NATIONAL INSTITUTE OF TECHNOLOGY TRICHY

COMPUTER SCIENCE AND ENGINEERING CURRICULUM

SEMESTER III

CA201

MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE

Set Theory - Set operations, properties - power set - methods of proof - relations, graph and matrix of a relation - partial and total orders, well ordering - equivalence relations, classes and properties - functions, 1-1, onto and bijective - composition of relations and functions - inverse functions.

Induction and Combinatorics - Peano's axioms - Mathematical induction (simple and strong) - pigeon-hole principle - principle of inclusion and exclusion - review of permutations and combinations - distribution problems - derangements - bijection principle.

Algebraic Structures - Semi-groups, monoids, groups, subgroups and their properties - cyclic groups - cosets - permutation groups - Lagrange's theorem - Cayley's theorem - normal subgroups - homomorphism of groups - quotient groups - rings and fields.

Recurrence Relations and Generating Functions - Homogeneous and inhomogeneous recurrences and their solutions - solving recurrences using generating functions - Repertoire method - Perturbation method - Convolutions - simple manipulations and tricks.

Graph Theory - Definitions and basic results - Representation of a graph by a matrix and adjacency list - Trees - Cycles - Properties - Paths and connectedness - Subgraphs - Graph Isomorphism - Operations on graphs - Vertex and edge cuts - Vertex and edge connectivity.

REFERENCE:

ARTHUR GILL, "Applied Algebra for Computer Science", Prentice Hall

K.D.JOSHI, "Discrete Mathematics", Wiley Eastern Ltd.

R.BALAKRISHNAN, K.RANGANATHAN, "A Text Book of Graph Theory", Springer

THOMAS KOSHY, "Discrete Mathematics with Applications", Elsevier.

CS203

NUMERICAL COMPUTING

Non-Linear Systems - Various types of errors - Bisection method - Regula falsi method - Newton-Raphson method - Horner's Method - Graffe's method - Bairstow's method - Newton's method for solving $f(x,y) = 0$ and $g(x,y) = 0$.

Linear Systems - Gaussian elimination - Iterative methods - Sufficient conditions for convergence - LU decomposition method - Power method to find the dominant eigen value and eigen vector.

Interpolation and Curve Fitting - Newton's forward and backward interpolation - Method of least squares to fit equations of the form $y = ab^2$ and $y = ax^2 + bx + c$.

Numerical Differentiation and Integration - Simpson's one-third rule - Simpson's three-eighth rule - Double integration using trapezoidal and Simpson's ont-third rule.

Numerical Solution of Differential Equations - Euler's method - Taylor's method - Runge-Kutta method of fourth order - Numerical solution of Laplace equation - One-dimensional heat flow equation and wave equation by finite difference methods.

REFERENCE:

C.F.GERALD and P.O.WHEATLEY, "Applied Numerical Analysis", Mc Graw-Hill, 1981

CHENEG and KINCAID, "Introduction to Numerical Computing", Tata McGraw-Hill, 1998

CS206

COMPUTER ORGANIZATION AND ARCHITECTURE

Basic structure of computers - Operational concepts - Bus structures - Arithmetic operations - Memory operations - Addressing modes - Basic I/O operations - Performance.

Arithmetic - Addition & subtraction of signed numbers - Multiplication - Integer division - Floating point operations.

Processing unit - Control unit - Pipelining - Multiple bus organization - Hardwired control - Micro programmed control - Hazards - Data path - Embedded systems.

Memory system - Basic concepts - Semiconductor RAM memory - Cache memory - Performance considerations - Virtual memory - Secondary storage.

I/O Organization - Accessing I/O devices - Interrupts - DMA - Buses - Interface circuits - Serial communication links.

TEXT:

C.HAMACHER, Z.VRANESIC, S.ZAKY, "Computer Organization", V Edition, McGraw Hill, 2002

W.STALLINGS, "Computer Organization and Architecture", I Edition,Pearson education, 2002

CS207

DIGITAL COMPUTER FUNDAMENTALS

Binary codes - Weighted and non-weighted - Binary arithmetic conversion algorithms - Error detecting and error correcting codes - Canonical and standard boolean expressions - Truth tables.

K-map reduction - Don't care conditions - Adders / Subtractors - Carry look-ahead adder - Code conversion algorithms - Design of code converters - Equivalence functions.

Binary/Decimal Parallel Adder/Subtractor for signed numbers - Magnitude comparator - Decoders / Encoders - Multiplexers / Demultiplexers - Boolean function implementation using multiplexers.

Sequential logic - Basic latch - Flip-flops (SR, D, JK, T and Master-Slave) - Triggering of flip-flops - Counters - Design procedure - Ripple counters - BCD and Binary - Synchronous counters.

