NET MVC, Authorize Attribute class, Preventing JavaScript Injection (XSS) Attacks

References:

1. Introduction to Visual basic.NET - NIIT PHI, 2005
2. Introducing Microsoft .NET- David S. Platt, Microsoft Press, Saarc Edition, 2001
3. Introduction to Microsoft® ASP.NET Work Book, Microsoft Press
4. Developing XML Web Services Using Microsoft® ASP.NET, Microsoft Press
5. Douglas J. Reilly, Designing Microsoft ASP.NET Applications, Microsoft Press
6. Danny Ryan and Tommy Ryan-Hungry Minds Maran Graphics, ASP.NET

IT 5E1: Elective -3

Select one from the list of IT5E1 electives and follow the specific syllabus.

IT 5E2: Elective -4

Select one from the list of IT5E2 electives and follow the specific syllabus.

IT 51L: Parallel Programming Lab

Students are to learn at least one parallel programming language/extensions suitable to different parallel programming models and should practice the implementation of programs like the followings:

Basic Applications: sending and receiving data to/from multiple processing nodes, Calculation the value of PI, Finding Partial Sum, Average, mean squared deviation, curve fitting, numerical integration, traveling salesman problem, Gaussian elimination, Discrete event time simulation

Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms

Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quick sort

Dense Matrix Algorithms; Matrix-Vector Multiplication, Matrix-Matrix Multiplication, dense matrix algorithms, sparse matrix algorithms, Solving a System of Linear Equations

Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths

Fast Fourier Transform: The Serial Algorithm, The Binary-Exchange Algorithm, The Transpose Algorithm, Cost-Effectiveness of Parallel FFT Algorithms,

IT 52L: .NET Framework Lab

Students are to implement different suitable application based on the .NET technologies i.e. VB.NET/ASP.NET/C#.NET etc.

IT 51IL:

Industrial lecture will be delivered by the invited person from SW/IT industry. For Industrial lectures the sessional marks are based on participation and report.

IT 51 S:

Seminars are suggested to enable the students of MCA to appreciate the software developments which are going on in industries. These seminars will help the students to face interviews with some confidence. The students are to choose relevant topic and prepare the seminar report. The seminar is to be presented before the concern authority.

IT 51P:

The students are to take one minor academic project in parallel to the academic curriculum of the semester. The project to be implemented using suitable programming languages and tools/techniques. Focus should be given on using different CASE tools and to learn industrial practices and standards. The complete detail project report to be prepared and to be presented before the concerned authority.

Detailed Syllabus of Elective Papers

IT 3E1 Electives

E31: Automata Theory & Formal Languages

Introduction to the theory of computation: Symbol, alphabet, sets, relations and functions, strings and languages. *Finite state machines:* Finite automata definition & description, transition system, DFA, NFA, equivalence of DFA and NFA, Conversion of NFA to DFA, finite automata with outputs, Moore machine, Melay machine ,equivalence between Moore and Melay machines, Chomsky Hierarchy of languages,

Regular expressions and regular grammars: Regular expressions, equivalence of regular expressions and FA, Regular sets and properties: Regular set, Pumping lemma for regular sets, closure properties of regular sets, Regular grammars, Right linear and Left linear grammar, equivalence between Regular linear grammar and FA inter conversion between RE and RG.

Context free languages: Introduction, context free grammars, derivation trees, single ficatum of context free grammars, leftmost and rightmost derivations, ambiguity in CFG, simplification of CFG, normal forms-Chomsky normal form CNF, Greibach normal form GNF, Enumeration of properties of CFL.

Pushdown automata: Definition, model, acceptance of CFL, deterministic PDA, nondeterministic PDA, the pumping lemma for CFL's, closure properties of CFL's, A context Free Grammar corresponding to a given context free grammar, equivalence of CFL and PDA

Turing machines: Definition, model, representation of TM, design of TM, Computable Languages and Functions of Turing Machines, Techniques of turing machine construction, types of TM, Universal Turing machine, computable languages and function, Halting Problem, Modifications of Turing machine, Church's Hypothesis, Linear bounded automata and context sensitive languages, Introduction of DCFL and DPDA, Decidability of problems.

Computability & Recursion: Basic definition of computable and non-computable functions, primitive Recursive, Recursive and partial Recursive functions, RICE theorem and Greibach theorem, PCP and un decidability, Properties of recursive & non recursive enumerable languages, post correspondence problem

References:

1. J. E. Hopcraft & J. D. Ullman, Introduction To Automate Theory, Languages & Computation, Narosa Publications.
2. John C. Martin, Introduction to Languages and the theory of Computation, TMH
3. Kamala Krithivasan, Rama R., Introduction to Formal Languages, Automata theory and Computation, Pearson Education
4. Peter Liz. , An Introduction to Formal Languages and automata
5. V. Krishnamurthy, Introductory theory of Computer Science
6. Mannaz, Mathematical theory of computation
7. KLP Mishra & N. Chandra Sekharan, Theory of Computer Science, PHI

E32: Principles of Programming Languages

Introduction: Concepts of programming languages, Programming domains, Language Evaluation Criteria, language definition - syntax and semantiIT; compilation versus interpretation, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming , Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments, The halting problem and computability, Turing completeness;

Syntax and SemantiIT: formal specifications, general Problem of describing Syntax and SemantiIT, formal methods of describing syntax - BNF, EBNF for common programming languages features, tokenizing versus parsing, recursive descent parsers; parse trees, one-token look ahead parsing, abstract syntax trees; ambiguous grammars, attribute grammars, denotational semantiIT and axiomatic semantiIT for common programming language features, attributes and binding; scope; symbol tables; allocation and storage classes; variables; pointers

Data types: Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type equivalence and compatibility, type systems; type inference; type coercion, named constants, variable initialization,

Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands.

