

COMPUTER PROGRAMMING

IT151

UNIT I

Introduction to unix, simple unix commands like date, who, cal, tty, is etc. file commands like mv, cp, rm, cat etc. directory commands like pwd, mkdir, rmdir, cd etc. other commands like echo, man etc. modifying files using vi editor.

UNIT II

General organization of typical computer, input output devices, storage devices, system software like assemblers, compilers, operating system.

Problem specification, flow chart, an algorithm development, data types, assignment statements, input output statements, developing simple c programs

UNIT III

If statement for loops, while loops, do-while loops, switch statement, break statement, continue statement, development of c programs using above statements.

UNIT IV

Arrays, functions, parameter passing, recursion, programming in c using these statements.

UNIT V

Structures, files, pointers and multi file handling.

Suggested Text Books and references.

1. Programming with C (Schaum Series) By Gottfried.
2. C programming By Ritchie & Kernighan
3. Unix Programming By Kernighan & Pike.
4. Let us C By Yashwant Kanitkar
5. Programming with C++ made simple by M. Kumar - TMH

ELECTRONIC CIRCUITS & NETWORK THEORY

IT201

UNIT I

Review of equivalent circuit for semi conductor devices (BJT, FET etc) classification of amplifiers , voltage amplifier , current amplifiers , amplifier characteristics ,BW , gain , input impedance , output impedance, distortion etc. Transistor Biasing and stabilization, Bias compensation, Thermal Runaway.

UNIT II

Switching characteristics –of BJT and FET, linear and non linear wave shaping circuit, bistable , monostable and astable multi-vibrators, RC integrators and differentiators, Clipper and Clamper circuits.

UNIT III

Classification of Amplifiers, Operational Amplifiers(OP-AMP), Inverting & Non inverting mode comparators, Zero Crossing Detector, VF and FV converter, Rectifier circuit using op- amp. 555 Timer and it's application.

UNIT IV

Circuit Elements, KVL, KCL, Elementary Graph Theory, Incidence Matrix, Cut-Set, Tie- Set, Network Theorems, Superposition, Thevenin's, Norton's, Reciprocity, Max. Power Transfer, Millman's, Tellengens Theorem, and Magnetically Coupled Circuits.

UNIT V

Differential Equations, First & Second order system, Time constant, Initial Conditions, Laplace Transform & its application in circuit analysis, Initial & Final value Theorem, Network Functions, Two Port Network Parameters.

References:

1. Integrated Electronics by Milliman & Halkias Mc-Grow Hill Publication
2. Micro-Electronics Circuit by Sedra Smieth Oxford University Press.
3. Network Analysis by Van Valkenburg PHI publication
4. Electronic Devices and Circuits by Boylsted

Digital Electronics IT 202

UNIT 1

Number system: Binary Number System, binary arithmetic, octal number system, hexadecimal system, radix conversion. Binary codes: BCD, Excess three code, grey code, display code, ASCII, EBCDIC,
Boolean algebra: Theorems, AND, OR, NOT, NAND, NOR, Exclusive OR gates, inhibit, simplification of Boolean expressions minimization techniques, karnaugh map, Quine MC – clusky method.

UNIT 2

Study of combinational circuits arithmetic logic unit, full and half adder, subtractor BCD adder, Excess 3 adder multiplexer, and demultiplexer encoder and decoder circuits.

UNIT 3

Flip-Flop: RS clocked RS, TD, JK, race-around problem, master – slave JK.
Elements of sequential switching circuits, synchronous and asynchronous system binary ripple counter, BCD counter up-down counter.

UNIT 4

Shift registers, serial and parallel shift registers, shift left and shift right operation, Johnson and rings counter.

UNIT 5

Design of Sequential circuits, state diagrams implementation of multivibrators, circuit using logic gates, Schmitt trigger.

DISCRETE STRUCTURES IT203

UNIT I

Introduction to set theory, combination of sets, finite and infinite sets, uncountable infinite sets, mathematical induction, principles of inclusion and exclusion, multi-sets. Introduction to Relations and Functions, Properties of Binary Relation, equivalence relation and partitions, partial ordering and total ordering, lattices, chains and anti-chains, functions and pigeonhole principle.