Registers - Shift registers - Registers with parallel load - Memory unit - Examples of RAM, ROM, PROM, EPROM - Reduction of state and flow tables - Race-free state assignment - Hazards.

TEXT:

MORRIS MANO, "Digital Design", Prentice Hall of India, 2001

W.H.GOTHMANN, "Digital Electronics - An Introduction to Theory and Practice", Prentice Hall of India, 2000

CS211

PROGRAMMING LANGUAGES LABORATORY

UNIX shell programming

Programming tools and windows

Network File Systems

Network Information Systems

Message Passing Interface

Functional programming techniques through LISP

Object-oriented programming techniques through C++/Java

Logic programming through techniques PROLOG

CS213

DATA STRUCTURES LABORATORY

Problems in C/C++/ Java using data structures involving arrays, stacks, queues, strings, linked lists, trees, graphs.

Operations on stacks, queues and linked lists

Conversion of infix expressions to postfix and evaluation of postfix expressions

Implementation of priority queue

CS201

PRINCIPLES OF PROGRAMMING LANGUAGES

Introduction to Language Paradigms - Criteria for good language design - Data types - Abstraction - Imperative languages - Pascal, C - design issues.

Object-Oriented Programming - Data encapsulation - Classes in C++ - Over loading - Derived classes - Information hiding - Inheritance and polymorphism - Generic functions.

Functional Programming - Introduction to LISP - Lists - Storage allocation for lists - Some useful functions - Error handling.

Logic Programming - Computing with relations - Introduction to Prolog - Data structures in Prolog - Programming techniques - Control in Prolog - Cuts.

Parallel Programming - Synchronizations - Concurrency - Deadlocks - Mutual exclusion - Concurrent programming - Communicating sequential processes: input-output commands.

TEXT:

R.SETHI, "Programming Languages: Concepts and Constructs", II Ed., Pearson Education, 1996

REFERENCE:

Robert W.Sebesta, "Concepts of Programming languages", IV Ed., Pearson Education 1999

CS205

DATA STRUCTURES

Development of Algorithms - Notations and analysis - Storage structures for arrays - Sparse matrices - Stacks and Queues: Representations and applications.

Linked Lists - Linked stacks and queues - Operations on polynomials - Doubly linked lists - Circularly linked lists - Dynamic storage management - Garbage collection and compaction.

Binary Trees - Binary search trees - Tree traversal - Expression manipulation - Symbol table construction - Height balanced trees - Red-black trees.

Graphs - Representation of graphs - BFS, DFS - Topological sort - Shortest path problems. String representation and manipulations - Pattern matching.

Sorting Techniques - Selection, Bubble, Insertion, Merge, Heap, Quick, and Radix sort - Address calculation - Linear search - Binary search - Hash table methods.

TEXT:

J.P.TREMBLAY and P.G.SORENSON, "An Introduction to Data Structures with applications", Second Edition, Tata McGraw Hill, 1981

SEMESTER 4

CS202

AUTOMATA AND FORMAL LANGUAGES

Finite Automata - Deterministic, non-deterministic and equivalence - Equivalence of regular expressions and FA - Moore and Mealy machines.

Regular Languages - Pumping lemma of regular sets - Myhill Nerode theorem - Minimization of finite automata - Chomsky hierarchy of languages.

Text-Free Language - Context-free grammar - Derivation trees - Ambiguity simplification - Normal forms - UVWXY theorem - Applications.

Pushdown Automata - Definitions - Context free languages - Construction of PDA for simple CFLs - Linear bounded automata.

Turing Machines - Universal Turing Machines - Types of Turing Machines - Techniques - Halting problem - Stack automata - Definitions.

TEXT:

J.E.HOPCROFT and J.D.ULLMAN, "Introduction to Automata Theory", Languages and Computation, Pearson Education, 2001

PETER LINZ, "An Introduction to Formal Language and Automata", Narosa Pub. House, Reprint 2000

CS209

UNIX AND WINDOWS

Introduction to the UNIX operating system, File system, vi (Visual Editor), Essential UNIX commands, Bourne Shell.

Overview of UNIX System Administration, Introduction to shell programming, Disk blocks and i-nodes.

Overview of MSDOS commands, Netware 5.0 features, Netware File System, Netware Directory and File commands.

Netware Printing Services, Netware Login Scripts, Netware Data Protection and Backup, Network File Systems, Netware Accounting System, Network Information Systems, Message Passing Interface.

Features of Windows, Windows Programming, HTML programming.

TEXT:

SUMITABHA DAS, "Unix Concepts and Applications", 3rd Edition, Tata McGraw-Hill, 2003

REFERENCE:

RACHEL MORGAN, HENRY MCGILTON, "Introduction to UNIX system", Tata McGraw Hill, 2000

CS204

DIGITAL SYSTEM DESIGN

Introduction to VLSI design - Basic gate design - Digital VLSI design - Design of general boolean circuits using CMOS gates.