Control: expressions, selection, loops, go-to, parameters, activation records for function calls

Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are sub-program names, design issues for functions user defined overloaded operators, co routines.

Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in small talk, C++, Java, C#, Ada 95 Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads.

Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java.

Functional Programming Languages: Introduction, functional algorithms; tail-recursion; fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative Languages. Scripting Language: PragmatiIT, Key Concepts, Case Study : Python – Values and Types, Variables , Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library, lambda calculus -conversions, Church-Rosser theorem, fixed-points,

Object-oriented Programming: Polymorphism, Exceptions, Lazy evaluation, Reflection, Inheritance and subtyping, Concurrency and synchronization ("threads")

Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming, Horn clause logic, resolution and unification

References:

1. Doris Appleby, Julius J. Vandekopple, Programming Languages Paradigm and Practice, 2nd Ed., TMH.
2. Robert .W. Sebesta, Concepts of Programming Languages, 8th Ed., Pearson Education,2008
3. D. A. Watt, Programming Language Design Concepts, Wiley dreamtech,rp-2007
4. A.B. Tucker, R.E. Noonan, Programming Languages, 2nd Ed., TMH
5. Kenneth C. Louden, Programming Languages: Principles and Practice, 3rd Ed.
6. Krishnamurthi, Programming Languages: Application and Interpretation.

E33: Real Time and Embedded Systems

Introduction: Embedded Systems, Challenges of Embedded Systems, fundamental components, examples of embedded systems, hardware fundamentals, gates, timing diagrams, memory, DMA, buses, interrupts, schematiIT, build process of embedded systems, examples.

Embedded System Design And Implementation: Requirements of an embedded system, Meeting real time constraints, Multi-state systems and function sequences, architecture styles and patterns, design methodologies and practices, implementation aspects and choices, 8051/89c51 and Advanced Processor Architectures, Memory Organization and Real world Interfacing, Memory access procedure, types of memory, memory management methods, Pointer related issues, polling versus interrupts, types of interrupts, interrupt latency, reentrancy, interrupt priority, programmable interrupt controllers, interrupt service routines.

Real-Time Operating Systems: Desktop Operating Systems versus RTOS, Basic design using an RTOS, need for Board Support Packages, Interrupt handling in RTOS , task management, race conditions, priority inversion, scheduling, inter task communication, timers, semaphores, queues, OS Security Issues; *RTOS Programming*- Micro/Os-II and VxWorks : Basic Functions and Types of RTOSES, RTOS mCOS-II, RTOS VxWorks Real-time Operating System, Windows CE, OSEK and Real-time Linux functions. Windows CE, OSEK, Linux 2.6.x and RTLinux

Programming Concepts and Embedded Programming in C, C++ and Java: Software Programming In Assembly Language (ALP) and in High-level Language C, Object-Oriented Programming, Embedded Programming in C++, Embedded Programming in Java.

Embedded Software Development Tools: Host and target machines, cross compilers, linker and locators for embedded software, Emulators and debuggers, address resolution, locating

program components, initialized data and constant strings, PROM programmers, ROM emulators, Flash memory.

References:

1. Raj Kamal, Embedded Systems Architecture, Programming and Design, TMH 2nd Ed.
2. Raj Kamal, Microcontroller, 2nd Indian Print
3. Sriram V.Iyer, Pankaj Gupta, Embedded Real-time Systems Programming, TMH, 2004
4. Ajay Deshmukh, Microcontrollers: Theory and Applications, TMH
5. David E. Simon, An Embedded Software Primer, Pearson Education, 1999
6. Dr. K. V. K. K. Prasad, Embedded Real Time Systems: Concepts, Design and Programming, Dreamtech Press
7. Frank Vahid & Tony Givargus, Embedded System Design, Willey Publication
8. Frank Vahid and Tony Givargis, A unified Hardware/Software Introduction, Embedded System Design, John Wiley & Sons publishers, 2002
9. M.A. Mazidi & J.G. Mazidi & R.D. McKinley Raj Kamal, The 8051Microcontroller and Embedded Systems, 2nd Ed.

E34: Mobile and Pervasive Computing

Mobile Computing: Introduction, Differences between Mobile Communication and Mobile Computing, Contexts and Names; Functions, Applications and Services, Design Considerations, Integration of Wireless and Wired Networks Standards Bodies;

Wireless Transmission and Networks: Wireless Transmission, Signal Propagation, Spread Spectrum, Satellite Networks, Frequency/Capacity Allocation, FAMA, DAMA, MAC; *Wireless networks*- Wireless LAN, IEEE 802.11 Standard, Architecture, Services, AdHoc Network, HiperLan, Blue tooth, WiFi, WiMAX, 3G, WATM; Cellular Wireless Networks, GSM, Architecture, Protocols, Connection Establishment; *Routing*- Mobile IP, DHCP, Proactive and Reactive Routing Protocols, Multicast Routing; Handover, GPRS; Transport And Application Layers- TCP over Adhoc Networks, Mobile IP protocols -WAP push architecture; WWW Programming Model, WDP, WTLS, WTP, WSP, WAE, WTA Architecture, WML, WML Scripts and applications

Sensor and Mesh Networks: Sensor Networks, Role in Pervasive Computing in Network Processing and Data Dissemination, Sensor Databases, Data Management in Wireless Mobile Environments, Wireless Mesh Networks Architecture, Mesh Routers, Mesh Clients Routing, Cross Layer Approach, Security Aspects of Various Layers in WMN, Applications of Sensor and Mesh networks

3g and 4g Cellular Networks: Migration to 3G Networks, IMT 2000 and UMTS, UMTS Architecture, User Equipment Radio Network Subsystem, UTRAN Node, B RNC functions, USIM Protocol Stack, IT and PS Domains, IMS Architecture, Handover 3.5G and 3.9G, a brief discussion 4G LAN and Cellular Networks, LTE Control Plane, NAS and RRC User Plane, PDCP, RLC and MAC WiMax IEEE 802.16d/e WiMax Internetworking with 3GPP

