NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (HP)–177005
Department of Computer Science & Engineering

Modified Teaching Scheme (B.Tech. in CSE)
Effective From July-2010

1st Semester (Group – A)

SNo	Course No	Subject	L	T	P	Hours	Credits
1	AM-111	Engineering Mathematics-I	3	1	0	4	4
2	AP-101	Engineering Physics	3	1	0	4	4
3	CS-101	Computer Fundamentals & Programming	3	1	0	4	4
4	MSS-101	Communication Skills	2	1	0	3	3
5	ME-102	Engineering Mechanics & Strength of Materials	4	2	0	6	5
6	EE-101	Basic Electrical Engineering	3	1	0	4	4
Practicals							
7	AP-101(P)	Engineering Physics Lab	0	0	2	2	1
8	CS-101(P)	Computers fundamentals & Programming Lab	0	0	2	2	1
9	MSS-101(P)	Communication Skills	0	0	2	2	1
10	EE-101(P)	Basic Electrical Engineering Lab	0	0	2	2	1
11	WS-111	Workshop-1	1	0	3	4	3
Total						37	31

2nd Semester (Group – A)

SNo	Course No	Subject	L	T	P	Hours	Credits
1	AM-121	Engineering Mathematics-II	3	1	0	4	4
2	AC-101	Engineering Chemistry	3	1	0	4	4
3	MSE-101	Material Science & Engineering	3	1	0	4	4
4	EC-101	Basic Electronics Engineering	3	1	0	4	4
5	ME-101	Basic Thermodynamics	3	1	0	4	4
6	AR-101	Engineering Graphics (Auto CAD)	1	0	3	4	3
Practicals							
7	AC-101(P)	Engineering Chemistry Lab	0	0	3	3	2
8	MSE-101(P)	Material Science & Engineering Lab	0	0	2	2	1
9	EC-101(P)	Basic Electronics Engineering Lab	0	0	2	2	1
10	WS-121	Workshop-II	1	0	3	4	3
Total						35	30

3rd Semester

SNo	Course No	Subject	L	T	P	Hours	Credits
1	AM-232	Differential Equations, Probability & Queuing Models	3	1	0	4	4
2	CS-231	Discrete Structure	3	1	0	4	4
3	CS-232	Object Oriented Paradigm	3	1	0	4	4
4	EC-231	Digital Electronics & Logic Design	3	1	0	4	4
5	CS-233	Computer Architecture	3	1	0	4	4
6	CS-234	Web Technologies	3	1	0	4	4
Practicals							
7	CS-232(P)	Object Oriented Paradigm Lab	0	0	2	2	1
8	CS-234(P)	Web Technologies Lab	0	0	2	2	1
9	EC-231(P)	Digital Electronics & Logic Design Lab	0	0	2	2	1
10	ECA-231	Extra Curricular Activities-I	0	0	2	2	1
Total						**32**	**28**

4th Semester

SNo	Course No	Subject	L	T	P	Hours	Credits
1	MSS-201	Financial Management	3	1	0	4	4
2	CS-241	Modeling and Simulation	3	1	0	4	4
3	CS-242	Theory of Computation	3	1	0	4	4
4	CS-243	Data Structure	3	1	0	4	4
5	CS-244	Operating System	3	1	0	4	4
6	CS-245	System Software	3	1	0	4	4
Practicals							
7	CS-241(P)	Modeling and Simulation	0	0	2	2	1
8	CS-243(P)	Data Structure Lab	0	0	2	2	1
9	CS-244(P)	Operating System Lab	0	0	2	2	1
10	ECA-241	Extra Curricular Activities – II	0	0	2	2	1
Total						**32**	**28**

5th Semester

SNo	Course No	Subject	L	T	P	Hours	Credits
1	CS-351	Compiler Design	3	1	0	4	4
2	CS-352	Analysis & Design of Algorithms	3	1	0	4	4
3	CS-353	Microprocessor & Microcontrollers	3	1	0	4	4
4	CS-354	Computer Graphics	3	1	0	4	4
5	CS-355	Unix Programming	3	1	0	4	4
6		Open Elective-I (from other Dept)	3	0	0	3	3
Practicals							
7	CS-353(P)	Microprocessor & Microcontrollers Lab	0	0	2	2	1
8	CS-354(P)	Computer Graphics Lab	0	0	2	2	1
9	CS-355(P)	Unix Programming Lab	0	0	2	2	1
		Total				**29**	**26**

6th Semester

SNo	Course No	Subject	L	T	P	Hours	Credits
1	MSS-301	Principles of Management	3	1	0	4	4
2	CS-361	Software Engineering	3	1	0	4	4
3	CS-362	Data Base Management Systems	3	1	0	4	4
4	CS-363	Computer Communication and Networks	3	1	0	4	4
5	CS-364	Digital Image Processing	3	1	0	4	4
6		Open Elective-II (from other Dept)	3	0	0	3	3
Practical							
7	CS-362(P)	DBMS Lab	0	0	2	2	1
8	CS-363(P)	Computer Communication and Networks Lab	0	0	2	2	1
9	CS-364(P)	DIP Lab	0	0	2	2	1
		Total				**29**	**26**

7th Semester

SNo	Course No	Subject	L	T	P	Hours	Credits
1	CS-471	Department Elective-I	3	0	0	3	3
2	CS-472	Department Elective-II	3	0	0	3	3
3	CS-473	Department Elective-III	3	0	0	3	3
4	CS-474	Department Elective-IV	3	0	0	3	3
5	CS-475	Department Elective-V	3	0	0	3	3
Practical							
6	CS-496	Industrial Training Viva	0	0	0	0	2
7	CS-498	Major Project-I	0	0	6	6	3
8	CS-497	Seminar	0	0	3	3	2
9	CS-476 (P)	Computer Lab	0	0	2	2	2
		Total				**26**	**24**

8th Semester

SNo	Course No	Subject	L	T	P	Hours	Credits
1	CS-481	Data Mining	3	1	0	4	4
2	CS-482	Mobile Computing	3	1	0	4	4
3	CS-483	Computer and Information Security	3	1	0	4	4
4	CS-484	Department Elective-VI	3	0	0	3	3
5	CS-485	Department Elective-VII	3	0	0	3	3
Practical							
6	CS-482(P)	Mobile Computing Lab	0	0	2	2	1
7	CS-483(P)	Computer and Information Security Lab	0	0	2	2	1
8	CS-499	Major Project-II	0	0	6	6	3
		Total				**28**	**23**

Departmental Electives

CS-471
(a)   Advance Computer Architecture
(b)   Parallel Algorithms
(c)   Real Time Systems

CS-472
(a)   Soft Computing
(b)   Artificial Intelligence
(c)   Virtual Reality

CS-473
(a)   Agent Based Systems
(b)   Distributed Systems
(c)   Client Server Computing

CS-474
(a)   Embedded Systems
(b)   Cluster and Grid Computing
(c)   Storage Technologies

CS-475
(a)   Advance Computer Networks
(b)   Multimedia Computing
(c)   Wireless Sensor Networks

CS-484
(a)   CAD of Digital System
(b)   Advance Data Base Systems
(c)   Mobile Ad Hoc Networks

CS-485
(a)   Advance Operating System
(b)   Management Information System
(c)   Mobile Databases
(d)   E-Commerce

In addition to these electives, any other core/elective floated for M.Tech.,
Computer Science & Engineering, and M.Tech., Mobile Computing may also be
floated as elective for B.Tech., Computer Science & Engineering

Open Elective (CS-350)
(a)   Digital Image Processing
(b)   Unix Programming
(c)   Computer Graphics

Open Elective (CS-360)
(a)   Modeling and Simulation
(b)   Data Base Management System

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CS-101 COMPUTER FUNDAMENTALS AND PROGRAMMING

Programming fundamentals
Introduction to computer, block diagram and organization of computer, number system and binary arithmetic, processing data, hardware, software, firmware, types of programming language-Machine language, ALL, HLL, source file, object file, translators-assembler, compiler, interpreter, translation of source code into object code, library files, linking, loading process and executable code, testing and debugging, software maintenance, hardware maintenance.

Programming Techniques
Steps in program development, algorithm, flowchart, psuedocode, evolution and classification of programming languages.

'C' as Structured programming language
'C' character set, literals, keywords, identifiers, data types and size, variable declaration, expression, labels, statements, formatted input output statements, types of operators, data type conversion, mixed mode arithmetic's, control structures.
'C' functions, library functions, parameter passing, recursion, storage classes, scope rules and visibility, arrays: declaration, initialization and usage, pointers, dynamic storage allocation, structures and unions, self-referential structures.
'C' files, function for file handling, 'C' pre-processors and command line arguments, macros and conditional compiler directives.

Text Books
1. Computer fundamentals by P.K.Sinha.
2.   Programming with C by Byron GottFried, Tata McGraw Hill.
3.   Let us C by Yashwant Kanetkar

Reference Books
1. The Spirit of C by Munish cooper, Jaico Books.
2. C Programming language by jernighan and Ritchie, Pretenice Hall of India.

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CS-231   DISCRETE STRUCTURE

Introduction to Preliminaries and Predicate Calculus
Basic concepts of discrete mathematics and related problems, propositions and predicates, disjunction and conjunction, tautologies and contradiction, laws of equivalence, rules of substitution and transitivity, normal forms.

Set Theory and Functions
Basic concepts, ,Venn Diagrams, set operations, power set, methods of proof for sets, Relations and ordering, Types of relations, Graph and matrix of a relation, properties of a relation, Functions: definitions and notation, one to one, onto, one to one and onto, composition, identity and inverse, related results.

Graph Theory
Basic concepts of graph theory, multigraphs and weighted graphs, walk path and circuits, Warshall's algorithm: shortest path, Eulerian paths and circuits, Hamiltonian paths and circuits, factors of a graph and planar graphs, Graph colorings.

Binary Trees
Introduction, complete and extended binary tree, traversing binary tree, binary search tree, Heaps, Huffman's algorithm

Basics of Structures
Mathematical induction, Algebraic structures properties, Semi group, Monoid, Group and Sub group - examples and standard results, generators and evaluation of powers, cosets and Langranges's theorem, rings, integral domains, fields.

Logic and Recursion
Propositional calculus - propositions, logical operators, truth tables, Lattice, propositions generated by a set of recurrence relations - partial and total recursion - problems.

Text Books
1. J.P. TEMBLAY AND R. MANOHAR, Discrete Mathematical structures with Applications to Computer Science, McGraw Hill.
2. C.L. LIU, Elements of Discrete Mathematics, McGraw Hill.

Reference Books
1. STEPHEN A.WITAL, Discrete Mathematics, McGraw Hill Book Coy.
2. Semyour Lipscdutz,Marc Lipson, Discrete Mathematics, Schaum's outlines.,Tata Macgraw Hills.

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CS-232   OBJECT ORIENTED PARADIGM

Concepts of Object-Oriented Programming
Oriented Programming Paradigm, Basic concepts of OOP's, Benefits of OOPS, Introduction to object oriented design and development, Design steps, Design example, Object oriented languages, Comparison of structured and object-oriented programming languages.

Arrays, Pointers and Functions
Arrays, Storage of arrays in memory, Initializing Arrays, Multi-Dimensional Arrays, Pointers, accessing array elements through pointers, Passing pointers as function arguments, Arrays of pointers, Pointers to pointers, Functions, Arguments, Inline functions, Function Overloading Polymorphism.