Introduction to hardware description languages through Verilog - Physical modeling - Structural/Data flow modeling - Behavioral modeling.

Advanced Verilog concepts - Synthesis concepts - Inferring latches and flip-flops - Modeling techniques for efficient circuit design.

Design of high-speed arithmetic circuits - Parallelism - Pipelined Wallace tree tipliers - Systolic algorithms - Systolic matrix multiplication.

TEXT:

SAMIR PALNITKAR, "Verilog HDL Synthesis",I Edition,BS Publications,2001

BHASKAR, "Verilog HDL Synthesis",I Edition,BS Publications,2001

CS208

SYSTEMS PROGRAMMING

Fundamentals of language processors - Language specification - Data structure for language processing - Scanning - Parsing.

Assemblers - Elements of assembly language programming - Single pass and two pass assembler - Assembler for IBM PC.

Macro Processors - Macro definition and call - Macro expansion - Conditional and nested macro calls - Design of a macro processor.

Loaders - Relocation and linking concepts - Relocating programs - Design of a linker - Linking for overlays - A linker for MSDOS.

Linkers - Software tools - Text editor - Debug monitors - Interpreters - Program generators - User interfaces - Recent trends and developments.

TEXT:

D.M.DHAMDHERE, "System Programming and Operating Systems", III Edition, Tata McGraw Hill, 2002

J.J.DONOVAN, "Systems Programming", McGraw Hill, 1984

LELAND L.BECK, "An Introduction to Systems Programming", 4th Edition, Addison-Wesley, 2001

CS210

DIGITAL SYSTEM DESIGN LABORATORY

Design of a 32-bit carry look-ahead adder with logarithmic depth using Verilog

Design of a Wallace tree multiplier using Verilog

Design of a 4-bit DSP processor using Verilog

Burning the 4-bit DSP processor on a FPGA

CS212

SYSTEMS PROGRAMMING LABORATORY

Symbol table (Tree-storage) construction

Implementation of single pass and two-pass assembler, macro preprocessor, module binder (with limited instruction set)

Implementation of software tools like text editor, interpreter, program generator etc.

MA204

INTRODUCTION TO PROBABILITY THEORY

Definitions of Probability - Notion of sample space - Events - Basics of Combinatorial Analysis - Posing Probability problems mathematically - Examples

Conditional Probability - Baye's Rule - Random variable - Probability mass function, Density function, Distribution Function - Bernoulli Trials - Binomial Distribution - Poisson Approximation - Poisson Distribution - Normal Distribution - Moment Generating Function

Joint Probability Density Function - Marginal and Conditional Densities - Function of Random Variable - Covariance and Conditional Expectation - Correlation Coefficient

Chebyshev Inequality - Law of Large Numbers - Central Limit Theorem - Random Process - Markov Dependence, Markov Chains, definition, examples, ergodicity

Finite Markov Chain - Various States - Limiting Probability - Introduction to Markov Process - M/M/1 Queues with finite and infinite waiting space.

TEXT:

W. FELLER, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley Eastern, New Delhi.

A. PAPOULIS, Probability, Random Variables and Stochastic Processes, McGraw Hill.

K. S. TRIVEDI, Probability and Statistics with Reliability and Queueing and Computer Science Applications, Prentice Hall of India, 1988

A. O. ALLEN, Introduction to Probability, Statistics and Queueing Theory with Computer Science Applications, Academic Press, 2006 reprint.

SEMESTER 5

CS301

INTRODUCTION TO ALGORITHMS

Algorithms - Examples - Tournament method - Evaluating polynomial functions - preprocessing of coefficients - solving recurrence equations.

Divide and Conquer method - Strassen's matrix multiplication - Greedy method - Knapsack problem - Job sequencing with deadlines - Minimum spanning trees.

Dynamic Programming - Multistage graphs - All pair’s shortest paths - Optimal binary search trees - Traveling salesman problem - Fast Fourier transform.

Randomized Algorithms and Amortized Analysis - Las Vegas and Monte Carlo types - Randomized quick sort and its analysis - Min-Cut algorithm.

NP-Hard and NP-complete problems - Basic concepts - Reducibility - Cook's theorem (without proof) - Turing machines - NP-Hard graph problems.

TEXT:

T.H.CORMEN, C.E. LEISERSON, R.L. RIVEST, "Introduction to Algorithms", The MIT press, Cambridge, Massachusetts and McGraw Hill, 1990

A.V. AHO, J.E.HOPCROFT and J.D.ULLMAN, "The Design and Analysis of Computer Algorithms", Addison Wesley, 1974

CS303

COMPUTER NETWORKS

Introductory Concepts - Network hardware - Network software - Physical layer - Guided transmission media - Cable television.