Context Aware Computing: Adaptability Mechanisms for Adaptation, Functionality and Data Transcoding, Location Aware Computing, Location Representation, Localization Techniques, Triangulation and Scene Analysis, De-launay Triangulation and Voronoi graphs, Types of Context, Role of Mobile Middleware, Adaptation and Agents, Service Discovery Middleware;

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

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

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

Pervasive Computing: BasiIT, Vision and Principles; CharacteristiIT- interaction transparency, context aware, automated experience capture; Architecture for pervasive computing, Pervasive devices, Categories of Pervasive Devices, embedded controls, smart sensors and actuators, Context communication and access services

Application Development: Three tier architecture, MVC Architecture, Memory Management, Information Access Devices, PDAs and Smart Phones, Smart Cards and Embedded Controls, J2ME Programming for CLDC, GUI in MIDP Application Development ON Android and iPhone.

References:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile Computing: Technology, Applications and Service Creation, 2nd Ed., TMH, 2010
2. Reto Meier, Professional Android 2 Application Development, Wrox Wiley, 2010
3. Pei Zheng and Lionel M Li, Smart Phone & Next Generation Mobile Computing, Morgan Kaufmann, 2006
4. Frank Adelstein, Fundamentals of Mobile and Pervasive Computing, TMH, 2005
5. Jochen Burthardt et al, Pervasive Computing: Technology and Architecture of Mobile Internet Applications, Pearson Education, 2003
6. Feng Zhao and Leonidas Guibas, Wireless Sensor Networks, Morgan Kaufmann, 2004
7. Uwe Hansmaan et al, Principles of Mobile Computing, Springer, 2003
8. Reto Meier, Professional Android 2 Application Development, Wrox Wiley, 2010
9. Stefan Poslad, Ubiquitous Computing: Smart Devices, Environments and Interactions, Wiley, 2009
10. Ivan Stojmenovic , Handbook of Wireless Networks and Mobile Computing, John Wiley & sons Inc, Canada, 2002
11. Asoke K Taukder,Roopa R Yavagal, Mobile Computing, TMH, 2005
12. Jochen Schiller, Mobile Communications, PHI/Pearson Education, 2nd Ed., 2003
13. William Stallings, Wireless Communications and Networks, PHI/Pearson Education, 2002
14. Kaveh Pahlavan, Prasanth Krishnamoorthy, Principles of Wireless Networks, PHI/Pearson Education, 2003
15. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Principles of Mobile Computing, Springer, New York, 2003.
16. C.K.Toh, AdHoc Mobile Wireless Networks, PHI, 2002
17. Charles E.Perkins, AdHoc Networking, Addison-Wesley, 2001
18. Seng Loke, Context-Aware Computing Pervasive Systems, Auerbach Pub., New York, 2007
19. Uwe Hansmann etl , Pervasive Computing, Springer, New York,2001.

IT 4E1 Electives

E41: Computer Graphics

Introduction to Computer Graphics: Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics

Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays

2D Transformations: Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations

3D Transformations: Introduction, Three-Dimensional Scaling, Three-Dimensional Shearing, Three-Dimensional Rotation, Three-Dimensional Reflection, Three-Dimensional Translation, Multiple Transformation, Rotation about an Arbitrary Axis in Space, Reflection through an Arbitrary Plane, Matrix Representation of 3D Transformations, Composition of 3D Transformations, A_ne and Perspective Geometry, Perspective Transformations, Techniques for Generating Perspective Views, Vanishing Points, the Perspective Geometry and camera models, Orthographic Projections, Axonometric Projections, Oblique Projections, View volumes for projections.

Viewing in 3D: Stages in 3D viewing, Canonical View Volume (CVV), specifying an Arbitrary

3D View, Examples of 3D Viewing, The Mathematics of Planar Geometric Projections, Combined transformation matrices for projections and viewing, Coordinate Systems and matrices, camera model and viewing pyramid, Scan conversion-Lines, circles and Ellipses; Filling polygons and clipping algorithms, Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure, Clipping Lines algorithms Cyrus-Beck, Cohen Sutherland and Liang-Barsky, Clipping Polygons, problem with multiple components.

Solid Modeling: Representing Solids, Regularized Boolean Set Operations, Primitive Instancing, Sweep Representations, Spatial-Partitioning Representations, Octree representation, B-Reps, Constructive Solid Geometry, Comparison of Representations

Visible-Surface Determination: Techniques for efficient Visible-Surface Algorithms, Categories of algorithms, Back face removal, The z-Buffer Algorithm, Scan-line method, Painters algorithms (depth sorting), Area sub-division method, BSP trees, Visible-Surface

Ray Tracing, comparison of the methods

Illumination and Shading: Illumination and Shading Models for Polygons, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenuation, Phongs model, Gouraud shading, some examples.

Plane Curves and Surfaces: Curve Representation, Nonparametric Curves, Parametric Curves, Parametric Representation of a Circle, Parametric Representation of an Ellipse, Parametric Representation of a Parabola, Parametric Representation of a Hyperbola, A Procedure for using Conic Sections, The General Conic Equation; Representation of Space Curves, Cubic Splines,

Bezier Curves, B-spline Curves, B-spline Curve Fit, B-spline Curve Subdivision, Parametric Cubic Curves, Quadric Surfaces. Bezier Surfaces

Graphics Programming using OPENGL: Why OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL GL, GLU & GLUT, 3D viewing pipeline, viewing matrix specifications, a few examples and demos of OpenGL programs.