Classes and Objects
Data types, operators, expressions, control structures, arrays, strings, Classes and objects, access specifiers, constructors, destructors, operator overloading, type conversion.

Storage classes
Fixed vs Automatic declaration, Scope, Global variables, The register specifier, Dynamic memory allocation.

Inheritance
Inheritance, single Inheritance, Multiple Inheritance, Multi level inheritance, hierarchical inheritance, hybrid inheritance, Virtual functions, Friend functions, Generic programming with templates.

Streams and Files
Opening and closing a file, File pointers and their manipulations, Sequential Input and output operations, multi-file programs, Random Access, command line argument, string class, Date class, Array class, List class, Queue class, User defined class, Generic Class.

Exception Handling and Graphics
List of exceptions, catching exception, handling exception. Text Mode, Graphics mode functions, Rectangles, and Lines, Polygons & Inheritance, Sound & Motion, Text in Graphics Mode.

Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Windows Programming Foundations: Windows concepts, Windows programming concept, Visual C++, Windows tools, Procedure-Oriented Windows Applications, Microsoft Foundation Class Library concepts, Windows application with MFC.

Wizards: Application class wizards, Introduction to OLE, ActiveX controls with the MFC library.

Text Books
1. Robert Lafore, Object Oriented Programming in Turbo C++, Galgotia Publications,
2. Balagurusamy, Object Oriented programming with C++, Tata McGraw Hill.

Reference Books
1. Bjarne Strustrup, The C++ programming Language, Addison Wesley,
2. Booch, Object Oriented Analysis and Design with Applications, Addison Wesley.
3. Chair H. Pappas & William H. Murray, *"The Complete Reference Visual C++"*, TMH

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CS-233   COMPUTER ARCHITECTURE

General System Architecture
Stored Program control concept (Von-Newman architecture principle), Flynn's Classification of computers (SIMD, MISD, MIMD), Structure organization (CPU, Caches, Main memory, Secondary memory unit & I/O), Register Transfer Operation, Micro-operation, Instruction Set Architecture (Instruction set based classification of processor i.e. RISC, CISC, RISC vs CISC Comparison), Addressing Modes, Operation instruction set (Arithmetic & logical, Data transfer, Control flow), Instruction set format.

Processor Design
Arithmetic & logic unit, Stack organization, CPU Architecture types, Accumulator Based- Register, Stack-Memory, Register, Detailed data path of a typical register based CPU, Fetch, Decode, and Execute Cycle.

Computer Arithmetic
Addition & Subtraction, Multiplication Algorithms (Booth's Multiplication Algorithm), Division Algorithm, Floating point arithmetic operations.

Control Design
Microprogrammed & Hard-wired control options, Hard-wired design methods, State table method, Multiplier control, CPU control unit. Microprogrammed, Basic concepts, control Memory, Address Sequencing.

I/O Organization & Memory Hierarchy
Programmed, Interrupt driven & Direct Memory Access, Synchronous & Asynchronous data transfer, The need for Memory Hierarchy, locality of reference principle, Memory Hierarchy, cache, main & secondary, Memory parameters, access cycle time, cost per unit.

Introduction to Parallelism
Goals of parallelism, Instruction level parallelism, pipelining, superscaling, Processor level parallelism, Multiprocessor system overview.

Text Books
1. J.P. Hayes, Computer architecture & organization.
2. William Stallings, *"Computer Organisation and Architecture, Designing for Performance"*, Pearson Education Asia.

Reference Books
1. M. Morris Mano, Computer system architecture.
2. David A. Patterson & John. L. Hennessy, Computer Architecture.

CS-234 Web Technologies

INTRODUCTION
History of the Internet and World Wide Web – HTML 4 protocols – HTTP, SMTP, POP3, MIME, IMAP. Introduction to JAVA Scripts – Object Based Scripting for the web. Structures – Functions – Arrays – Objects.

DYNAMIC   HTML
Introduction – Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – Onenor – Mouse rel – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data – Binding of an Image and table.

MULTIMEDIA
Audio and video speech synthesis and recognition - Electronic Commerce – E-Business Model – E- Marketing – Online Payments and Security – Web Servers – HTTP request types – System Architecture – Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server.

DATABASE- ASP – XML
Database, Relational Database model – Overview, SQL – ASP – Working of ASP – Objects – File System Objects – Session tracking and cookies – ADO – Access a Database from ASP – Server side Active-X Components – Web Resources – XML – Structure in Data – Name spaces – DTD – Vocabularies – DOM methods.

SERVLETS AND JSP
Introduction – Servlet Overview Architecture – Handling HTTP Request – Get and post request – redirecting request – multi-tier applications – JSP – Overview – Objects – scripting – Standard Actions – Directives.

Text Books
1. Deitel & Deitel, Goldberg, "Internet and world wide web – How to Program", Pearson Education Asia, 2001.

Reference Books
2. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999.
3. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.
   Rajkamal, "Web Technology", Tata McGraw-Hill, 2001.

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CS-241   MODELING AND SIMULATION

Fundamentals
Definition and reasons for simulation, Continuous (time-oriented) and discrete (event) systems, Modeling/programming simple deterministic systems, Rates and system dynamics.

Concepts in Simulation
Stochastic variables; discrete vs continuous probability; algorithms for generating random numbers, their comparison with respect to speed and validity; continuous uniformly distributed random numbers; methods for generating non-uniform distributions.

Building Simulation Programming Models
Arrival patterns, service times, and queue formation. Formulating systems as events and entities (such as resources, queues, gates, and linkages). Congestion in systems; arrival patterns; Poisson arrivals; the exponential distribution; the coefficient of variation; service times; normal distribution; queuing disciplines; Measures for Queues; Analytic Solutions of Queuing Problems; Utilization as a Design Factor; Other factors like grade of service.

Discrete Event System Simulation
Discrete events; representation of time; queues and servers; generation of arrival patterns; resource seizing; departures simulation of a telephone system and computer networks; simulating components of an operating system; delayed calls; modeling policies; priority queues; tasks; gathering statistics; counters and summary statistics; measuring utilization and occupancy; recording distributions and transit times.

Introduction to a Simulation Languages
Simulation in C++, GPSS, Simulations Packages, Trends in simulation Software. SIMSCRIPT programs; SIMSCRIPT system concepts; organization of a SIMSCRIPT program; blocks, names, and labels; SIMSCRIPT statements; entities, events, and activities; defining the system; defining the system model; referencing variables; the procedural structures; arrival event; timing routine; disconnect event; closing event; execution, debugging and validation; interpreting outputs and system optimization via modification.

TEXT BOOKS
1. Simulation Modeling and Analysis, Law and Kelton, McGraw-Hill.

REFERENCE BOOKS
1. Discrete-Event System Simulation, Prentice-Hall.
2. Getting Started in GPSS, Engineering Press, San Jose, CA.
3. Simulation Model Design and Execution, Prentice-Hall.

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CS-242   THEORY OF COMPUTATION

Machines
Basic machine, FSM , Transition graph, Transition matrix, Deterministic and non-deterministic FSM'S, Equivalence of DFA and NDFA, Mealy & Moore machines, minimization of finite automata, Two-way finite automata.

Regular Sets and Regular Grammars
Alphabet, words, Operations, Regular sets, Finite automata and regular expression, Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets.

Formal Grammars & Languages
Basic definitions and examples of languages, Chomsky hierarchy, Regular grammars, context free & context sensitive grammars, context free languages, non-context free languages, Chomskey normal forms, binary operations on languages.

Turing Machines & Pushdown Automata
TM model, representation and languages acceptability of TM Design of TM, Universal TM & Other modification, composite & iterated TM, Pushdown automata , Acceptance by PDA.

Computability
Basic concepts, primitive & partial recursive function, Recursive function, Decidability, Kleen's theorem.

Undecidibility
Properties of recursive & recursively enumerable languages, Universal Turing machine and an undecidable problem, Rice's theorem & some more undecidable problems.

Computational complexity Theory
Definition, linear speed-up, tape compression & reduction in number of tapes, Hierarchy Theorem, Relation among complexity measures, Transition lemmas & non deterministic hierarchies, properties of general complexity measures, the gap, speed-up, union theorem, Automatic complexity theorem.

Text Book
1. John E. Hopcroft, Jeffery Ullman, Introduction to Automata theory, Langauges & computation, Narosa Publishers.

Reference Books
1. E.V. Krishnamurthy, Introductory Theory of computer science.
2. K.L.P. Mishra, Theory of computer Science, Prentice Hall of India Pvt. Ltd.

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<center>**CS-243   DATA STRUCTURE**</center>

Introduction
Data types, data structures, abstract data types, the running time of a program, the running time and storage cost of algorithms, complexity, asymptotic complexity, big O notation, obtaining the complexity of an algorithm.

Development of Algorithms
Notations and Analysis, Storage structures for arrays - sparse matrices - structures and arrays of structures, Stacks and Queues: Representations, implementations and applications.

Linked Lists
Singly linked lists, Linked stacks and queues, operations on Polynomials, Doubly Linked Lists, Circularly Linked Lists, Operations on linked lists- Insertion, deletion and traversal, Dynamic storage management - Garbage collection and compaction.

Trees
Basic terminology, General Trees, Binary Trees, Tree Traversing: inorder, preorder and postorder traversal, building a binary search tree, Operations on Binary Trees - Expression Manipulations - Symbol Table construction, Height Balanced Trees(AVL), B-trees, B+ -trees.

Graphs
Basic definitions, representations of directed and undirected graphs, the single-source shortest path problem, the all-pair shortest path problem, traversals of directed and undirected graphs, directed acyclic graphs, strong components, minimum cost spanning tress, articulation points and biconnected components, graph matching.

Sorting and Searching Techniques
Bubble sorting, Insertion sort, Selection sort, Shell sort, Merge sort, Heap and Heap sort, Quick sort, Radix sort and Bucket sort, Address calculation, Sequential searching, Binary Searching, Index searching, Hash table methods.

Text Books
1. J.P. TREMBLAY AND P.G. SORENSON, An Introduction to Data Structures with applications, Second Edition, Tata McGraw Hill.
2. E. HOROWITZ AND S. SAHNI, Fundamentals of Data Structures in Pascal, Galgotia.
3. S.SAHNI, Data structures, Algorithms ad Applications in C++, WCB/McGraw Hill.

Reference Books
1. A.TANENBAUM AND M.J. AUGUSTEIN, Data Structures using Pascal, Prentice Hall of India.
2. AHO ULLMAN, Data Structures and Algorithms.

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CS-244   OPERATING SYSTEM

Evolution of operating systems

Evolution of operating systems, Types of operating systems. The process concept, system programmer's view of processes, operating system's views of processes, operating system services for process management.

CPU Scheduling

Scheduling concepts, scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling.

Concurrent programming and Deadlocks

Critical regions, Conditional critical regions, Monitors, Interprocess communication, Messages, Pipes, Semaphores, Modularization, Synchronization, Concurrent languages. Deadlocks: Characterization, Prevention, Avoidance, Detection and Recovery, Combined approach to Deadlock Handling, precedence graphs.

Memory management

Memory Management, Contiguous allocation, static-swapping, overlays, dynamic partitioned memory allocation, demand paging, page replacement, segmentation. Non-contiguous allocation, paging, Hardware support, Virtual Memory.

File systems

A Simple file system, General model of a file system, Symbolic file system, Access control verification, Logical file system, Physical file system, Allocation strategy module, Device strategy module, I/O initiators, Device handlers, Disk scheduling.