Data Link Layer - Design issues - Channel allocation problem - Multiple access protocols - Ethernet - Wireless LAN - 802.11 architecture.

Network Layer - Design issues - Routing algorithms - Congestion control algorithms - Quality of Service - Internetworking.

Transport Layer - Transport service - Elements of transport protocols - User Datagram Protocol - Transmission Control Protocol.

Application Layer - DNS - Electronic mail - World Wide Web - Multimedia - Network security.

TEXT:

A.S.TANENBAUM, "Computer Networks", Pearson Education, IV Edition, 2003

W.STALLINGS, "Data and Computer Communication", Pearson Education, V Edition, 2001

CS305

MICROPROCESSOR SYSTEMS

8085 Microprocessor - Architecture - Bus organization - Registers - ALU - Instruction set of 8085 - Instruction format - Addressing modes - Timing diagrams.

Serial I/O - Interrupts - Data transfer techniques - Parallel data transfer using 8155 - DMA transfer using 8257 DMA controller.

Microprocessor System Design - System design using interrupt controller - Floppy Disk Controller - CRT controller.

Microprocessor Interfacing Techniques - Interfacing memory and I/O devices - Interfacing A/D converters and D/A converters - Recent trends and developments.

8086/8088 - Internal architecture - Instruction set - Segmented memory concepts - Memory interfacing [ROM/DRAM] - Bus concepts.

TEXT:

R.S. GAONKAR, "Microprocessor Architecture, Programming and Applications with the 8085/8080A", Wiley Eastern Ltd, Second Edition, 1986

D.V.HALL, "Microprocessors and Digital Systems", McGraw Hill International students, Second Edition, 1986

CS307

SOFTWARE ENGINEERING

Introductory Concepts - Systems engineering - Software project planning - Cost estimation - Project scheduling.

Analysis - Data flow oriented design - Object oriented life cycle models - CASE tools.

Software Design - Software design fundamentals - Data structure oriented Design - JS, LCP - Various design methods.

Implementation and Testing - Testing objectives - Black box & white box testing - Various testing strategies - Art of debugging.

Maintenance - Re-engineering - Reverse engineering - Reliability - Repair and availability - Reliability and availability models - Recent trends and developments.

TEXT:

R.S.PRESSMAN, "Software Engineering - A practitioners approach", III Edition, McGraw Hill International editions, 1992

STEPHEN R. SCHACH, "Object oriented and classical software Engineering", IV Ed., McGraw Hill, 2002

CS309

LOGICAL FOUNDATIONS OF COMPUTER SCIENCE

Review of Prepositional Calculus - Validity - Satisfiability related concepts - CNF and DNF forms - Conversion of arbitrary prepositional formula to CNF or DNF.

Compactness idea - Resolution principle and proof of the theorem - Review of predicate calculus - Interpretation of formulae in predicate calculus.

Prenex normal form and examples - Application of logic in programming - Proof rules for structured statements (assignment, while, repeat-until, for statements).

Pre-conditions / Post-conditions - Weakest precondition - Notion of machine - Mechanism and Wp as a predicate transformer - Properties of Wp.

Guarded Commands - General form of **if** command - Wp of **if** - Related theorem - General form of **do** command - Wp of **do** - Need for strong guards.

TEXT:

D.GRIES, "The Science of Programming", Narosa, 1981

S.ALAGIC, M.A.ARBIB, "The Design of Well-Structured and Correct Programs", SpringerVerlagn, 1978

E.W.DJIKSTRA, "A Discipline of Programming", Prentice Hall, Englewood Cliffs, 1976

CS311

COMPUTER GRAPHICS

Graphics Hardware - Display devices - Hard copy devices - Hardware interaction tasks - Line drawing algorithms - Circle generation algorithms - Character generation.

Basic Raster Graphics Algorithms - Scan conversion - Filling - Clipping - Anti-aliasing - Half-toning.

2D and 3D Transformations - Window to viewport transformation - Viewing in 3D projections - Specifying an arbitrary 3D view.

3D Object Representation - Polygon surfaces - Curves and surfaces - Spline representation - Modeling techniques - Solid fractals - Procedural / Grammar based models.

Hidden line and hidden surface removal algorithm - Illumination - Shading models - Animation - Languages and rules for animation - Recent trends.