Miscellaneous topics: Why Realism? Aliasing and Anti-aliasing, texture bump mapping, Animation methods, methods of controlling animation, soft modeling of objects, image based rendering, Fundamental Difficulties.

Image Manipulation and Storage: What is an Image? Digital image file formats, Image compression standard JPEG, Image Processing - Digital image enhancement, contrast stretching, Histogram Equalization, smoothing and median Filtering.

References:

1. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics Principles and Practice, Second Edition in C, Pearson Education, 2003
2. D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition, 2004
3. D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Ed., TMH, 1990
4. F. S. Hill Jr., Computer Graphics using OpenGL, Pearson Education, 2003

E42: Digital Image Processing and Steganography

Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship between pixels and distance measurement, connectivity, Image Geometry, Photographic film, Light, Brightness adaption and discrimination, Perspective Projection, Spatial Domain Filtering, Grayscale and Color fundamentals, color models (RGB, CMY, HIS), formulation, color complements, color slicing, tone and color corrections, image file formats

Image Filtering: *Spatial Domain Filtering*- Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian; *Frequency domain Filtering*- Hotelling Transform, Fourier Transforms and properties, FFT, Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering, Inverse filtering, Least squares filtering. Recursive filtering

Image Compression: Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Hufiman Coding,

Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation; Wavelet based Image Compression- Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding, Digital Image Watermarking; Fidelity criterion- MSE, PSNR, Compression ratio,

Image Restoration: Basic Framework and models, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization,

Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections.

Morphological Image Processing: Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

Image Segmentation: Definition, Detection of Discontinuities, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Iterative and Multivariable thresholding, Otsu's method, Moving averages, Boundary detection based techniques; Characteristics of segmentation, Pixel based, Region based and histogram based segmentation methods, segmentation by sub region aggregation, split and merge technique, Watershed segmentation, Use of motion in segmentation (spatial domain technique only),

Image Enhancement: *Spatial Domain Methods*- Arithmetic and Analytical operations, pixel or point operations, size operations) Smoothing filters Mean, Median, Mode filters. Low pass filters, high pass filters, sharpening filters; *Frequency Domain Method*- Design of Low Pass, High Pass, Edge enhancement, Sharpening filters in frequency domain, Bufier Worth Filter, Homomorphic filters in frequency domain and spatial domain.

Steganography: Introduction, importance, steganography related issues and popular techniques-image authentication, watermarking and other applications

References:

1. Gonslaez, et.a1, "Digital Image Processing", Addison Wesley, Reading, M.A., 1990
2. Anil K Jain; Fundamentals of Digital Image Processing
3. Rafael C Gonzalez, Richard E Woods; Digital Image Processing, Pearson Education
4. Rafael C Gonzalez, Richard E Woods, Eddins; Digital Image Processing using MATLAB, Pearson Education
5. B Chanda & D Dutta Majumder; Digital Image Processing and Analysis, PHI

E43: Adhoc and Sensor Networks

Introduction of ad-hoc/sensor networks: Key definitions of ad-hoc/sensor networks, Advantages of ad-hoc/sensor networks, Unique constraints and challenges, Driving Applications, Wireless Communications/Radio Characteristics, Ad-Hoc wireless networks

Media Access Control (MAC) Protocols: Issues in designing MAC protocols, Classifications of MAC protocols, MAC protocols

Routing: Cellular and Ad hoc wireless networks, Issues in designing routing protocols, Classification of routing protocols, Issues of MAC layer and Routing, Proactive, Reactive and Hybrid Routing protocols, Multicast Routing, Tree based and Mesh based protocols, Multicast with Quality of Service Provision, Routing protocols

Quality of Service: Real-time traffic support, Issues and challenges in providing QoS, Classification of QoS Solutions, MAC layer classifications, QoS Aware Routing Protocols, Ticket based and Predictive location based Qos Routing Protocols

Energy Management Ad Hoc Networks: Need for Energy Management, Classification of Energy Management Schemes, Battery Management and Transmission Power Management Schemes, Network Layer and Data Link Layer Solutions, System power Management schemes

Mesh Networks: Necessity for Mesh Networks, MAC enhancements, IEEE 802.11s Architecture, Opportunistic Routing, Self Configuration and Auto Configuration, Capacity Models, Fairness, Heterogeneous Mesh Networks, Vehicular Mesh Networks

Sensor Networks: Introduction, Unique features, Sensor Network architecture, Data Dissemination, Data Gathering, MAC Protocols for sensor Networks, Deployment of ad-hoc/sensor network, Sensor tasking and control, Transport layer and security protocols, Location discovery, Quality of Sensor Networks, Evolving Standards, Other Issues, Recent trends in Infrastructure less Networks

Sensor Network Platforms and Tools: Berkley Motes, Sensor network programming challenges, Embedded Operating System, Simulators

Applications of Ad-Hoc/Sensor Network and Future Directions: Ultra wide band radio communication, Wireless fidelity systems

References:

1. C. Siva Ram Murthy And B.S.Manoj, Ad Hoc Wireless Networks – Architectures And Protocols, Pearson Education, 2004
2. Feng Zhao And Leonidas Guibas, Wireless Sensor Networks, Morgan Kaufman Publishers, 2004.
3. C. K. Toh, Adhoc Mobile Wireless Networks, Pearson Education, 2002.
4. Thomas Krag And Sebastin Buettrich, Wireless Mesh Networking‘, O‘Reilly Publishers, 2007
5. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, WILEY

E44: Human Computer Interaction

Design Process: Humans, Information Process, Computer, Information Process, Differences and Similarities, Need for Interaction, Models, Ergonomics, Style, Context, Paradigms, Designing of

Interactive Systems, Usability, Paradigm shift, Interaction Design Basics, Design Process, Scenarios, Users Need, Complexity of Design

Design And Evaluation Of Interactive Systems: Software Process, Usability Engineering, Issue based Information Systems, Iterative Design, Practices, Design Rules, Maximum Usability, Principles, Standards and Guidelines, Design Patterns, Programming Tools, Windowing Systems, Interaction Tool Kit, User Interface Management System, Evaluation Techniques, Evaluation Design, Evaluating Implementations, Observational Methods.