Networks, Security and Design Principles

Network operating system, distributed operating system, external security, operational security, password protection, access control, security kernels, hardware security, layered approach, design principle.

Text Book
1. J.L. PETERSON AND A. SILBERCHATZ, Operating System Concepts, Addison Wesley.

Reference Books
1. HARVEY M. DIETEL, An Introduction to Operating System, Addison Wesley.
2. C.CROWLEY, Operating Systems - A Design Oriented Approach, Irwin.
3. W. STALLINGS, Operating systems, Second Edition, Prentice Hall.

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CS-245   SYSTEM SOFTWARE

System Software
Distinction between system software and application software, Components of System Software, Evolution of System Software, H/W Independent features of System Software, General features of a System Software, Layered Organization of System Software, Overview of Compilers and Interpreters.

Machine Language and Macroprocessor
Defining and Usage of Macro Expression, Macro Definition Language: Macro generation, Positional Parameters and Keyword parameters, Conditional Macro expansion, Macro Calls within Macros and its implementation, Macro Instructions Defining Macros, One-Pass Macro Processor.

Instruction set of 8086/8088 microprocessors
Programming examples - Assembly language program development on IBM PC using MASM - Study of DEBUG and LINK utility. Interrupts and interrupt priority management in 8086. Maximum mode and 16 bit bus interface design – Architecture and functions of 8087 numeric processor and its programming – Interfacing with 8086/8088.

Assembler
Machine Structure, Machine Languages, Elements of Assembly language Programming, Machine Independent features: Instructions, Program location, Command to Loader, Machine Dependent features: Literals, Symbol defining statements, Expressions, Program Block, Control section and program linking, Design of Two-Pass Assembler, Data Structures Format of Databases, Algorithm, A Single-Pass Assembler IBM PC.

Loaders
Object Code, Function to be performed by Object Code, Machine dependent Features: Location, Linking, Machine Independent features: Automatic Library Search, Loader options, Overlay program, Loader Schemes: Compile and go Loaders, Absolute Loaders, Relocatability: Non-Relocating Program, Relocatable Program, Self-Relocating Programs, Algorithms for Relocating Loaders Using Relocation bit, Algorithm for Relocating loader Using Relocatable Location table, design of BSS Loader, Linking Schemes.

System Software Tools
Elements of System software Tools, Text Editor: Line and Stream Editor, Screen Editor, Structure Editor, Word Processor, Editor Structure, Debug Monitor, Programming Environment, DOS functions, Keyboard Management, Screen Management,Window or Display management, Text or Graphics, Overlayed or Tiled, Transcription and Image Buffer process per Window, Multi Tasking Window System, Machine and Assembly language Programming Interface, Device Driver Programming.

Virus
Classification of Virus, Virus Detection and Control System, Virus in other environment, case studies.

TEXT BOOKS
1. John J. Donovan, System Programming.
2. D. M. Dhamdhere, System Software and Operating System.
3. Leland L. Black, System Software -An Introduction to System Programming, Addision Wesley.
4. Intel Users manual for 8086, 80386 & 80486, Pentium & Pentium pro.

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CS-351   COMPILER DESIGN

Introduction to Compilers
Compiler and translators need of translators, structure of a compiler, lexical analysis, syntax Analysis.

Basic Parsing Techniques
Parsers, shift-reduce parsing, predictive parsing.

Automatic Construction of Efficient Parsers
LR parsers, canonical collection of LR(0) items, construction canonical LR parsing tables, construction LALR and SLR parsing tables using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables, construction LALR sets of items.

Syntax-Directed Translation
Syntax directed translation schemes, implementation of syntax directed translation, intermediate code, postfix notation parse trees and syntax trees, three address code, quadruples and triples, translation of assignment statements, postfix translation with top down parser.

Symbol Tables
Contents of a table, data structures for symbol tables, representing scope information.

Error detection and recovery
Errors, lexical-phase errors, syntax-phase errors, semantic errors.

Introduction to Code optimization
The principal source of optimization, loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, global data flow analysis.

Code Generation
Object programs, problems in code generation, machine model, simple code generator, register allocation and assignment, code generation from DAG's, peephole optimization.

Assembler
Machine Structure, Machine Languages, Elements of Assembly language Programming, Machine Independent features: Instructions, Program location, Command to Loader, Machine Dependent features: Literals, Symbol defining statements, Expressions, Program Block, Control section and program linking, Design of Two-Pass Assembler, Data Structures Format of Databases, Algorithm, A Single-Pass Assembler IBM PC.

Loaders
Object Code, Function to be performed by Object Code, Machine dependent Features: Location, Linking, Machine Independent features: Automatic Library Search, Loader options, Overlay program, Loader Schemes: Compile and go Loaders, Absolute Loaders, Relocatability: Non-Relocating Program, Relocatable Program, Self-Relocating Programs, Algorithms for Relocating Loaders Using Relocation bit, Algorithm for Relocating loader Using Relocatable Location table, design of BSS Loader, Linking Schemes

Text Books
1. Principles of Compiler Design by ALFRED V. Aho and J.D. ULLMAN Narosa Publishing House.
2. Compilers Principles, Techniques and Tools, ALFRED V. AHO, RAVI SETHI, JEFFREY D ULMAN Addision-Wesley Publishing House.
3. John J. Donovan, System Programming.
4. D. M. Dhamdhere, System Software and Operating System.
5. Leland L. Black, System Software -An Introduction to System Programming, Addision Wesley.

Reference Books
1. Compiler Construction by D.M. Dhamdhere {IIT Bombay}, Tata Mc-Graw Publishing Copy Ltd. New Delhi.
2. Roy S. Elizey, Compuer System Software -The Programmer/Machine Interface,Bigger Staff, System Software Tools.

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CS-352   ANALYSIS & DESIGN OF ALGORITHMS

Algorithms Introduction:
Algorithm Design paradigms- motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations.

Divide and Conquer approach:
Structure of divide-and-conquer algorithms: sets and disjoint sets: Union and Find algorithms, quick sort, Finding the maximum an minimum, Quick Sort, Merge sort, Heap and heap sort,.

Greedy Algorithms:
Optimal storage on tapes, Knapsack problem, Job sequencing with deadlines, Minimum Spanning trees: Prim's algorithm & Kruskal's algorithm, Huffman codes.

Graph Algorithms:
Representation of graphs, BFS, DFS, Topological sort, strongly connected components; single source shortest paths: Bellmen-Ford algorithm, Dijkstra's algorithm; All pairs shortest path: The Warshall's algorithm.

Dynamic programming: Overview, difference between dynamic programming and divide and conquer, Matrix chain multiplication, Traveling salesman Problem, longest Common sequence, 0/1 knapsack.

Backtracking: 8-Queen Problem, Sum of subsets, graph coloring, Hamiltonian cycles.

Branch and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem

Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

TEXT BOOKS
1. E.Horowitz And S.Sahni, Fundamentals Of Computer Algorithms, Galgotia.
2. T.H.Cormen, C.E. Leiserson, R.L. Rivest, Introduction To Algorithms, The MIT Press,Cambridge.

REFERENCE BOOKS
1. A.V. Aho, J.E. Hopcroft And J.D. Ullman, The Design And Analysis Of Computer Algorithms, Addison Wesley.

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<center>CS-353   MICROPROCESSOR & MICROCONTROLLERS</center>

Introduction To Microprocessor
History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

Assembly Language Programming and Timing Diagram
Assembly language programming in 8085, Macros, Labels and Directives, Microprocessor timings, Microinstructions, Instruction cycle, Machine cycles, T states, State transition diagrams, Timing diagram for different machine cycles.

Serial I/O, Interrupts and Comparison of Contemporary Microprocessors
Serial I/O using SID, SOD. Interrupts in 8085, RST instructions, Issues in implementing interrupts, Multiple interrupts and priorities, Daisy chaining, Interrupt handling in 8085, Enabling, disabling and masking of interrupts. Brief comparison of contemporary 8-bit microprocessors like Z-80, M68000 with 8085.

Data Transfer techniques
Data transfer techniques, Programmed data transfer, Parallel data transfer using 8155. Programmable parallel ports and handshake input/output, Asynchronous and Synchronous data transfer using 8251A. Programmable interrupt controller 8259A. DMA transfer, cycle stealing and burst mode of DMA, 8257 DMA controller.

Microprocessor Interfacing Techniques
Interfacing memory and I/O devices, Addressing memory, interfacing static RAMs, Interfacing and refreshing dynamic RAMs, Interfacing a keyboard, Interfacing LED and seven segment displays, Interfacing a printer, Interfacing A/D converters, D/A converters.

Architecture of 8086
Memory Address space and data organization,- segment registers and memory segmentation, Generating memory addresses, IO address space, addressing modes, Comparison of 8086 and 8088, minimum mode maximum mode, system timing.

8051 Microcontrollers
Microcontrollers and Embedded Processors, Overview of the 8051 Family. Internals of 8051, Introduction to 8051 Assembly Programming, Assembling and running an 8051 Program, Data Types & directives, 8051 Flag Bits and the PSW Register, Pin Description of the8051, I/O Programming, Bit Manipulation, 8051 Addressing Modes. Basics of Serial Communication, 8051 Connection to RS-232, 8051 Serial Communication Programming.

Microcomputer Based System
Embedded Computer System, Applications, Software Issues, Memory Mapped Architecture, MC68HC05 Architecture.

Pentium processor
Functional units and its working - Super scalar architecture - Addressing modes - Concepts like intelligent branch prediction and U-V pipelining -

Burst mode of data transfer - Introduction to Pentium pro and its architecture.

Text Books

1. R.S. GAONKAR, Microprocessor Architecture, Programming and applications with the 8085/8080A, Wiley Eastern Ltd.
2. A.H. MUHOPADHYAY, Microprocessor Based Laboratory Experiments and Projects, Wheeler Publishing, 1997.
3. YU-Cheng Liu & Glenn A Gibson, Microprocessor System, Architecture Programming & Design.
4. Douglas V Hall, Microprocessors & Interfacing.
5. Muhammad Ali Mazidi, The 8051 Microcontroller and Embedded Systems.
6. Jonathan W. Valvano, Embedded Microcomputer Systems

Reference Books

1. D.V.HALL, Microprocessors and Digital Systems, McGraw Hill International students Edition.
2. A.P.MATHUR, Introduction to Microprocessor, Tata McGraw Hill.
3. Avtar Singh, IBM PC/ 8088 Assembly Language Programming.
4. Scott Muller, Upgrading and repairing IBM PCS.
5. James L Hardey, Advanced 80386 Programming Techniques.
6. Intel Users manual for 8086, 80386 & 80486, Pentium & Pentium Pro.

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CS-354   COMPUTER GRAPHICS

Introduction to Computer Graphics
Overview of Graphics Systems, Display Devices, Hard copy Devices. Interactive
Input Devices, Display Processors, The Graphical Kernel System, Output
Primitives, Line drawing algorithms, Circle Generation algorithms, Character
Generation.

Raster Scan Graphics
Line Drawing Algorithms, Circle Generation, General Function Rasterization,
Scan Conversion- Generation of the display, Image Compression, Polygon
Filling , Fundamentals of Antialiasing.

Two-Dimensional Geometric Transformation & Viewing
Basic Transformation, Translation, Rotation, Scaling, Other Transformation
Reflection, Shear, Transformation functions, Window to viewport co-ordinate
transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon
Clipping.