TEXT:

J.D. FOLEY, A. VAN DAM, S.K. FIENER and J.F.HUGHES, "Computer Graphics: Principles and Practice", Second Edition, Addison - Wesley, 1996

D. HEARN and M.P. BAKER, "Computer Graphics", III Edition, Prentice Hall of India, 2004

CS313

MICROPROCESSOR SYSTEMS LABORATORY

Solving problems using 8085

Interfacing various devices with the microprocessor: A/D converter, D/A converter, seven segment display, stepper motor, external keyboard, interrupt controller and 8251 for serial data transfer

Interfacing using microcontroller trainer kits

PC hardware assembly

Installation and trouble shooting

CS315

ALGORITHMS LABORATORY

Estimating worst-case/average-case complexity of algorithms via programs

Determining machine constants

Programs involving some advanced data structures

Implementing example problems

Illustrating the different paradigms of algorithm design

Solving miscellaneous problems e.g. problems in string manipulation, graph theory, optimization

SEMESTER 6

CS302

COMBINATORICS AND GRAPH THEORY

Permutations and Combinations - Distribution of distinct / non-distinct objects - Generating functions for combinations - Portion of integers - Ferrers graph.

Recurrence Relations - Linear recurrence relations with constant coefficients - Solution by the technique of generating functions - Permutations with restrictions on relative positions.

Basic Definitions - Trees and fundamental circuits - Cut-sets and Cut-vertices - Connectivity and Separability - Network flows - 1 and 2 isomorphism.

Planar and Dual Graphs - Kuratowski's graphs - Representations of a planar graph - Vector space associated with a graph - Subspaces - Orthogonal vectors and spaces.

Matrix Representation of Graphs - Circuit matrix - Cutset matrix - Path matrix - Adjacency matrix - Coloring problems - Algorithms for fundamental circuits, cut-vertices and separability.

TEXT:

E.S.PAGE and L.B.WILSON, "An introduction to computational combinatorics", Cambridge University Press, 1979

D.E.KNUTH, O.PATASHUK, R.L.GRAHAM, "Concrete Mathematics", 1994

DOUGLAS. B. WEST, "Introduction to Graph Theory", Second edition. Prentice Hall,2001

CS304

OPERATING SYSTEMS

Basic OS Concepts - User's view of the OS - Architectural support - Thread and process scheduling - Preemptive and non-preemptive - FCFS, SJF, Round Robin, Multilevel Queue.

Synchronization - Peterson's solution - Bakery algorithm - Hardware-based solutions - Sempahores - Critical regions - Problems of synchronization - Deadlock prevention and recovery - Banker's algorithms.

Memory Management - Segmentation, Paging and Virtual memory - Case study of x86 32-bit memory management unit - FCFS, FRU - Belady's anomaly - Stack-based algorithms - Thrashing - Working set.

Design of the Unix File System - Buffer caches - File system organization - Inodes - Super blocks - File access algorithms - File tables - Inode tables - Network file systems.

I/O Organization - Block and character device drivers - Unix system file protection mechanism - Access and capability lists - Authentication - Spoofing - Case study of a virus on UNIX.

TEXT:

A.SILBERCHATZ, P.B.GALVIN, "Operating System Concepts", Addison Wesley, VI Edition, 2005

W.STALLINGS, "Operating Systems", Prentice Hall, V Edition, 2005

CS306

DATABASE MANAGEMENT SYSTEMS

Databases - Need - Concepts - Architecture - Data independence - Data modeling: Entity-relationship model - Weak entity sets - Mapping ER model to Relational model.

Concepts - Integrity constraints - Relational algebra - Relational calculus - Tuple relational calculus - Domain relational calculus - Overview of QBE.

SQL Queries - Nested queries - Aggregate operators - Null values - Embedded SQL - Database security - Views - Queries on views.

Schema Refinement - Functional dependencies - Normalization - Decomposition - Armstrong’s axioms - 3NF, BCNF, 4NF - Multi-valued dependencies.

Object-oriented data model - Object identity and pointers - Object definition and manipulation language - Object-oriented databases - Object relational databases - Recent trends.

TEXT:

A.SILBERCHATZ, F.KORTH, S.SUDARSHAN, "Database System Concepts", IV Edition, McGraw Hill,2002

R.ELMASRI, S.B.NAVATHE, "Fundamentals of Database Systems", III Edition, Pearson Education, 2000

CS310

ADVANCED MICROPROCESSOR SYSTEMS

80286 Architecture - Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers.

Basic 486 Architecture - 486 memory system and memory management - Features of Pentium memory and I/O systems - Pentium memory management - Introduction to Pentium Pro features.

Introduction to PCs - Study of PC system layout - SCSI, CD-ROM & multimedia - Development of PC - PC components - Features and system design - Motherboards - Buses - BIOS.

IDE Interface - Magnetic storage principles - Hard disk storage - Floppy disk storage - Optical Storage - Physical drive installation and configuration - Video hardware - Audio hardware.

Input devices - Power supply chassis - Building/upgrading systems - PC diagnostics - Testing and maintenance.