Models: Universal Design Principles, Multimodal Systems, User Support, Presentation and

Implementation Issues, Types, Requirements, Approaches, Cognitive Model, Hierarchical

Model, Linguistic Model, Physical and Device Models, Socio technical Models, Communication and Collaboration Models, Task Models, Task Analysis And Design.

Experimental Design And Statistical Analysis Of HCI: Basic Design Structure, Single Independent Variable, Multiple Independent Variable, Factorial Design, Split-Plot Design, Random Errors, Experimental Procedure, Statistical Analysis, T Tests, Analysis of Variance Test, Regression, Chi-Square Test, Survey, Probabilistic Sampling, Non-Probabilistic Sampling, Developing Survey Questions.

Theories: Dialogue Notations and Design, Dialogue Need, Dialogue Design Notations, Graphical, Textual, Representing Dialogue, Formal Descriptions, Dialogue Analysis, System Models, Interaction Models, Relationship with Dialogue, Formalisms, Formal Notations, Interstitial

Behavior, Virtual Reality, Modeling Rich Interaction, Status Event Analysis, Properties, Rich Contexts, Sensor-based Systems, Groupware, Applications, Ubiquitous Computing, Virtual Reality

References:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Ed., PHI, 2004
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human Computer Interaction, Wiley, 2010
3. Ben Shneiderman and Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th Ed., Addison-Wesley Publishing Co, 2009

IT 5E1 Electives

E51: System Software and Compiler Constructions

System Software: Introduction, Definition, Role and Functions, characteristics, types

Assembler: Introduction, functions, features, design of one pass and two pass assemblers;

Macroprocessors: Introduction, functions, features and design;

Loader and Linkers: Basic Concepts of Linkers and Loader Functions, Boot Loaders, Linking Loaders, Linkage Editors, Dynamic Linking

Compiler: Introduction to Compiler, Difierent phases and passes of compiler

Compiler Structure, Analysis-synthesis model of compilation, various phases of a compiler, tool based approach to compiler construction.

Lexical Analysis: Role of Lexical Analyzer, Interface with input, parser and symbol table, Input Buffering, Specification of Tokens, lexeme and patterns; difficulties in lexical analysis; error reporting; Finite state machines and regular expressions and their applications to lexical analysis, regular definition, transition diagrams, Lex., Review of regular languages, design and implementation of a lexical analyzer,

Syntax Analysis: Role of the parser, Formal and context free grammars(CFGs) and their application to syntax analysis, ambiguity, associatively, precedence, Derivation and parse trees, Top Down parsing, LL(1) grammars, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, Shift Reduce Parsing, LR(0) grammars, operator precedence grammars, LR parsing algorithms and LR parsers, Yacc.

Syntax directed translation and Definitions: Syntax directed definitions, Construction of syntax trees, Top down and bottom up approaches, dependency graph, data types, mixed mode expression; subscripted variables, evaluation order and sequencing statement, Inherited and synthesized attributes, bottom up and top down evaluation of attributes, L- and S-attributed definitions.

Type Checking: Type system, type expressions, structural and name equivalence of types, type conversion.

Run Time System Environments: Source Language issues, Storage organization, Storage Allocation strategies, activation tree, activation record, parameter passing, symbol table, dynamic storage allocation, Access to non-local names, Parameter passing mechanism

Intermediate Code Generation: Intermediate languages, Intermediate Graphical representations, Three address code, Implementation of three address statements (Quadruples, Triples, Indirect triples), translation of declarations, assignments, control flow, Boolean expressions and procedure calls, implementational issues.

Code Optimization and generation: Introduction and Issues, Basic blocks and flow graphs, Transformation of basic blocks, DAG representation of basic blocks, code generation from dags, Loops in flow graph, Principle sources of optimization, Peephole optimization, machine dependent and machine independent optimization techniques, Issues in the design of code generator, Register allocation and assignment, code generation, specifications of machine.

Subroutines and functions: parameters called by address, by name and by value, subroutines with side effects.

References:

1. A. V. Aho, R. Sethi and J. D. Ullman, Compilers: Principles, Techniques, and Tools (US edition), Addison Wesley, 1986
2. R. Mak, Writing Compilers and Interpreters, 2nd Ed., John Wiley & Sons, 1996
3. D. Galles, Modern Compiler Design, Pearson Education, 2007
4. S. Chattopadhyay, Compiler Design, PHI, 2005
5. Alfred Aho, Monica S. Lam, Ravi Sethi, Jefirey D Ullman, Compilers Principles, Techniques and Tools, 2nd Ed., Pearson Education Asia, 2009
6. Leland L. Beck, System Software: An Introduction to Systems Programming, 3rd Ed., Addison- Wesley, 1997
7. Allen I. Holub Compiler Design in C, PHI, 2006
8. C. N. Fischer and R. J. LeBlanc, Crafting a compiler with C, Pearson Education.
9. J. P. Bennet, Introduction to Compiler Techniques, Second Edition, TMH, 2003
10. Henk Alblas and Albert Nymeyer, Practice and Principles of Compiler Building with C, PHI, 2001
11. Kenneth C. Louden, Compiler Construction: Principles and Practice, Thomson Learning
12. D. M. Dhamdhere, Systems Programming and Operating Systems, TMH
13. John J. Donovan, Systems Programming, 3rd Ed., 1997, Addison Wesley