Three- Dimensional Concepts & Object Representations
Three Dimensional Display Methods, Parallel Projection, Perspective
Projection, Translation, Rotation, Scaling, Composite Transformation, Three
dimensional Transformation function, Polygon Surfaces, Curved Lines and
surfaces, Bezier Curves and surfaces, B-Spline Curves and surfaces.

Graphics hardware
Display technology, random scan, raster scan display processing, input
devices for interaction.

Visible Lines and Visible Surfaces
Visual Realism, Hidden line and hidden surface removal : depth buffer
algorithm, geometric computations, scan line coherence algorithms, area
coherence algorithms, priority algorithm., shading and color models, Modeling
methods.

Rendering
A simple illumination model, Transparency, Refraction effects in transparent
materials, Simple Transparency Models, Z-Buffer Transparency, Shadows,
Texture.

Text Books
1. D.F. ROGERS, Procedural Elements for Computer Graphics, McGraw Hill.
2. HEARN and BAKER, Computer graphics, PHI

Reference Books
1. S. HARRINGTON, Computer Graphics - A programming approach, McGraw Hill.
2. D.F. ROGERS, Mathematical Elements for Computer Graphics, McGraw Hill.

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CS-355   UNIX PROGRAMMING

UNIX Standards
Brief History of UNIX, AT&T and Berkeley UNIX Systems, POSIX, Library vs. System-Level Functions.

Files and Directories
Basic File Types, File Descriptors, The open() and creat() Functions, Keeping Track of Open Files, File Table Entries, The v-node structure, The fcntl() function, File Attributes, The access() function, Link(), unlink(), remove(), and rename() functions, Functions to Manipulate Directories.

Shell Programming
Bourne Shell, korn shell and C shell. Shell metacharacters, shell variable and scripts, facilities and command, environment, integer arithmetic and string manipulation, decision making, aliasing, arrays and job control.

System I/O
Standard I/O vs system I/O, System I/O Calls, File and Record Locking.

Processes
Process Creation and Termination, Process Memory Layout, Dynamic Memory Allocation, Accessing Environment Variables, Real and Effective User IDs.

Process Management
Programs and Processes, The fork() System Function, Parent and Child, The Exec System Functions, Current Image and New Image, The wait() and waitpid() function, Interpreter files and exec.

Pipes - Basic IPC
Interprocess Communication, Pipes, FIFOs.

Signals
What is a Signal?, Types of Signals, Signal Actions, Blocking Signals from Delivery, The sigaction() function, Signal Sets and Operations, Sending a Signal to Another Process, Blocking Signals with sigprocmask(), Scheduling and Waiting for Signals, Restarting System Calls (SVR4)
Signals and Reentrancy.

Introduction to Threads
Processes and Threads, Creating Threads, Multitasking, Overview of Thread Architectures, Processes Versus Threads, The Threads API, Thread Termination, Joining and Detaching Threads, Passing Arguments to Threads.

Threads Synchronization
The Sharing Problem, Mutexes, Creating and Initializing Mutexes, Using Mutexes, Additional Synchronization Requirement, Using Condition Variables.

Overview of Client/Server Programming
Designing Distributed Application, Clients and Servers, Ports and Services, Connectionless vs. Connection-Oriented Servers, Stateless vs. Stateful Servers, Concurrency Issues.

The Berkeley Sockets API

Berkeley Sockets, Data Structures of the Sockets API, Socket System Calls, Socket Utility Functions.

Text Books
1. W. Richard Stevens, Advanced Programming in the UNIX Environment, Addison-Wesley.
2. Eric Steven Raymond, The Art of UNIX Programming, Addison-Wesley.

Reference Book
1. W. Richard Stevens, UNIX Network Programming, Prentice Hall.

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CS-361   SOFTWARE ENGINEERING

Introduction:
Problem domain, software engineering challenges, software engineering approach.

Software Processes:
Software process, characteristics of software process, software development process models, other processes.

Software Requirements analysis and specification:
Software requirements, problem analysis, requirements specification, functional specification with use cases, validation, matrices.

Software Architecture
Role of software architect, architecture views, component and connector view, architecture style for C & C view, discussion and evaluating architectures.

Planning a software project:
Effort estimation, project scheduling and staffing, software configuration management plan, quality assurance plan, risk management, project monitoring plan.

Function oriented design:
Design principles, module level concepts, design notation and specification, structured design methodology, verification, metrics.

Object oriented design:
OO concepts, design concept, Unified Modeling Language, design methodology, metrics.

Detailed Design, Software Measurements, metrics and Models:
Detailed design and PDL, verification, Metrics and their scope, Qualities of a good Software metrics, classification of metrics, Cost estimation models COCOMO, Quality attributes, SQA, Quality Standards, ISO 9000 and CMM.

Coding
Programming principles and guidelines, coding process, refactoring, verification, metrics.

Testing:
Testing fundamentals, black-box testing, white-box testing, testing process, defect analysis and prevention, metrics - reliability estimation.

CASE Tools: Types of CASE tools, advantages and components of CASE tools, Unified Modelling Language (UML)

Text Books
1. An integrated approach to software engineering, Pankaj Jalote, 3rd edition, Narosa Publishing.
2. Pressman Roger R, "*Software Engineering: A Practitioner's Approach*", TMH

Reference Books

1. Fundamentals of Software Engineering Rajib Mall, Pretence Hall of India.
2. Software Engineering, Ian Sommerville , Addition- Wesley Publishing Company.
3. Tom Pender *"UML Bible"*, Wiley Dreamtech
4. Ian Sommerville, *"Software Engineering"*, 5th edition, Addison-Wesley
5. Wamman S Jawadkar, *"Software Engineering"*, Tata McGraw-Hill.

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CS-362   DATA BASE MANAGEMENT SYSTEM

Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modeling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.

Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems, DB2. DB2 Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Table spaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

Relational data base design: function dependencies & normalization for relational databases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures. Object-oriented Databases, Distributed and Parallel Databases, Multi-databases, Access Methods, Transaction Management, Query Processing, Deductive Databases, multimedia Databases, Real-Time Databases, Active Databases, Temporal Databases, Mobile Databases, Database Benchmarks, Database Security, Data Mining and Data Warehousing.

Books and References
1. Desai, B., "An introduction to database concepts", Galgotia publications.
2. Readings in Database Systems edited by M. Stonebraker, Morgan Kaufmann, 2nd ed., 1994 Conference and Journal papers
3. Date, C. J. , "An introduction to database systems", 7rd Edition, Addison Wesley.
4. Date, C. J. , "An introduction to database systems", 3rd Edition, Narosa publishing house.
5. Elmsari and Navathe, "Fundamentals of database systems", Addison Wesley.
6. Ullman, J. D., "Principals of database systems", Galgotia publications.
7. DB2 Manuals

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CS-363   COMPUTER COMMUNICATION AND NETWORKS

Introductory Concepts
Goals and Applications of Networks, LAN, WAN, MAN, Wireless network, Network software: Protocol hierarchies, design issues of layers, Interfaces and services. Reference Model: The OSI reference model, TCP/IP reference model, Example networks: Novell Netware, The ARPANET, The Internet, X-25 Networks, network standards.

Physical Layer
Fourier Analysis, Maximum data rate of a channel, Transmission media, Wireless transmission, Narrowband ISDN, Broadband ISDN and ATM, Virtual circuits, Circuit switching, Communication satellite.

Data Link Layer
Data link layer design issues, services provided to network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A one-bit Sliding protocol, A protocol using go-back-N, A protocol using selective repeat, Protocol specification and verification, Example data link protocol-HDLC, PPP and SLIP.

Medium Access Sublayer
Channel Allocations, Static and dynamic allocation in LAN and MAN, Multiple Access protocols, ALOHA, Carrier Sense multiple access protocols, WDMA protocols, Wireless protocols, Collision free protocols, Limited contention protocols, IEEE standard 802.3 and Ethernet, IEEE standard 802.4, Token bus IEEE standard 802.5, Token Ring, Distributed Queue Dual bus, Logical link control, bridges, High speed LAN, Satellite networks.

Network Layer
Network Layer design issue, Routing algorithms, Congestion Control Algorithms, Internetworking.

Transport Layer
Transport services, Design issues, elements of transport protocols, simple transport protocols, Connection management, TCP, UDP.

Session, Presentation and Application Layer
Session Layer - Design issues, remote procedure call. Presentation Layer - Design issues, Data compression techniques, cryptography. Application Layer - File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other applications, Example Networks - Internet and Public Networks.

Text Books
1. A.S. Tanenbaum, Computer Networks, Prentice Hall of India.
2. J. Kurose and K.W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Addison-Wesley.

Reference Book
1. W. Stallings, Data and Computer Communication, Prentice Hall of India.

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CS-364   DIGITAL IMAGE PROCESSING

Introduction
Digital image representation, Fundamental steps in image processing, Elements of Digital Image processing systems, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels, Imaging geometry.

Image Enhancement
Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.

Image Compression
Coding redundancy, Inter-pixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.

Image Segmentation
Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, Frequency domain techniques.

Spatial Operations and Transformations
Spatially dependent transform template and convolution, Window operations, 2-Dimensional geometric transformations.

Pattern Recognition
Classification and description, Structure of a pattern recognition system, feature extraction, Classifiers, Decision regions and boundaries, discriminent functions, Supervised and Unsupervised learning, PR-Approaches statistics, syntactic and neural.

Statistical Pattern Recognition
Statistical PR, Classifier Gaussian Model, Classifier performance, Risk and error, Maximum likelihood estimation, Bayessian parameter estimation approach, Clustering for unsupervised learning and classifiers.

Text Books
1. R. GONZALEZ and R. E. WOOD, Digital Image Processing, Prentice Hall of India.
2. ANDRIAN LOW, Introductory Computer Vision and Image Procession, McGraw Hill CO.
3. ROBERT SCHOLKOFF and JOHN WILLEY & SONS, Pattern Recognition-Statistical, Structural and neural approach.

Reference Books
1. W.K. PRATT, Digital Image Processing, McGraw Hill.
2. A. K. JAIN, Fundamentals of Image Processing.

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CS-481   DATA MINING

Introduction
Data mining – Data mining functionalities – kinds of patterns can be mined – classification – major issues. Data warehouse – A multidimensional data model – Data warehouse architecture – Data warehouse implementation – From data warehouse to data mining

Data Pre-Processing
Data cleaning – Data Integration and Transformation – Data Reduction – Discretization and concept hierarchy generation – Data mining primitives – Data mining Task – A data mining query language – Architecture of Data mining systems – Characterization and comparison

Association Rule Mining
Mining single dimensional Boolean association rules from transactional databases – mining multilevel association rules from transaction databases- mining multidimensional association rules from Relational databases and Data warehouses – From association mining to correlation analysis – constraint-based association mining

Classification and Prediction
Issues regarding classification and prediction – classification by decision Tree Induction – Bayesian Classification – Classification by Back propagation –classification based on concepts from association rule mining – other classification methods – prediction – classifier accuracy

Applications and Trends in Data Mining
Data mining system products and Research prototypes – Additional themes on Data mining – Social Impacts of Data Mining – Trends in Data mining – Realization to data mining using SQL Server, Case studies in building business environment, Application of data ware housing and Data mining in Government, National Data ware houses and case studies.

Text Book
1. Jiawei Han and Michelien Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann.