TEXT:

D.V.HALL, "Microprocessor and Interfacing Programming and Hardware", Mc Graw Hill, II Edition, 1999

B.B.BREY, "The Intel Microprocessors 8086/8088, 80186/ 80188, 80286, 80386, 80486 and Pentium and Pentium Pro Processor", Prentice Hall of India, V Edition, 2006

CS312

OPERATING SYSTEMS LABORATORY

Designing a command shell in Java

Synchronization of processes

Study of scheduling algorithms

Implementation of a file system

Advanced file system implementation

CS314

DATABASE LABORATORY

Exercises to be based on Sybase / Oracle / Postgres / VB / Power Builder / DB2 / MS-Access.

Applications involving vendor development systems, stores management system, finance management etc.

Creation and querying of database tables

Design of tables by normalization and dependency analysis

Writing application software with host language interface

SEMESTER 7

CS401

DISTRIBUTED COMPUTING

Distributed Systems - Goal - Advantages over centralized systems - Organization of multiprocessor systems - Hardware/software concepts - Review of layered protocols.

Client/Server Model - Microkernel - RMI - Distributed algorithms - Time stamping - Circulating tokens - Diffusing computations.

Mutual Exclusion Algorithm - Election algorithm - Detecting loss of tokens and regeneration - Distributed deadlock detection algorithms - Distributed termination algorithms.

File Replication - Semantics of file sharing - Remote access methods - Fault tolerant issues - Introduction to distributed operating systems.

Introduction to Distributed Operating Systems - Motivations - Management systems - Levels of distribution transparency - Architecture - Introduction to concurrency control.

TEXT:

GEORGE COULOURIS, JEAN DOLLIMORE, TIM KINDBERG, "Distributed System Concepts and Design", 4th Edition, Addison Wesley, 2005

A. S. TANENBAUM, "Distributed Operating Systems", Prentice Hall, 1995

S. CERI, G.PELAGATTI, "Distributed Databases - Principles and Systems", McGraw Hill, 1985

CS403

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Search Strategies - Hill climbing - Backtracking - Graph search - Properties of A* algorithm - Monotone restriction - Specialized production systems - AO* algorithm.

Searching game trees - Minimax procedure - Alpha-beta pruning - Introduction to predicate calculus.

Knowledge Representation - Reasoning - STRIPS - Structured representation of knowledge - Dealing with uncertainty.

Introduction to Expert Systems - Inference - Forward chaining - Backward chaining - Languages and tools - Explanation facilities - Knowledge acquisition.

Natural Language Processing - Introduction - Understanding - Perception - Machine learning.

TEXT:

G.LUGER, W.A. STUBBLEFIELD, "Artificial Intelligence", Third Edition, Addison-Wesley Longman, 1998

N.J. NILSSON, "Principles of Artificial Intelligence", Narosa Publishing House, 1980

CS405

PRINCIPLES OF COMPILER DESIGN

Introduction - Structure of a compiler - Different phases of a compiler - Finite automata and lexical analysis.

Syntactic specification - Context-free grammars - Derivation and parse trees - Basic parsing techniques.

LR Parsers - SLR, Canonical LR and LALR - Syntax-directed translation schemes - Various forms of intermediate code.

Translation of array references, procedure calls, declarations and case statements - Symbol tables - Run-time storage administration - Error detection and recovery.

Code Optimization - Loop optimization - DAG representation of basic blocks - Code generation from DAG's - Compiler compilers: YACC - Attributed parser generators.

TEXT:

A.V.AHO, R.SETHI, J.D.ULLMAN, "Compilers, Principles, Techniques and Tools", Pearson Education, 13th Indian Reprint, 2003

J.P. TREMBLAY, P.G. SORRENSON, "The Theory and Practice of Compiler Writing", McGraw Hill, 1985

CS407

ADVANCED COMPUTER ARCHITECTURE

Parallel computer models - Flynn's classification - Parallel and vector computers - System, implicit and explicit parallelism - Multi-vector and SIMD computers - PRAM and VLSI models.

Program and network properties - Data and control dependence - Hardware and software parallelism - Partitioning and scheduling - Interconnection architectures.

Performance laws - Metrics and measures - Amdahl's law for fixed workload - Bounded speed-up model - Scalability analysis and approaches.

Symbolic Processors - CISC and RISC architectures - Super scalar processors and their features - Memory hierarchy.

Linear Pipeline Processors - Basic considerations - Basics of non-linear pipeline processors - Design of pipelined architecture - Recent trends and developments.