E52: Information Security and Cyber Forensics

Information Security Concepts: Introduction, History, Critical Characteristics of Information, Information System and its components, Security Vs. Protection, Need for Security, Information Security Overview, Goals for Security, Securing the Components, Information Security Services, The Security SDLC, Business Needs, Security Threats and Vulnerabilities , Attacks and Types of Attacks, Legal, Ethical and Professional Issues, Balancing Security and Access, NSTISSC Security Model, E-commerce Security, Computer Forensics, Steganography, Security Engineering

Security Threats, vulnerabilities and Scanning: Overview of Security threats, Hacking Techniques, Password Cracking, Insecure Network connections, Malicious Code, Programming Bugs, Cyber crime and Cyber terrorism, Information Warfare and Surveillance, Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet

Network Defense tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System

Web Application Tools: Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities, Curl, OpenSSL and Stunnel, Application Inspection tools, Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools, John the Ripper, L0htcrack, Pwdump, HTC-Hydra

Network and Computer Security: Cryptography, Access Control and Intrusion Detection, Access Control Devices, Physical Security, Security and Personnel, Security issues in wireless

Cyber Security: Introduction, Weak / Strong Passwords and Password Cracking, Web Browsers Security, Email Security: PGP and SMIME, Web Security: web authentication, SSL and SET, Firewall And Utm,

Cyber Forensics: Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

Cyber Crimes and Law: Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Realms of the Cyber world, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Cyber Law, Indian IT Act, 2000, Information Security Policy, Standards and Practices, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity, SSE-CMM / COBIT, ISO 17799/BS 7799, ISO 27001, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

References:

1. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, 2003
2. Matt Bishop, Computer Security Art and Science, Pearson Education, 2002
3. Ron Weber, Information Systems Control and Audit, Pearson Education, 2004
4. Stuart Mc Clure, Joel Scrambray, George Kurtz, Hacking Exposed, TMH, 2003
5. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), TMH
6. Nina Godbole and Sunit Belpure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Publication Wiley
7. Garms, Jess and Daniel Somerfield, Professional Java Security, Wrox. 2001
8. Nelson Phillips and Enfinger Steuart, Computer Forensics and Investigations, Cengage Learning, New Delhi, 2009
9. Kevin Mandia, Chris Prosise, Matt Pepe, Incident Response and Computer Forensics, TMH, 2006
10. Bernadette H Schell, Clemens Martin, Cybercrime, ABC – CLIO Inc, California, 2004
11. Understanding Forensics in IT, NIIT Ltd, 2005

E53: Cryptography and Network Security

Introduction to Classical Cryptosystems: Introduction, Need and importance of Cryptography, Classical Cryptosystems, Introduction to symmetric and asymmetric cryptography, Cryptanalysis of Classical Cryptosystems, Shannons Theory

Mathematical Foundations: Number Theory, Number Theoretic Results, Factorization-Factoring Algorithms, Quadratic Sieve Factoring Algorithm, Pollard-Rho Method; Modular Arithmetic- Groups, Solving Modular Linear Equations, Chinese Remainder Theorem, Modular Exponentiation, Discrete Logarithm Problem; GCD Computation- Euclids Algorithm, Extended Euclids Algorithm, Probability and Information Theory, The Discrete Logarithm Problem (DLP), Computation of Generators of Primes; Stream Ciphers, Pseudorandom functions.

Symmetric Key Ciphers and Cryptanalysis: Introduction, Symmetric Key Ciphers, Modern Block Ciphers- DES, AES; Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers, NIST recommendations.

Hash Functions and MACs: Hash functions, The Merkle Damgard Construction, Message Authentication Codes (MACs)

Asymmetric Key Ciphers and Cryptanalysis: Construction and Cryptanalysis, RSA Cryptosystem, Different Attacks & Remedies on RSA, Semantic Security of RSA, The Discrete Logarithm Problem (DLP), Diffie Hellman Key Exchange algorithm, The ElGamal Encryption Algorithm, Massey-Omura; Construction and Cryptanalysis, Cryptanalysis of DLP

Modern Trends in Asymmetric Key Cryptography: Overview of Modern Cryptography, Elliptic curve theory and Elliptic Curves based cryptography, Security of Elliptic Curves Cryptography, Elliptic Curve Factorization.

Digital Signatures: Introduction, Signature schemes, Authentication Protocols, Digital Signature Standards (DSS), Proxy Signatures

Network Security: Secret Sharing Schemes, Network Protocols, Kerberos, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls

Primality Testing: Primality Testing, Quadratic Residues, Randomized Primality Test & Deterministic Polynomial Time Algorithm

References:

1. Neal Koblitz, A Course in Number Theory and Cryptography, Springer Verlag, New York Inc, 2001
2. William Stallings, Cryptography and Network security: Principles and Practice, Pearson Education, 2002
3. W. Trappe and L. C. Washington, Introduction to Cryptography with Coding Theory, 2nd Ed., Pearson Education 2007
4. R. Motwani and P. Raghavan, Randomized Algorithms, Cambridge University Press, 1995
5. Douglas Stinson, Cryptography Theory and Practice, 2nd Ed., Chapman & Hall/CRC
6. B. A. Forouzan, Cryptography & Network Security, TMH
7. Wenbo Mao, Modern Cryptography, Theory & Practice, Pearson Education.
8. Hofistein, Pipher, Silvermman, An Introduction to Mathematical Cryptography, Springer
9. J. Daemen, V. Rijmen, The Design of Rijndael, Springer.
10. A. Joux,Algorithmic Cryptanalysis, CRC Press
11. S. G. Telang, Number Theory, TMH
12. C. Boyd, A. Mathuria, Protocols for Authentication and Key Establishment, Springer
13. Matt Bishop, Computer Security, Pearson Education