Reference Book
1. Alex Berson and Stephen Smith, Data Warehousing, Data mining and OLAP, McGraw Hill

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CS-482 MOBILE COMPUTING

Introduction : Challenges in mobile computing, coping with uncertainties, resource poorness, bandwidth, etc. Cellular architecture, co-channel interference, frequency reuse, capacity increase by cell splitting.

Medium Access Control : Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.

Telecommunication Systems : GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode .

Wireless LAN : Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link management.

Mobile Network Layer : Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation , Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing .

Mobile Transport Layer : Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP .

Data Dissemination and Management: Challenges, Data dissemination, Mobile data replication, Mobile data caching, Mobile cache maintenance, mobile web caching, caching in ad hoc networks.

Context Aware Computing: Ubiquitous computing, concept of context, context aware computing and applications, middleware support.

Mobile Middleware: Service discovery, adaptation, mobile agents.

Wireless security: Traditional security issues, mobile and wireless security issues, Problems in ad hoc networks.

Text Books
1. Frank Adelstein, S.K.S. Gupta, Golden G. Richard III and *Loren Schwiebert,* Fundamentals of Mobile and Pervasive Computing, McGraw-Hill Professional.

2. D.P. Agrawal and Q.-A. Zeng, Introduction to Wireless and Mobile Systems, Thomson Brooks/Cole.

Reference Books
1. K. Pahlavan and P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall.
2. C. Siva Ram Murthy and B.S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Pearson.

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Introduction
Introduction to OSI Network Security Architectures, Services, Mechanisms and Attacks, Classical Encryption Techniques, Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

Introduction To Finite Fields: Groups, Rings, and Fields, Modular Arithmetic, Euclid's Algorithm, Finite Fields of the Form *GF(p),* Polynomial Arithmetic, Finite Fields of the Form *GF(2n).*

Cryptographic Techniques - An overview of Cryptology, Primality test, *Perfect* security, Stream Cipher *Stream ciphers:* The one time pad. Pseudo-random key streams - properties and generation. Block Cipher -, Introduction to DES, differential and Linear Cryptanalysis, Block Cipher Cryptography, Triple DES Algorithm, International Data Encryption Algorithm (IDEA), Blowfish Algorithm, RC-x Algorithms, CAST-x Algorithms, Symmetric Block Cipher Schemes, Encryption Function Placement and Confidentiality problems. Cryptographic hash functions, Digital signatures.

Public-Key Cryptography and Message Authentication
The Key Distribution Problem, Random Number Generation, The Public-Key Cryptosystems, The RSA Algorithm, The Key Management riddle, The Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. The Chinese Remainder Theorem, Discrete Logarithms., Introduction to Message Authentication, requirements and functions, Message Authentication Codes, Hash Functions, their Security and other considerations.

Authentication Applications
The Message Digest (MD5) Algorithm, The Secure Hash Algorithm (SHA-1), RIPEMD-x and HMAC fundamentals, Digital Signature basics, Authentication Protocols, The Digital Signature Standard, Introduction to the Kerberos Authentication scheme, The X.319 Directory Authentication scheme.

Systems and Applications Security
Authentication, Access control policies, Mail security, PGP, *Data* (base) security, File system security, Program security, Memory security, Session security, SSH, Web security, Web applications security, Sandboxing, Linux security , Windows.

Security Protocols
Security properties, attacks, Design of a security protocol, Examples of security protocols, Contract signing protocols, *Formal* models of protocols and detecting leaks, Electronic voting protocols, IPSec,, SSL, TLS worms and viruses, micro payments, smart card security, Security of wired / wireless networks.

Intrusion detection
Key Management in Group Communication Systems, Router security, Denial of service and side-channel attacks, *Intrusion* Detection Systems, Intrusion detection techniques - centralized and distributed.

Text Books

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, New Delhi
2. D Stinson, "*Cryptography: Theory and Practice*", Second Edition Chapman & Hall

Reference Books
1. C. Kaufman, R. Perlman and M. Spenser, Network Security, PHI .
2. S. Bellovin and W. Chesvick, Internet Security and Firewalls, Second Edition, Addison-Wesley, Reading
3. Trappe & Washington, "*Introduction to Cryptography with Coding Theory*", Prentice-Hall

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CS-471(a) ADVANCED COMPUTER ARCHITECTURE

Introduction
Elements of modern computers, Systems attributes to performance, Quantitative principles of computer design, Amdahl's Law, Cost considerations, MIPS, MFLOPS, Benchmarking.

Instruction Set Design
Classification of Instruction set architectures, Operand storage memory addressing, Operation in the instruction set, Type and size of operands, Role of high level languages and Compilers, MIPS architecture and its Instruction format.

Processor Implementation Techniques
Processor data path, Basic steps of execution, Hardwired Control, Microprogrammed Control, Interrupts and other entanglements, Control for MIPS.

Pipelining
What is Pipelining, Basic Pipeline for MIPS, Pipeline Hazards, Extended MIPS pipeline to handle Multi-cycle operations, General pipelines and reservation stations, Dynamic scheduling around hazards with a scoreboard, Latency analysis and Collision Free Scheduling, Tomasulo's Algorithm, Loop unrolling, Software Pipelining, Prediction of control flow, Register renaming, Trace Scheduling. Superscalar pipelining design, Superpiplined Design.

Instruction Level Parallel Processors
Division of responsibilities between hardware and software, Superscalars, Data flow architectures, Multi-threaded architectures, Independent architectures, VLIWs, Vector processors, Vector Length, Chaining, Predicated Execution.

Multiprocessor
Flynn's classification, Shared memory processor, Message passing architectures, Packet routing, Worm Hole Routing, MIMD and SIMD machines, Interconnection Networks, Arrays, Meshes, Torii, Hypercubes, Dynamic Interconnection Networks, Cache coherence and memory consistency, Scalability.

Memory System Architecture
Principles of Locality, Principles of Memory hierarchy, Caches, Write-through and Write-back, Cache organization, I-cache, D-cache, Organization for improving main memory, Wide memory, Interleaved memory, DRAM, Virtual memory, Translation look aside buffer, Instruction prefetch, Register Windows, Sectored cache, Multiple-level cache.

Text Books
1. Kai Hwang, "Advanced Computer architecture", McGraw Hill Publishing Co.
2. David Peterson, John L. Hennessy," A quantitative approach", Morgan Kamfnann Publisher, Inc.
3. William Stalling, "Computer Architecture".

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CS-471(b) PARALLEL ALGORITHMS

Review of sequential algorithms
Introduction to parallel algorithms and architectures: EREW, CREW, CRCW PRAMs and interconnection network models such as the mesh. Knowledge of how to efficiently sum, broadcast and search on these architectures.

Efficiency measurement
Parallel efficiency measures for parallel algorithms, e.g., time, speedup, cost (work), processor efficiency.

Parallel Sorting and Sorting Networks
Parallel Insertion Sort, Even-odd Merge Sort, Bitonic Merge Sort etc. Parallelization of Algorithm, Parallel linear algebra routines, Loop optimizations, Implementation. Principal of Locality, Caches and Buffers.

Parallel Algorithm
Massively Data Parallel Algorithms, Array notation, Fortran90 and HPC Fortran, Parallel and Vector C Code, Layout, Align, Replicate, Masking, Shifting, Spreading, Broadcasting, Forall Loops. Purely Parallel Algorithms.

Block Decomposition Methods.

Parallel Programming Packages.

Text Books
1. *Design and Analysis of Sequential and Parallel Algorithms,* Berman and Paul.
2. K. Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill, 1993.
3. D. A. Patterson and J. L. Hennessy, Computer Architecture: A Quantitative Approach, Morgan Kaufmann Publ., 1990.
4. Levesque and Williamson, A Guidebook to FORTRAN on Supercomputers, Academic Press, 1988.

Reference Books
1. Metcalf, FORTRAN Optimization, Academic Press,
2. J. M. Ortega, Introduction to Parallel and Vector Solution of Linear Systems, Plenum,
3. Quinn, Designing Efficient Algorithms for Parallel Computers, McGraw-Hill,
4. P. J. Hatcher and M. J. Quinn, Data-Parallel Programming on MIMD Computers, MIT Press,

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CS-471(c) REAL TIME SYSTEMS

Introduction
Definition, Typical Real Time Applications: Digital Control, High Level
Controls, Signal Processing etc., Release Times, Deadlines, and Timing
Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference
Models for Real Time Systems: Processors and Resources, Temporal Parameters
of Real Time Workload, Periodic Task Model, Precedence Constraints and Data
Dependency.

Real Time Scheduling
Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted
Round Robin Approach, Priority Driven Approach, Dynamic Versus Static
Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-
First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling
Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Resources Access Control
Effect of Resource Contention and Resource Access Control (RAC),
Nonpreemptive Critical Sections, Basic Priority-Inheritance and Priority-
Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-
Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol,
Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to
Data Objects.

Multiprocessor System Environment
Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling
Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks,
Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in
Heterogeneous Systems, Predictability and Validation of Dynamic
Multiprocessor Systems, Scheduling of Tasks with Temporal Distance
Constraints.

Real Time Communication
Model of Real Time Communication, Priority-Based Service and Weighted Round-
Robin Service Disciplines for Switched Networks, Medium Access Control
Protocols for Broadcast Networks, Internet and Resource Reservation
Protocols, Real Time Protocols, Communication in Multicomputer System, An
Overview of Real Time Operating Systems.

Text Books
1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.
2. Real-Time Systems: Scheduling, Analysis, and Verification by Prof. Albert
   M. K. Cheng, John Wiley and Sons Publications.

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CS-472(a) SOFT COMPUTING

Neural Networks
History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Fuzzy Logic:
Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Uncertainty based Information:
Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic: Medicine, Economics etc.

Genetic Algorithm: An Overview, GA in problem solving, Implementation of GA.

Swarm Intelligence: Ant Colony system, PSO system.

Text Books
1. Anderson J.A., "An Introduction to Neural Networks", PHI,
2. Hertz J. Krogh, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley,
3. G.J. Klir & B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI,
4. Melanie Mitchell , "An Introduction to Genetic Algorithm", PHI,

Reference Book
1.   Freeman J.A. & D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley

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CS-472(b)   ARTIFICIAL INTELLIGENCE

Introduction
Introduction to AI, AI techniques, level of model ,criteria for success, Turing test

Problems, Problem Spaces &Search
Defining problem as a space, search, production system, problem characteristics, production system characteristics, issues in the design of search programs.

Heuristics Search Strategies
Generate and test, Hill climbing, best first search(A^*), problem reduction(AO^*), constraint satisfaction,Means Ends analysis.

Knowledge Representation Issues
Representations and mappings, Approaches to knowledge representation, The frame problem, Semantic network, Frame representation.

Using Predicate Logic
Representing simple facts in logic, representing instance and is-a relationship, Computable functions and predicates, Resolution, Natural deduction.

Representing Knowledge Using Rules
Procedural Vs Declarative knowledge, Logic programming, Forward and Backward searching, Matching knowledge representation.

Game Playing and Search
Introduction, Min-Max algorithm, Alpha-Beta cut off, Example of Games.

Intelligent Systems
Learning Model, Types of Learning, Components of an Expert System, categories of Expert System, stages of Development of Expert System, Expert System Development Tools., Overview of fuzzy systems, ANN, Swarm Intelligent systems

Text Books
1. N.J. NILSSON, Principles of artificial Intelligence, Narosa Publishing House.
2. E. RICH AND KNIGHT, Artificial Intelligence, McGraw Hill International.