TEXT:

K.HWANG, "Advanced Computer Architecture, Parallelism, Scalability, Programmability", McGraw Hill, New York, 1993

D.A.PATTERSON, J.L.HENNESSY, "Computer Architecture: A Quantitative Approach", Harcourt Asia, Morgan Kaufmann, 1999

CS413

COMPILER DESIGN LABORATORY

Design of lexical analyzers and parsers like recursive-descent parser for a block structured language with typical constructs

Exercises using LEX and YACC

Quadruples/Triples generation using LEX and YACC for a subset of a block structured language e.g. PASCAL

CS415

NETWORK ENGINEERING LABORATORY

Familiarization with configuring and installing a LAN

Experimenting with network protocols for achieving communication between computers

Interconnection software for communication between two different network architectures

Experiments using TCP/IP, POP, e-mail, HTTP

Implementation of a web server and web client

Design of a mini search engine and firewall

Internet/web browser implementation

Web programming using HTML/XML/Perl/Java/PHP

Network security: email security / web security

SEMESTER 8

CS402

ADVANCED DATABASE MANAGEMENT SYSTEMS

Concepts - EER-to-Relational mapping - Integrity constraints in data modeling - Review of normalization theory - Review of file structures and access methods.

Basic Algorithms - Use of heuristics - Optimization algorithm - Heuristic optimization of query graphs - Using cost estimations in query optimization.

More Concepts - Concurrent execution - Implementation of atomicity, durability - Isolation - Recoverability - Serializability of schedules - Testing for conflict - Serializability - View serializability.

Lock-based protocols - Timestamp-based protocols - Validation-based protocols - Multiversion schemes - Deadlock handling.

Log-based recovery - Buffer management - Recovery with concurrent transactions - Recovery techniques - Shadow paging.

Database System Architectures - Parallel databases - Advanced transaction processing - Emerging database applications - Recent trends and developments.

TEXT:

A.SILBERSCHATZ, H.F.KORTH, S.SUDARSHAN, "Database System Concepts", IV Ed, McGraw Hill, 2000

R.ELMASRI, S.B.NAVATHE, "Fundamentals of Database Systems", III Ed., Pearson Education, 2000

HM402

INDUSTRIAL ECONOMICS

Industrial Economics - Elasticity of demand and supply - Consumption laws - Types of competitions - Keynesian employment theory - Production, planning and control.

Money Banking & Financial Management - Functions of commercial and central banking - The problem of foreign exchange - Sources of industrial finance - Management accounting.

General Management - Principles of management - Scientific management - Advanced techniques in management: MBE, MBO, MBC, MBP, MIS - Quantitative techniques in management.

Marketing Management - Definition of marketing - Market research - Need for marketing - Sales forecasting - Product life cycle - Market segmentation.

Personnel Management & Industrial Psychology - Selection and recruitment - Training and development - Job evaluation and merit rating - Worker participation - Quality - Work life.

TEXT:

GUPTA, G.S., "Managerial Economics", Tata McGraw Hill, 1993 Edn.

RASAD, L.N., "Principles of Management Theory and Practice", Sultan & Chand, 1992 Edn.

DAVAR, S.R., "Personal Management & Industrial Relations", Vikas Publishing (P) Ltd., 1993 Edn.

ELECTIVES

CS352

DESIGN AND ANALYSIS OF PARALLEL ALGORITHMS

Introduction to Parallel Computers - SIMD - EREW, CREW - SM-SIMD algorithms - Shared memory SIMD - Tree and mesh interconnection computers.

Sorting - Sorting on a linear array - Sorting on a mesh - Sorting on EREW SIMD computer - MIMD enumeration sort - MIMD quick sort - Sorting on other networks.

Matrix operations - Mesh transpose - Shuffle transpose - EREW transpose - Mesh multiplication - Cube multiplication - Matrix by vector multiplication - Tree multiplication.

Numerical problems - Linear equations - SIMD algorithm - Roots of nonlinear equations - MIMD algorithm - Partial differential equations - Computing Eigen values.

Graph problems - Computing the connectivity matrix - Finding connected components - Traversal - Minimal alpha-beta tree - Storage requirements.

TEXT:

S.G.AKL, "The Design and Analysis of Parallel Algorithms", Prentice Hall of India, 1989

S. LAKSHMIVARAHAN, S.K. DHALL, "Analysis and Design of Parallel Algorithms - Arithmetic and Matrix Problems", McGraw Hill, 1990

CS354

SOFTWARE DESIGN AND PRACTICES

Software Engineering - Paradigms - Planning - Cost estimation - Software project scheduling - Risk analysis and management - Requirements and specifications - Stakeholders needs and analysis.

Structured Design - Design principles - Problem partitioning and hierarchy - Modularity - Top-down and bottom-up strategies - Transformation of a DFD to a structure chart - Coupling and cohesion.

Object-oriented analysis - UML - Use case - Conceptual model - Class analysis patterns - Overview - Diagrams - Aggregation - Collaboration - Sequence - Class - Managing analysis and design.

Architecture Concepts - Design methods - Design patterns - Design processes and strategies - Design by template incremental design - Structured systems analysis and structured design - JSP - JSD.