E54: Cloud and Grid Computing

Introduction to Grid Computing: What is a grid? Infrastructure of hardware and software, Main Projects and Applications, The Open Grid Forum, International Grid Trust Federation; Grid Architecture, Overview of Resource Managers, Overview of Grid Systems; Application Management: Grid Application Description Languages, Application Partitioning, Meta-scheduling, Mapping, Monitoring; Web Services, Grid Portals,

Cloud Computing Overview: What is a cloud, Definition of cloud, Characteristics of cloud, Why use clouds, How clouds are changing, Driving factors towards cloud, Comparing grid with cloud, Public clouds (commercial), Cloud Computing and SOA, Enterprise Cloud drivers and adoption trends, Typical Cloud Enterprise workloads, Cloud service models/types, Cloud deployment models, Cloud ROI models, Cloud reference architectures, Cloud standards, Technology providers vs. Cloud providers vs. Cloud vendors, Planning Cloud transformations

Cloud service delivery: Cloud service, Cloud service model architectures, Infrastructure as a service (IaaS) architecture, Platform as a service (PaaS) architecture, Platform as a service (PaaS), Software as a service (SaaS) architecture, Examples of SaaS applications, Business Process as a Service (BPaaS) Architecture, Trade-off in cost to install versus, Common cloud management platform reference architecture: Architecture overview diagram, Common cloud management platform.

Cloud deployment scenarios: Cloud deployment models, Public clouds, Hybrid clouds, Community, Virtual private clouds, Vertical and special purpose, Migration paths for cloud, Selection criteria for cloud deployment, Case study example: IBM Smart Cloud

Security in cloud computing: Cloud security, Cloud security reference model, How security gets integrated, Cloud security challenges, Understanding security risks, Cloud security approaches: encryption, Digital signature, tokenization/ obfuscation, cloud security alliance standards, cloud security models and related patterns; Virtualization and multitenancy, Internal security breaches, Data corruption or loss, User account and service hijacking, Steps to reduce cloud security breaches, Steps to reduce cloud security breaches; Identity detection, forensics and management, What is SSL? Cloud security in mainstream vendor solutions; Mainstream Cloud security offerings: security assessment, secure Cloud architecture design; Design a secure Cloud architecture to support the deployment of a secure version of the course project application.

References:

1. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011
3. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012
4. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010
5. M. N. Rao, Cloud Computing, PHI

IT 5E2 Electives

E55: AI and Expert System

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction.

Problem solving: State space search- Production systems; Search space control-Depth first search, breadth first search, heuristic search – Hill climbing, best first search, branch and bound; Minimax search- Alpha-Beta cutoffs.

Knowledge Representation: Predicate Logic- Skolemizing queries, Unification, Modus pones. Resolution, dependency directed backtracking.

Rule Based Systems- Forward reasoning, Conflict resolution, Backward reasoning- Use of no backtrack.

Structured Knowledge Representations: Semantic Net: slots, Frames.

Handling uncertainty: Probabilistic reasoning, Use of certainty factors, Fuzzy logic.

Learning: Concept of learning, learning automation, genetic algorithm, learning by induction, neural nets-back propagation.

Expert Systems: Need and justification for expert systems, Knowledge acquisition

Case studies: MYCIN, RI.

References:

1. Nilsson, N. J., Principles of AI, Narosa publishing House, 1990
2. Patterson, D. W., Introduction to AI and Expert Systems, PHI, 1992
3. Peter Jackson, Introduction to Expert Systems, Addison Wesley Publishing Company, M.A., 1992
4. Rich. E., and knight, K., Artificial Intelligence, 2nd Ed., TMH, 1992
5. Schalkoff, R.J., Artificial Intelligence – An Engineering Approch, McGraw Hill International Edition, Singapore, 1992
6. Sasikumar, M. Ramani, S., Rule Based Expert System, Narosa Publishing House, 1994

E56: Data Warehousing & Data Mining

Introduction to Data Mining: Definition of data mining ,Data Mining functionalities, Classification of data mining systems , Data Mining Applications, Architectures of data mining systems, Data mining class comparison.

Data Mining Algorithms: Concept Description: Definition, Data Generalization and Summarization –Based Characterization, Mining Descriptive Statistical Measures in Large Databases; Mining Association Rules: Association Rule Mining, Market Basket Analysis,

Association Rule Classification, The Apriori Algorithm, Mining Multilevel Association Rules, Constraint-Based Association Mining, Sequential mining

Classification and Prediction: What is Classification and Prediction? Data Classification Process, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification Based on Association Rule Mining, Other

Classification Methods Cluster Analysis: What is Cluster Analysis? Types of Data in Cluster Analysis, Categorization of Clustering Methods, Partitioning methods

Introduction to Data Warehousing: Introduction to Decision Support System: DSS Definition, History of DSS, Ingredients of DSS, Data and Model Management, DSS Knowledge base, User

Interfaces, The DSS Users, Categories and Classes of DSSs Need for data warehousing, Operational & informational data, Data Warehouse Definition and characteristics, Operational Data Stores

Data warehouse Components: Architectural components, Data Preprocessing: Why Preprocess Data? Data Cleaning Techniques, Data Integration and Transformation, Data Reduction Techniques, Discretization and Concept Hierarchy, Generation for numeric and categorical data, Significant role of metadata, Building a Data warehouse, Benefits of Data Warehousing.

OLAP in the Data Warehouse: A Multidimensional Data Model, Schemas for Multidimensional Databases: Stars, Snowakes, Star join and Fact Constellations Measures, Concept Hierarchies, OLAP Operations in the Multidimensional Data Model, Need for OLAP, OLAP tools , Mining Multimedia Databases, Mining Text Databases, Mining the World Wide Web.