Reference Books
1. PETERSON, Artificial Intelligence, PHI Ltd.
2. R.FORSYTH, Expert systems, Principles and Case Studies, Chapman and Hill.
3. R. KELLER, Expert system Technology Development and Application, Yourdon Press.

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CS-472(c)   VIRTUAL REALITY

Introduction : The three I's of virtual reality, commercial VR technology and the five classic components of a VR system.

Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.

Output Devices: Graphics displays, sound displays & haptic feedback.

Modeling : Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management.

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues.

Applications: Medical applications, military applications, robotics applications.

VR Programming-I : Introducing Java 3D, loading and manipulating external models, using a lathe to make shapes.

VR Programming-II : 3D Sprites, animated 3D sprites, particle systems.

TEXT BOOKS
1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc.,
2. Killer Game Programming in Java, Andrew Davison, Oreilly-SPD, 2005.

REFERENCE BOOKS
1. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier(Morgan Kaufmann).
2. 3D Modeling and surfacing, Bill Fleming, Elsevier(Morgan Kauffman).
3. 3D Game Engine Design, David H.Eberly, Elsevier.
4. Virtual Reality Systems, John Vince, Pearson Education.

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CS-473(a) AGENT BASED SYSTEMS

Introduction
Definitions of agency; properties of agents; agents and objects; comparison between agents and other softwares, agents and expert systems; agents and distributed systems; typical application areas for agent systems.

Agent Architectures
Reactive/deliberative/hybrid agents; BDI and practical reasoning agents; deductive reasoning agents, Rational Reasoning: decision-theoretic/game-theoretic foundations; bounded rationality; means-ends reasoning. the design of intelligent agents - reasoning agents (eg AgentO), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (eg Interrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM! system).

Multi-Agent Systems
Designing multi agent society, Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; cooperation,- the Prisoner's dilema and Axelrod's experiments;

Interactions between self-interested agents
Auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.

Agent coordination
Distributed problem solving, planning and task sharing; teamwork and coalition formation; negotiation (game-theoretic/heuristic/argumentation-based); matchmaking and brokering. distributed search/distributed constraint satisfaction; multiagent learning; agent-oriented software engineering; trust/norms/institutions, organisational approaches.

Text Books
1. Michael J. Wooldridge. An Introduction to Multiagent Systems, John Wiley and Sons.
2. G. Weiss (ed.). Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence, MIT Press.

Reference Books
1. Singh, M. and Huhns, M., "Readings in Agents", Morgan Kaufmann.
2. Ferber, J., "Multi-Agent Systems", Addison Wesley.

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CS-473(b)   DISTRIBUTED SYSTEMS

Introduction to Distributed System
Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems.

Communication
Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream-oriented communication.

Processes
Threads, Clients, Servers, Code Migration, Software agent.

Naming
Naming entities, Locating mobile entities, Removing un-referenced entities.

Synchronization
Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.

Consistency and Replication
Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols.

Fault Tolerance
Introduction, Process resilience, Reliable client server communication, Reliable group communication. Distributed commit, Recovery.

Security
Introduction, Secure channels, Access control, Security management.

Distributed File System
Sun network file system, CODA files system.

Case Study
CORBA, Distributed COM, Globe, Comparison of CORBA, DCOM, and Globe.

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

Reference Book
1. M. Singhal & N. Shivaratri, Advanced Concepts in Operating Systems, TMH.

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CS-473(c)   CLIENT SERVER COMPUTING

Introduction to client server computing : Evolution of corporate computing models from centralized to distributed computing, client server models. Benefits of client server computing, pitfalls of client server programming.

Review of Java concepts : Java fundamentals, Exceptions, Threads, Strings, Java applets, AWT, Swings, stream I/O, Socket interface, RMI, RMI API, JDBC.

CORBA with Java : Client/Server CORBA-style, The object web: CORBA with Java, CORBA / Java

Core CORBA / Java : Two types of Client/ Server invocations-static, dynamic. The static CORBA, first CORBA program, ORBlets with Applets, Dynamic CORBA-The portable count, the dynamic count multi count.

Other Technologies : Creating client / server application using-java sockets, HTTP/CGI, Servlets, RMI, Caffeine

Existential CORBA : CORBA initialization protocol, CORBa activation services, CORBAIDL mapping CORBA java- to- IDL mapping, The introspective CORBA/Java object.

Java Bean Component Model : Events, properties, persistency, Intrespection of beans, CORBA Beans.

EJBs and CORBA : Object transaction monitors CORBA OTM's, EJB and CORBA OTM's, EJB container frame work, Session and Entity Beans, The EJB client/server development Process The EJB container protocol, support for transaction EJB packaging EJB design Guidelines.

TEXT BOOKS
1. Client/Server programming with Java and CORBA Robert Orfali and Dan Harkey, John Wiley & Sons,SPD 2nd Edition
2. Java programming with CORBA 3rd Edition, G.Brose, A Vogel and K.Duddy, Wiley-dreamtech, India John wiley and sons

REFERENCE BOOKS
1. Distributed Computing, Principles and applications, M.L.Liu, Pearson Education.
2. Client/Server Survival Guide 3rd edition Robert Orfali Dan Harkey & Jeri Edwards, John Wiley & Sons
3. Client/Server Computing D T Dewire, TMH.
4. IBM Webspere Starter Kit Ron Ben Natan Ori Sasson, TMH, New Delhi.

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CS-474(a)   EMBEDDED SYSTEMS

Introduction to Embedded Systems

Architecture of Embedded Systems - Hardware Architecture, Software Architecture, Communication Software, Development/Testing Tools

Programming for Embedded Systems

The Process of Embedded System Development - Design Trade offs, Hardware Software co-design, Implementation, Integration and Testing Hardware Platforms, Communication Interfaces

Embedded/Real-time Operating Systems Concepts - Representative Embedded Systems, Programming in RT-Linux Embedded Database Application Mobile Java Applications Embedded Software Development on 8051 Micro-controller Platform

DSP-based Embedded Systems - Implementation of Embedded Systems with VHDL, FPGA and CPLD Embedded Systems Applications using Strong ARM Platform

Text Books
1. Embedded/Real-time Systems: Concepts, Design and Programming – Dr. K.V.K.K.Prasad, Dreamtech press.
2. Proramming for Embedded Systems – Dreamtech Software team, Willey – dreamtech

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CS-474(b)   CLUSTER AND GRID COMPUTING

Introduction : High Performance Computing (HPC), Grand Challenge Problems-Computational and communication intensive, Parallel Architectures-Classifications-SMP, MPP, NUMA, Clusters and Components of a Parallel Machine, Conventional Supercomputers and it's limitations, Multi-processor and Multi-Computer based Distributed Systems.

Cluster and Grids: Cluster Components-Processor/machine, High Speed Interconnections-goals, topology, latency, bandwidth, Example Interconnect: Myrinet, Inifiniband, QsNet, Fast Ethernet, Gigabit Ethernet, Light weight Messaging system/Light weight communication Protocols, Cluster Middleware-Job/Resource Management System, Load balancing, Scheduling of parallel processes, Enforcing policies, GUI, Introduction to programming tools such as PVM, MPI, Cluster Operating Systems Examples: Linux, MOSIX, CONDOR, Characteristics of Grid, Computational services, Computational Grids, Data grids/Storage grids, management and applications, Different components of Grid-Grid fabric, Grid middleware, Grid applications and portal, Globus toolkit Ver.2.4, web services, MDS,GRAM, Grid Security –Cryptography, Authentication, Integrity, Digital Signature, Digital Certificates, Certificate Authority, MD-5, RSA, GSI,GSSAPI, Directory Service, LDAP,GRID FTP,GASS

Fault Tolerance: Fault detection and diagnosis of Clusters and Grids.

Text Books
1. D. Janakiram, *Grid Computing*, Tata McGraw Hill, 2005
2. R. K. Buyya, *High Performance Cluster Computing: Programming and Applications, Vol 2*, Prentice Hall, NJ, USA, 1999.

Reference Books
1. Pankaj Jalote, Fault Tolerance in Distributed Systems, Prentice Hall, 1994.
2. J. J. Jos & R. K. Buyya, High Performance Cluster Computing: Architectures and Systems, Vol I, Prentice Hall, NJ, USA, 1999.
3. R. K. Buyya & C. Szyperski, *Cluster Computing*, Nova Science, New York, USA, 2001.
4. R. K. Buyya & K. Bubendorfer, *Market Oriented Grid and Utility Computing*, Wiley, 2008.
5. J. Jaseph & C. Fellenstein, *Grid Computing*, Pearson, 1st Ed, 2004.

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CS-474(c)   STORAGE TECHNOLOGIES

Introduction to Storage Technology
Introduction to storage network, Five pillars of IT, parameters related with storage, data proliferation, problem caused by data proliferation, Hierarchical storage management, Information life cycle management (ILM), Role of ILM, Information value vs. time mapping, Evolution of storage, Storage infrastructure component, basic storage management skills and activities, Introduction to Datacenters, Technical & Physical components for building datacenters

Technologies for Storage network
Server centric IT architecture & its limitations, Storage centric IT architecture & advantages, replacing a server with storage networks, Disk subsystems, Architecture of disk subsystem, Hard disks and Internal I/O channel, JBOD, RAID& RAID levels, RAID parity, comparison of RAID levels, Hot sparing, Hot swapping, Caching : acceleration of hard disk access, Intelligent Disk subsystem architecture,

Tape drives
Introduction to tape drives, Tape media, caring for Tape& Tape heads, Tape drive performance, Linear tape technology, Helical scan tape technology

I/O techniques
I/O path from CPU to storage systems, SCSI technology – basics & protocol, SCSI and storage networks, Limitations of SCSI,

Fibre channel
Fibre channel, characteristic of fibre channel, serial data transfer vs. parallel data transfer, Fibre channel protocol stack, Links, ports & topologies, Data transport in fibre channel, Addressing in fibre channel, Designing of FC-SAN, components, Interoperability of FCSAN, FC products,

IP Storage
IP storage standards (iSCSI, iFCP, FCIP, iSNS), IPSAN products, Security in IP SAN, introduction to infiniband, Architecture of Infiniband

NAS – Evolution, elements & connectivity, NAS architecture,

Storage Virtualization
Introduction to storage virtualization, products, definition, core concepts, virtualization on various levels of storage network, advantages and disadvantages, Symmetric and asymmetric virtualization, performance of San virtualization, Scaling storage with virtualization

Management of storage Networks
Management of storage network, SNMP protocol, requirements of management systems, Management interfaces, Standardized and proprietary mechanism, In-band& Out-band management,

Text Books
1. "Storage Networks: The Complete Reference", R. Spalding, McGraw-Hill
2. "Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and Filing Systems", Marc Farley, Cisco Press.
3. "Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, Second Edition", Tom Clark Addison Wesley

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CS-475(a)   ADVANCE COMPUTER NETWORKS

Introduction: Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, etc. MAC protocols for high-speed LANS, MANs, and wireless LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless ethernet, etc.)Fast access technologies. (For example, ADSL, Cable Modem, etc.)

IPv6: Why IPv6, basic protcol, extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, routing. Changes to other protocols. Application Programming Interface for IPv6. 6bone.

Mobility in networks. Mobile IP. Security related issues. IP Multicasting. Multicast routing protocols, adderss assignments, session discovery, etc. TCP extensions for high-speed networks, transaction-oriented applications. Other new options in TCP.

Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, Keydistribution protocols. Digital signatures, digital certificates.