Unit II

Introduction to discrete numeric functions and generating functions, manipulation of numeric functions, asymptotic behavior of numeric function, combinatorial problems.

Unit III

Introduction to recurrence relation and recursive algorithm, linear recurrence relations with constant coefficients, homogeneous solutions, particular solutions, total solution, solution by method of generating functions, sorting algorithm, matrix multiplication algorithm.

Unit IV

Introduction to groups and rings, subgroups, generators and evaluation of powers, Cosets and Lagrange's theorem, permutation groups and Burnside's theorem, codes and group codes, isomorphism and automorphism, homomorphism and normal subgroups, rings, integral domains and fields, ring homomorphism, polynomial rings and cyclic codes.

Unit V

Introduction to Boolean algebra, lattices and algebraic systems, principles of duality, relation between algebraic system and lattices, distributive and complemented lattices, Boolean lattices and Boolean algebra, uniqueness of finite Boolean algebra's, Boolean functions and Boolean expressions, propositional calculus, design and implementation of digital networks switching circuits.

Suggested Books and References.

1. Element of Discrete Mathematics By C. L. Liu

DATA STRUCTURES IT204

UNIT 1:

Introduction to data structures, algorithm evaluation, arrays, ordered lists, operations in ordered list, sparse matrices, multi-dimensional arrays, linked lists, operations on linked list, storage pools, garbage collection, doubly linked list and its operations, generalized linked lists.

UNIT 2:

Stacks and Operations in a stack, applications of Stacks and queues, difference between Stacks and queues, Operations in a queue & its application, Circular queues, Mazing problem, Prefix, postfix, infix notations

UNIT 3:

Trees: applications and representation in memory, binary tree : operations on binary tree
Spanning tree, cut sets, graphs : Traversing and properties, Hamiltonian path and circuits
Eularian paths and circuits, Planner graphs and its applications

UNIT 4:

Symbol table: types and use, Static tree table, Dynamic tree table, Hashing, Hash table
Representation of sets: using list, Representation of sets: using bit vector & trees
Operations on sets

UNIT 5:

Sequential Search, Binary Search, Other search techniques, Time complexity & memory requirements, Bubble Sort, Insertion sort, Quick sort, Selection sort, Merge sort, Heap sort, maxima and minima heap

References:

- 1) Data Structure by Tanenbaum
- 2) Data Structure by Horowitz & Sahani

ANALOG COMMUNICATION IT251

UNIT 1

Signals Analysis : Review of Fourier Transformation ,convolution ,signal transformation and its properties , through linear system ,signal distortion in transmission, Paley – Wiener criteria , bandwidth and rise time ,energy and power density and Parseval's theorem for energy of power signals, convolution & correlations.

UNIT 2

Linear Modulation : Necessity of modulation , principal of amplitude modulation generation and detection of AM-SC, SSB-SC and VSB, Comparison of various AM systems, FDM.

UNIT 3

Exponential Modulation : - Definition and relationship between PM ad FM frequency deviation , Bessel's function , spectrum and transmission BW of FM , WBFM , phaser diagram of FM signals in FM system s, comparison of AM and FM systems.

UNIT 4

Radio transmitter and receiver : Different type of AM and FM transmitters and receivers , AM and FM standard broadcast calculation of noise for signal and cascaded stages .

UNIT 5

Noise-performance of analog communication systems : SNR, Noise figure, noise temperature , noise calculation for cascaded stages , noise figure of merit, of SSB , DSB , AM , FM systems , noise threshold improvement in FM system: FMFB PLL, Pre-emphasis and de-emphasis and other threshold improvement circuits.

COMPUTER ARCHITECTURE

IT252

UNIT I

Central processor organizations, basic building blocks, bus organized computer memory, address structure, memory data register, program counter, accumulator, instruction register, instruction field, address field, micro-operations, register transfer languages, instruction fetch, decoding and execution, instruction formats and addressing modes.

UNIT II

Control unit organization, instruction sequencing, instruction interpretation, hardwired control & micro-programmed control organization, control memory, address sequencing micro-instruction formats, micro-program sequencer, micro-programming, bit slicing in AHPL, emulation.

UNIT III

Arithmetic processor design, addition and subtraction algorithm, multiplication algorithm, division algorithm, processor configuration, design of control unit and floating point arithmetic.