References:

1. Jiawei Han, Micheline Kamber; Data Mining: Concepts and Techniques, Morgan Kaufmann, 2006
2. Paul Punnian, Data Warehousing Fundamentals, John Wiley
3. Alex Berson, S.J. Smith; Data Warehousing, Data Mining and OLAP, TMH
4. Margaret Dunham, Data Mining: Concepts and Techniques, Morgan Kaufmann
5. Ralph Kimball, The Data Warehouse Lifecycle toolkit, John Wiley

E57: Soft Computing

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing; Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies; Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

Optimization: Derivative-based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, Random Search, Downhill Simplex Search.

Artificial Neural Networks: Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory; Propogation Networks- introduction, Counter propagation network, architecture, functioning & its characteristics, Back Propogation Networks -Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications; Hopfield/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications; Hopfield v/s Boltzman machine; Adaptive Resonance Theory: Architecture, classifications, Implementation and training; Associative Memory.

Fuzzy Logic: Basic concepts of crisp and fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion; Fuzzy rule base system-Membership functions, features of membership functions,

fuzzy reasoning, interference in fuzzy logic, fuzzy decision making, fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Applications of fuzzy logic, Industrial applications,

Genetic Algorithm(GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, fitness function, reproduction, Genetic modeling: Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator; Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method

Hybrid Systems: Integration of neural networks, fuzzy logic and genetic algorithms.

References:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm:Synthesis and Applications, PHI.
2. Siman Haykin, Neural Netowrks, PHI
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997
4. Kumar Satish, Neural Networks, TMH
5. J. Yen and R. Langari., Fuzzy Logic, Intelligence, Control and Information, Pearson Education
6. J. S. R. Jang, C. T. Sun and E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004

E58: Software Project Management and SQA

Introduction to SW Project Management (SPM): Introduction, Concept of Project, Need and importance of SW Project, concept of management, Evolution of Software Economics, Software Management Process Framework, Software Management Disciplines, Problem with SW projects, Modern Project Profiles, Project Evaluation- Strategic Assessment, Technical Assessment, Cost Benefit Analysis

SW Project Planning: Defining the problems, developing a solutions strategy, planning the development process, activity involved in SW project planning, Steps in SW project planning, planning an organizational structures.

SPM Activities and Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, *Umbrella Activities*- Metrics, Configuration Management, Software Quality Assurance; *In Stream Activities*- Project Initiation, Project Planning, Execution and Tracking, Project Wind up, Concept of Process/Project Database, Network Planning Models i.e PERT and CPM, Shortening Project Duration

Software Estimation & Costing: cost factors, software cost estimations, Problems in Software Estimation, Algorithmic Cost Estimation Process, Function Points, Software Life cycle Management, COCOMO, Estimating Web Application Development, Concepts of Finance, Activity Based Costing and Economic Value Added (EVA), estimating software maintenance cost,

Risk Management: Definition, Categories, Nature and Types of SW project risk , Risk Assessment, Risk Management, Risk Control, Failure Mode and Effects Analysis (FMEA), Hazard Identification and Analysis, Risk Planning And Control.

Monitoring and Control: Creating Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value, Priortizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types of Contract, Stages In Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.

Metrics: Need for Software Metrics, Classification of Software Metrics: Product Metrics (Size

Metrics, Complexity Metrics, Halstead's Product Metrics, Quality Metrics), and Process metrics (Empirical Models, Statistical Models, Theory-based Models, Composite Models, and Reliability Models)

Managing People and Organizing Teams: Introduction, Becoming a Team, Organizational and team Structures, Team Management, Client Relationship Management, Case Studies.

SW Quality Fundamentals: SW quality concept- what and why? Benefits and importance, SW Quality models i.e. McCall, Boehm, FURPS, Dromey, ISO 9001, 9126 etc., Cost of Poor quality,

SQA: Introduction, roles and benefits, SQA and quality control, SQA planning and activities, SQA process framework i.e. ISO, CMM, Six-Sigma, TMMi, People CMM etc. and their relevance to Project Management

Fundamentals of Software Quality Assurance: Ethical Basis for Software Quality, Total Quality Management Principles, Software Processes and Methodologies.

Quality Standards: Quality Standards, Practices and Conventions, Software Configuration Management, Reviews and Audits, Enterprise Resource Planning Software.

Quality Metric System: Concepts, Measurement Theory, Software Quality Metrics, importance and categories of metrics, Metrics Program (GQM), Designing Software Measurement Programs, Complexity Metrics and Models, Organizational Learning, Improving Quality with Methodologies, Structured/Information Engineering, commonly used metrics i.e. Process, Product and Resource metrics.

Test Management: Recap of SW Testing fundamentals, Test Management and activities involved, Evaluation of Test Effectiveness, release management, Test management tools

Tools for Quality Improvement: Basic quality control tools, check sheet, C&E diagram, Pareto diagram, histogram, Scatter Plot, Run Chart, Control Chart, orthogonal defect classification,

References:

1. McConnell, S. Software Project: Survival Guide, Microsoft Press, 1998
2. Royce, W., Software Project management: A Unified Framework, Addison Wesley, 1998
3. Fenton, N.E., and Pfleeger, S. L., Software Metrics: A Rigorous and Practical Approach, Revised, Brooks Col , 1998
4. Demarco, T. and Lister, T., Peopleware: Productive Projects and Teams, 2nd Ed., Dorset House, 1999
5. Humphrey,Watts, Managing the Software Process, Addison Wesley,1986
6. Bob Hughes, Mikecotterell, Software Project Management, 3rd Ed., TMH, 2004
7. Ramesh, Gopalaswamy, Managing Global Projects, TMH, 2001
8. Royce, Software Project Management, Pearson Education, 1999
9. Jalote P., Software Project Manangement in Practice, Pearson Education, 2002
10. Schulmeyer, G. Gordon, James McManus, Handbook of Software Quality Assurance, Second Edition, Van Nostrand Reinhold, 1992
11. Anirban Basu, Software Quality Assurance, Testing and Metrics, 1st Ed., PHI