Books and References
1. W. R. Stevens. TCP/IP Illustrated, Volume 1: The protocols, Addison Wesley, 1994.
2. G. R. Wright. TCP/IP Illustrated, Volume 2: The Implementation, Addison Wesley,1995.
3. W. R. Stevens. TCP/IP Illustrated, Volume 3: TCP for Transactions, HTTP, NNTP, andthe Unix Domain Protocols, Addison Wesley, 1996.
4. R. Handel, M. N. Huber, and S. Schroeder. ATM Networks: Concepts, Protocols,Applications, Addison Wesley, 1998.
5. W. Stallings. Cryptography and Network Security: Principles and Practice, 2nd Edition,Prentice Hall, 1998.
6. C. E. Perkins, B. Woolf, and S. R. Alpert. Mobile IP: Design Principles and Practices,Addison Wesley, 1997.

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CS-475(b) MULTIMEDIA COMPUTING

Introduction
Defining the scope of multimedia, Hypertext and Collaborative research, Multimedia and personalised computing, Multimedia on the map, Emerging applications, The challenges, The technology trends, Multimedia appliances, Hybrid Devices, Designers perspective, industry perspective of the future, Key challenges ahead, Technical, Regulatory, Social.Architectures and Issues for Distributed Multimedia Systems,Distributed Multimedia systems, Synchronization, and QoS Architecture, The role of Standards, A frame work for Multimedia systems.

Digital Audio Representation and Processing
Uses of Audio in Computer Applications, Psychoacoustics, Digital representation of sound, transmission of digital sound, Digital Audio signal processing, Digital music making, Speech recognition and generation, digital audio and the computers, Video Technology – Raster Scanning Principles, Sensors for TV Cameras, Colour Fundamentals, Colour Video, Video performance Measurements, Analog video Artifacts, video equipments, World wide television standards.

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

Operating System Support for Continuous Media Applications
Limitation of Work station Operating system, New OS support.

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

Multimedia Devices, Presentation Services, and the User Interface
Client control of continuous multimedia, Device control, Temporal coordination and composition, toolkits, hyper applications.

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

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

Multimedia Services over the Public Networks
Requirements, Architecture, and protocols, Net work services, applications.

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

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

Multimedia Groupware
Computer and Video fusion approach to open shared wok place, High Definition Television and desktop computing, HDTV standards, Knowledge based Multimedia systems, Anatomy of an Intelligent Multimedia system.

Books and Referances
1. John F. Koegel Buford, Multimedia Systems, Pearson Education.
2. Nalin K. Sharda, Multimedia Information Networking, Prentice Hall.

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CS-475(c) WIRELESS SENSOR NETWORKS

Sensor networks overview: introduction, applications, design issues, requirements.Sensor node architecture.

Network architecture: optimization goals, evaluation metrics, network design principles. Sensor network operating systems and brief introduction to sensor network programming.

Network protocols: MAC protocols and energy efficiency.

Routing protocols:data centric, hierarchical, location-based, energy efficient routing etc. Sensor deployment, scheduling and coverage issues, self configuration and topology control.Querying, data collection and processing, collaborative information processing and group connectivity.Target tracking, localization and identity management. Power management. Security and privacy.

Books and Referances:
1. Feng Zhao, Leonidas Guibas "Wireless Sensor Networks-An Information Processing Approach". Morgan Kauffman.
2. Research Publications
3. Technical documents

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CS-484(a)   CAD OF DIGITAL SYSTEM

Introduction
Hierarchical and Structural Design , Analog stages in CAD of Digital Systems, Y-Chart-Levels and Domains of description, Design flow and Synthesis of Taxonomy, Single Component Tools, Layout Editor, Symbolic Layout Editor, Semi-custom design approach, Schematic Editor approach, Module generator to generate specific layout.

Design Using VHDL
Existing hardware description languages, Design in VHDL, Design description, Description of component using sequence detector, Basic concepts in VHDL, Signals and variables, Timing and Control, Concurrent and sequential assignment, Library support, Block structure, structural description, Subprogram, type declaration and usage.

High Level Synthesis
Introduction to design space and constraints, High level synthesis tasks, Internal representation, Synthesis of the register transfer level structure, Scheduling: Resource constrained scheduling, Force directed scheduling, Path based scheduling, Scheduling for pipelining design, Allocation and binding, General algorithm: Clique-partitioning, Left-edge Algorithm, Bipartite Graph, Weighted   bipartite Graph, Binding after allocation, Bus allocation and binding, Allocation after Scheduling, Comparison of various schemes.

Register Level Synthesis
Data path synthesis, Optimization strategies, Retiming and Resynthesis, Resource allocation and assignment, Control Synthesis, State assignment for controllers, State assignments for single PLA Controllers.

Logic Level Synthesis
Preliminaries and definitions, Two-level minimization Algorithm, ESPRESSO, Multi level logic minimization method, Sequential circuits and state assignments, Multi-level logic and state assignment, Mustang Algorithm.

Technology Mapping
Abstraction of technology, Tree, DAG, Look up tables.

Field Programmable Gate Arrays (FPGA)
FPGA, CAD system for FPGA, classification of FPGA, Programming technologies, Static RAM, Anti-fuse, EPROM, Advantages and disadvantages of FPGA, Applications of FPGA.

Text Books
1. P. Michel, U. Lauther, P. Duzy , The Synthesis Approach to digital System design, Kluwer Academic
2. Z. Navabi, VHDL –Analysis & Modelling of Digital systems, McGraw Hill.

Reference Books
1. D. Gajski, N. Dutt, A. Wu, S. Lin, High Level Syntheis, Kluwer Academic Publisher.
2. J.Bhaskar, " A VHDL Primer", Addison Wesley
3. Doglas Perry, "VHDL", MGH

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CS-484(b)   ADVANCE DATA BASE SYSTEMS

Overview of database management
Traditional database models, relational model, relational languages, SQL and Embedded SQL.

Conceptual database design
Conceptual database design process, ER model, generalization, specialization and aggregation, conventions, ternary and higher order relationships and concept of cardinalities in such relationships.

Logical database design
Relational Database design and update anomalies, structures, guidelines for relational schema, normalization, dependencies, transformation of entity relationship model into relational schema.

Physical database design
Database performance, tables using operating system files, multi-table files and table fragmentation clustered table organization, page organization, indexing, B-Tree, B+ Tree, B-tree organizations, ISAM organization, clustered and non clustered indexes, hashing, static and dynamic hashing, buffer management, physical design features .

Query processing
Query processing stages, query Interpretation, query resource utilization, query execution, estimation of query processing cost, table scants, simple index access, fill factor, multiple index access, methods for join tables, (nested loop, merge join, hybrid join, multiple table join); structure of query optimizer, examples from one or two actual contemporary database management software.

Transaction Processing
Types of Failures of applications, transaction, properties, schedules and recoverability, serializability of schedules, levels of transaction, consistency, deadlocks, transaction performance, bench marking, transaction in contemporary database management systems.

Crash Recovery
Failure classification, recovery concepts based on deferred update, recovery concepts based on intermediate update, shadow paging, check points, on-line backup during database updates, case study from contemporary database management software.

Concurrency Control
Techniques based on time stamp ordering, multi-version techniques, optimistic techniques, multiple granularity, case studies Distributed Databases, distributed database concepts, architecture and design of distributed database, query processing, recovery, federated databases, asynchronous replication concepts, distributed database features in contemporary database management systems.

Client/Server Databases

Client/Server concepts, approach, Client/Server environments, characterization of Client/Server computing, application partitioning, the two-layer, and the Three layer architecture, Client/Server communication, APIs in Client/Server computing, middleware technology, application developments, design concepts, Client application development tools, and database servers.

Integrity, Security and Repositories
Needs for database integrity, integrity constraints, non-procedural integrity constraints, integrity constraints specifications in SQL, introduction to database security mechanism, security specification in SQL, system catalogues.

Emerging Database Trends
Object-Oriented databases, active databases, deductive databases, concept of next generation databases, data warehouses and executive information system, data mining, parallel query processing: multi-media databases.

Text Books
1. H Korth, A Silberschatz, "*Database System Concepts*", McGraw-Hill
2. R Elmasri, S Navathe, "*Fundamentals of database Systems*", Benjamin Cummings
3. Bipin Desai, "*An introduction to database Systems*", Galgotra Publications, West Publishing

Reference Books
1. Peter Rob, Carlos Coronel, "*Database Design and Implementation and Management*", Wadsworth Publishing Company
2. C J Date, "*An introduction to Database Systems, Volume I*", Addison-Wesley.

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CS-484(c) MOBILE AD HOC NETWORKS

Introductory concepts. Different models of operation. Various applications of MANET.

Destination-Sequenced Distance Vector protocol - overview, route advertisement, extending base station coverage. Properties of DSDV protocol.

Dynamic Source Routing protocol - overview and properties, DSR route discovery, route maintenance. Support for heterogeneous networks and mobile IP. Multicast routing with DSR.

Ad Hoc On-Demand Distance-Vector protocol - properties, unicast route establishment, multicast route establishment. Broadcast. Optimizations and Enhancements.

Link Reversal Routing - Gafni-Bertsekas algorithm, lightweight mobile routing algorithm. Temporally ordered routing algorithm.

Preserving battery life of mobile nodes - Associativity based routing, effects of beaconingon battery life.

Recent trends in MANET.

Books and Referances
1. Toh C.K., "Ad-Hoc Mobile Wireless Networks – Protocols and Systems.
2. Reserch Publications.
3. Technical Documents.

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CS-485(a)   ADVANCED OPERATING SYSTEM

Overview of Advanced Operating Systems
Introduction, Functions of OS, Design approaches, Types of advance OS.
Architecture of Distributed OS
Introduction, Motivations, System Architecture Types, Distributed OS, Issues in distributed OS, Communication Networks and Primitives.
Theoretical Foundations for Distributed OS
Introduction, Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Casual Ordering of Message, Global State, Cuts of a Distributed Computation, Termination Detection.
Distributed Mutual Exclusion
Introduction, Classification of Mutual Exclusion Algorithms, Preliminaries, Simple solution to distributed Mutual Exclusion, Non-Token-Based Algorithm, Maekawa's Algorithm, Generalized Non-Token Based Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Singhal's Heuristic Algorithm, Comparative Performance Analysis.
Distribution Deadlock Detection
Introduction, Preliminaries, Deadlock Handling Strategies in Distributed Database, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized Deadlock-Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms, Perspective.
Agreement Protocols
Introduction, System Model, Classification of Agreement Problems, Solutions to the Byzantine Agreement Problem, Applications of Agreement Algorithms.
Distributed File Systems
Introduction, Architecture, Mechanism for building Distributed File Systems, Design Issues, Case Studies, Log-Structured File Systems.
Distributed Shared Memory
Introduction, Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues, Case Studies.
Distributed Scheduling
Introduction, Motivation, Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributed Algorithms, Performance Comparison, Selecting a suitable Load Sharing Algorithm, Requirements for Load Distributing, Load Sharing Policies: Case Studies, task Migration.
Fault Tolerances and Recovery
Fault Tolerance - Introduction, Issues, Atomic Action and Committing, No blocking Commit Protocols, Voting Protocols, Dynamic Protocols, Majority based Dynamic Voting Protocol, Dynamic Vote Reassignment Protocols, Failure Resilient Process, Reliable Communication, Case Studies. Recovery- Introduction, Basic Concepts, Classification of Failures, Types of Recovery, Check pointing.