TEXT:

DAVID BUDGEN, "Software Design", Second Edition, Pearson Education, 2004

R.S.PRESSMAN, "Software Engineering", Fifth Edition, McGraw Hill Inc., 2001

ED DOWNS, PETER CLARE, JAN COE, "Structured System Analysis and Design Methods - Application & Context", Prentice Hall, 1998

CS451

PRINCIPLES OF CRYPTOGRAPHY

Origins of Cryptography - Issues - Codes and ciphers - Preliminary ideas of factoring and testing - gcd and its complexity.

Symmetric Key Cryptosystems - Block ciphers - Substitution ciphers - DES and Feistel ciphers and the problem of breaking them - The field Z/pZ - Euler's φ function.

Stream Ciphers - Linear feedback shift registers and associated results - Geffe generator - Diffe-Hellman key exchange - Bit commitment using symmetric key.

Public-key Cryptosystems - Discrete logarithm - RSA and Miller-Rabin - Authentication - Digital signatures - Merkle-Hellman Knapsack public key cipher.

Factoring and other topics - Pollard ρ-heuristic - Pollard p-1 algorithm - Quadratic sieve algorithm - Zero-knowledge proof idea - Recent developments.

TEXT:

A.J. MENEZES, P. VAN OORSCHOT, S. VANSTONE, "Handbook of Applied Cryptography", CRC Press

WILLIAM STALLINGS, "Cryptography and Network Security", Pearson Education, 3rd Edition, Reprint 2003

CS453

NETWORK PRINCIPLES AND PROTOCOLS

Introduction to Networks - Applications of networks - Architecture - Topology - Switching - SLIP - PPP - ALOHA protocols - CSMA/CD - IEEE 802.3, 802.4, 802.5.

Network Layer Issues - Routing - Congestion control - Internetworking - Issues - Address learning bridges - Spanning tree - Source routing - Bridges - Routers - Gateways.

Network Protocols - IP datagram - hop by hop routing - ARP/RARP - Subnet addressing - Address masking - ICMP - RIP/RIPV2 - OSPF - DNS - LAN and WAN multicast.

Transport Layer - Design issues - Connection management - Transmission Control Protocol (TCP) - User Datagram Protocol (UDP).

Application Layer - Telnet - TFTP - FTP - SMTP - Ping - Finger - Bootstrap - Network Time Protocol - SNMP.

TEXT:

A.S. TANENBAUM, "Computer Networks", Third Edition, Prentice Hall India, 1997

W. RICHARD STEVENS, "TCP/IP Illustrated - Volume I, The protocols", Addition-Wesley Professional Computing Series, 1994

CS452

REAL-TIME SYSTEMS

Introduction to real-time computing - Structure of a real-time system - Characterization of real-time systems and tasks - Performance measures.

Task Assignment and Scheduling - Uniprocessor scheduling algorithms - Task assignment - Mode changes - Fault tolerant scheduling.

Real-time Communication - Network topologies and architecture issues - Protocols - Contention-based, token-based, polled bus - Fault tolerant routing.

Real-time Databases - Transaction priorities and aborts - Concurrency control issues - Scheduling algorithms - Two-phase approach to improve predictability.

Programming Languages and Tools - Hierarchical decomposition - Run-time error handling - Overloading - Timing specification - Recent trends and developments.

TEXT:

C.M. KRISHNA, KANG G. SHIN, "Real-Time Systems", International Edition, McGraw Hill Companies, Inc., New York, 1997

CS454

NETWORK SECURITY

Introduction - Attacks, services and mechanisms - Classical encryption techniques - DES - Block cipher - Design principles and modes of operation.

Encryption Algorithms - Hash functions - Triple DES - RC5 - Key management - Public key cryptography - RSA algorithm - Digital signatures and authentication protocols.

System Security - Backups - Integrity management - Protecting against programmed threats, viruses and worms - Physical security - Personnel security.

Network Security - Protection against eavesdropping - Security for modems - IP security - Web security - Electronic mail security - Authentication applications.

Security Tools - Firewalls - Wrappers - Proxies - Discovering a break-in - Denial of service attacks and solutions - Cryptographic security tools: Kerberos, PGP, SSH, SRP, OPIE.

TEXT:

WILLIAM STALLINGS, "Cryptography and Network Security – Principles and Practice", II Edition, Pearson Education, 2000, Ch 1 to 16

STEVE BURNETT, STEPHENE PAINE, "RSA Security's official guide to cryptography", RSA Pren, Tata McGraw Hill Edition, 2001

E. NEMETH, G. SNYDER, S. SEEBASS, T.R. HEIN, "UNIX System Administration Handbook", III Edition, Pearson Education, Asia, 2001