Text Book
1. M. Signal & N. Shivaratri, Advanced Concepts in Operating Systems: Distributed, Database and Multiprocessor Operating Systems, McGraw Hill International Edition.

Reference Book
2. R.K. Sinha, "Distributed Operating Systems", Prentice Hall

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CS-485(b)   MANAGEMENT INFORMATION SYSTEM

Introduction
Overview of MIS, structure of MIS.

Survey of information system technology
HW and SW, communication technology, storage and data retrieval, transaction processing, office automation and information processing control functions.

Conceptual foundations
Decision making process, concepts of information, Human information processors, system concepts, concepts of planning and control, organizational structure and management concepts.

Information based support systems
Support systems for Planning, Control, decision making and management of knowledge work.

Information system requirements
Developing long range information plan, strategies for determination of information requirements, database requirements, user interface requirements.

Development, implementation and management of information system resources
Developing and implementing application systems, quality assurance and evaluation of information systems, organization and management of information resources function, future developments and their organizational and social implications.

Text Book
1. Management information systems by G.B.Davis and M.H. Olson.

Reference Books
1. Information systems for modern management by R.J.Murdick, Ross and Clagget "PHI".
2. Management information systems by K.C.Laudon and J.P.Laudon.
3. Management information systems by David Kroenke.

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CS-485(c)   MOBILE DATABASES

Mobile Database: Introduction, Fully Connected Information Space, Types of Mobility.

Fundamentals of Database Technology: Conventional Database Architecture, Database Processing, Serialization of Transaction, Advanced Transaction Model.

Concurrency Control Mechanism: Introduction, ways of locking data items. The Phantom Problem, Multigranularity locking, Heuristics approach in locking scheme, Non locking based schemes.

Data Processing and Mobility: Introduction, Effect of mobility on the management of data, Data Categorization, Location dependent data distribution.

Transaction management in Mobile Database systems: Mobile Database systems, Transaction execution in MDS, Mobile Transaction Model, Execution model on ACID transaction framework, pre-write transaction execution model, data consistency in intermittent connectivity.

Mobile database Recovery: Introduction, Log Management in Mobile Database systems, Mobile database recovery scheme.

Books and Referances
1. Kumar Vijay, " Mobile Database Systems". John Willy & Sons.
2. Research Publication
3. Technical Documants.

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CS-485(d)   E-COMMERCE

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

Consumer Oriented Electronic commerce - Mercantile Process models.

Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks.

Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processings, Desktop video conferencing.

Text Books
1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

Reference Books
1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
4. Electronic Commerce – Gary P.Schneider – Thomson.
5. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver.

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CS-350(a)   DIGITAL IMAGE PROCESSING

Introduction
Digital image representation, Fundamental steps in image processing, Elements of Digital Image processing systems, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels, Imaging geometry.

Image Enhancement
Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.

Image Compression
Coding redundancy, Inter-pixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.

Image Segmentation
Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, Frequency domain techniques.

Spatial Operations and Transformations
Spatially dependent transform template and convolution, Window operations, 2-Dimensional geometric transformations.

Pattern Recognition
Classification and description, Structure of a pattern recognition system, feature extraction, Classifiers, Decision regions and boundaries, discriminent functions, Supervised and Unsupervised learning, PR-Approaches statistics, syntactic and neural.

Statistical Pattern Recognition
Statistical PR, Classifier Gaussian Model, Classifier performance, Risk and error, Maximum likelihood estimation, Bayessian parameter estimation approach, Clustering for unsupervised learning and classifiers.

Text Books
1. R. GONZALEZ and R. E. WOOD, Digital Image Processing, Prentice Hall of India.
2. ANDRIAN LOW, Introductory Computer Vision and Image Procession, McGraw Hill CO.
3. ROBERT SCHOLKOFF and JOHN WILLEY & SONS, Pattern Recognition-Statistical, Structural and neural approach.

Reference Books
1. W.K. PRATT, Digital Image Processing, McGraw Hill.
2. A. K. JAIN, Fundamentals of Image Processing.

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CS-350(b)   UNIX PROGRAMMING

UNIX Standards
Brief History of UNIX, AT&T and Berkeley UNIX Systems, POSIX, Library vs.
System-Level Functions.
Files and Directories
Basic File Types, File Descriptors, The open() and creat() Functions, Keeping
Track of Open Files, File Table Entries, The v-node structure, The fcntl()
function, File Attributes, The access() function, Link(), unlink(), remove(),
and rename() functions, Functions to Manipulate Directories.
Shell Programming
Bourne Shell, korn shell and C shell. Shell metacharacters, shell variable
and scripts, facilities and command, environment, integer arithmetic and
string manipulation, decision making, aliasing, arrays and job control.
System I/O
Standard I/O vs system I/O, System I/O Calls, File and Record Locking.
Processes
Process Creation and Termination, Process Memory Layout, Dynamic Memory
Allocation, Accessing Environment Variables, Real and Effective User IDs.
Process Management
Programs and Processes, The fork() System Function, Parent and Child, The
Exec System Functions, Current Image and New Image, The wait() and waitpid()
function, Interpreter files and exec.
Pipes - Basic IPC
Interprocess Communication, Pipes, FIFOs.
Signals
What is a Signal?, Types of Signals, Signal Actions, Blocking Signals from
Delivery, The sigaction() function, Signal Sets and Operations, Sending a
Signal to Another Process, Blocking Signals with sigprocmask(), Scheduling
and Waiting for Signals, Restarting System Calls (SVR4)
Signals and Reentrancy.
Introduction to Threads
Processes and Threads, Creating Threads, Multitasking, Overview of Thread
Architectures, Processes Versus Threads, The Threads API, Thread Termination,
Joining and Detaching Threads, Passing Arguments to Threads.
Threads Synchronization
The Sharing Problem, Mutexes, Creating and Initializing Mutexes, Using
Mutexes, Additional Synchronization Requirement, Using Condition Variables.
Overview of Client/Server Programming
Designing Distributed Application, Clients and Servers, Ports and Services,
Connectionless vs. Connection-Oriented Servers, Stateless vs. Stateful
Servers, Concurrency Issues.
The Berkeley Sockets API
Berkeley Sockets, Data Structures of the Sockets API, Socket System Calls,
Socket Utility Functions.

Text Books
1. W. Richard Stevens, Advanced Programming in the UNIX Environment, Addison-
   Wesley.
2. Eric Steven Raymond, The Art of UNIX Programming, Addison-Wesley.

Reference Book
1. W. Richard Stevens, UNIX Network Programming, Prentice Hall.

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CS-350(c)   COMPUTER GRAPHICS

Introduction to Computer Graphics
Overview of Graphics Systems, Display Devices, Hard copy Devices. Interactive Input Devices, Display Processors, The Graphical Kernel System, Output Primitives, Line drawing algorithms, Circle Generation algorithms, Character Generation.

Raster Scan Graphics
Line Drawing Algorithms, Circle Generation, General Function Rasterization, Scan Conversion- Generation of the display, Image Compression, Polygon Filling , Fundamentals of Antialiasing.

Two-Dimensional Geometric Transformation & Viewing
Basic Transformation, Translation, Rotation, Scaling, Other Transformation Reflection, Shear, Transformation functions, Window to viewport co-ordinate transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping.

Three- Dimensional Concepts & Object Representations
Three Dimensional Display Methods, Parallel Projection, Perspective Projection, Translation, Rotation, Scaling, Composite Transformation, Three dimensional Transformation function, Polygon Surfaces, Curved Lines and surfaces, Bezier Curves and surfaces, B-Spline Curves and surfaces.

Graphics hardware
Display technology, random scan, raster scan display processing, input devices for interaction.

Visible Lines and Visible Surfaces
Visual Realism, Hidden line and hidden surface removal : depth buffer algorithm, geometric computations, scan line coherence algorithms, area coherence algorithms, priority algorithm., shading and color models, Modeling methods.

Rendering
A simple illumination model, Transparency, Refraction effects in transparent materials, Simple Transparency Models, Z-Buffer Transparency, Shadows, Texture.

Text Books
1. D.F. ROGERS, Procedural Elements for Computer Graphics, McGraw Hill.
2. HEARN and BAKER, Computer graphics, PHI

Reference Books
1. S. HARRINGTON, Computer Graphics - A programming approach, McGraw Hill.
2. D.F. ROGERS, Mathematical Elements for Computer Graphics, McGraw Hill.

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CS-360(a)   MODELING AND SIMULATION

Fundamentals
Definition and reasons for simulation, Continuous (time-oriented) and discrete (event) systems, Modeling/programming simple deterministic systems, Rates and system dynamics.

Concepts in Simulation
Stochastic variables; discrete vs continuous probability; algorithms for generating random numbers, their comparison with respect to speed and validity; continuous uniformly distributed random numbers; methods for generating non-uniform distributions.

Building Simulation Programming Models
Arrival patterns, service times, and queue formation. Formulating systems as events and entities (such as resources, queues, gates, and linkages). Congestion in systems; arrival patterns; Poisson arrivals; the exponential distribution; the coefficient of variation; service times; normal distribution; queuing disciplines; Measures for Queues; Analytic Solutions of Queuing Problems; Utilization as a Design Factor; Other factors like grade of service.

Discrete Event System Simulation
Discrete events; representation of time; queues and servers; generation of arrival patterns; resource seizing; departures simulation of a telephone system and computer networks; simulating components of an operating system; delayed calls; modeling policies; priority queues; tasks; gathering statistics; counters and summary statistics; measuring utilization and occupancy; recording distributions and transit times.

Introduction to a Simulation Languages
Simulation in C++, GPSS, Simulations Packages, Trends in simulation Software. SIMSCRIPT programs; SIMSCRIPT system concepts; organization of a SIMSCRIPT program; blocks, names, and labels; SIMSCRIPT statements; entities, events, and activities; defining the system; defining the system model; referencing variables; the procedural structures; arrival event; timing routine; disconnect event; closing event; execution, debugging and validation; interpreting outputs and system optimization via modification.

TEXT BOOKS
1. Simulation Modeling and Analysis, Law and Kelton, McGraw-Hill.

REFERENCE BOOKS
1. Discrete-Event System Simulation, Prentice-Hall.
2. Getting Started in GPSS, Engineering Press, San Jose, CA.
3. Simulation Model Design and Execution, Prentice-Hall.

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CS-360(b)   DATA BASE MANAGEMENT SYSTEM

Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modeling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.

Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems, DB2. DB2 Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Table spaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

Relational data base design: function dependencies & normalization for relational databases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures. Object-oriented Databases, Distributed and Parallel Databases, Multi-databases, Access Methods, Transaction Management, Query Processing, Deductive Databases, multimedia Databases, Real-Time Databases, Active Databases, Temporal Databases, Mobile Databases, Database Benchmarks, Database Security, Data Mining and Data Warehousing.

Books and References
1. Desai, B., "An introduction to database concepts", Galgotia publications.
2. Readings in Database Systems edited by M. Stonebraker, Morgan Kaufmann, 2nd ed., 1994 Conference and Journal papers
3. Date, C. J. , "An introduction to database systems", 7rd Edition, Addison Wesley.
4. Date, C. J. , "An introduction to database systems", 3rd Edition, Narosa publishing house.
5. Elmsari and Navathe, "Fundamentals of database systems", Addison Wesley.
6. Ullman, J. D., "Principals of database systems", Galgotia publications.
7. DB2 Manuals