UNIT IV

Input-Output organization, programmed I/O, I/O addressing, I/O instruction, synchronization, I/O interfacing, standard I/O interfaces interrupt mechanism, DMA, I/O processors and data communication.

UNIT V

Memory organization and multiprocessing, basic concepts and terminology, memory hierarchy, semiconductor memories (RAM, ROM), virtual memory, associative memory, cache memory,

cache mapping techniques, memory allocation and management policies, structure of multiprocessors, parallel processing, pipeline processing.

Suggested Text Books and References:

1. Computer Organization and architecture- William Stallings, Macmillan Publishing Company, Fourth Edition.
2. Computer Architecture – Morris Mano, PHI Publication.
3. Advanced Computer Architecture: A System Design Approach- Kain, PHI Publication

PRINCIPLES OF PROGRAMMING LANGUAGES

IT253

UNIT I

Evaluation, design and applications of programming languages, using L and R values, Von Neumann bottleneck, basics of logic and functional programming. Data types in Ada, parameter passing mechanism, scope of a variable, binding, coercion, storage allocation of multidimensional arrays in a computer, control structures like if statement, while statement etc., data abstraction.

UNIT II

Data types, simple statements like (assignment statement, if statement, switch statement), control statement like (for loop, while and do – while loops, break and continue statements etc.), arrays, functions and pointers in C, C++ and Java.

UNIT III

Introduction to object oriented programming, concepts of objects, classes and instances, various types of classes like base class, derived class, abstract class etc., class hierarchy, difference between public, private and protected class, Inheritance, multiple Inheritance and its problem, public and private Inheritance in C++ and Java.

UNIT IV

Introduction to applicative languages, study of LISP, programming style, lambda calculus, property list and macro expansion in LISP and LISP programming. Data types and data structures in PROLOG, basic statements, control structures and input – output statement used in PROLOG, recursion and iteration used in PROLOG, programming in PROLOG.

UNIT V

Introduction to COBOL, various divisions and sections used in COBOL, simple type of statements like ADD, SUBTRACT, COMPUTE, OPEN, CLOSE, MOVE etc. in COBOL, loop type statements like PERFORM etc. in COBOL, table handling, sequential file processing, file sorting and merging in COBOL. Comparative study of various programming, language like C, C++, Java, LISP, PROLOG, Ada and COBOL.

Suggested Text Books and References:

1. Fundamentals of Programming Languages by Ellis Horowitz, Galgotia Publications Pvt. Ltd.
2. Programming Languages by Allen B. Tucker, Mc Graw Hill International Edition, 2nd Edition, 1987.
3. Object Oriented Programming in Turbo C++ By Robert Lafore, Galgotia Pub, 1998.
4. The complete reference JAVA By Herbert Schildt & Patrick Naughton, Tata Mc Graw Hill, 1997. Programming with Advanced Structured COBOL By Lawrence R. Newcomes, Schaum's Outline Series, McGraw Hill Book Company, 1987.

DATA BASE MANAGEMENT SYSTEMS

IT254

Unit I

Introduction to DBMS, advantages of database management, meaning of physical, internal, conceptual and external level in a database system, data independence, different data models (Relational data model, hierarchical data model, network data model and their comparison) , DDL, DML, database manager, DBA, various types of database users. Introduction to relational database systems, meaning of tuples, attributes, insertion, deletion, updating and retrieval in relational approach, various operations in relational approach like select, project, join, union, intersection etc.

Unit II

Introduction to ER modeling, entity, entity sets, relation and relationship sets in ER models, ER diagrams, reducing ER diagrams to tables, generalization and aggregation in ER models, design strategies for a database scheme. Various types of relational commercial languages like SQL, QBE, QUEL etc.

Unit III

Meaning of integrity constraints, various types of integrity constraints in relational approach like domain constraints, referential integrity constraints, functional dependency constraints, assertions, triggers etc. Normalization in relational approach, conversion of a relational to higher normal forms, normalization using functional dependencies, multi-valued dependencies, join dependencies etc., domain key normal form.

Unit IV

Methods of storing relational database record in files, various types of files like sequential files, indexed files, indexed sequential files etc. for storing of relational data, buffer management, data dictionary, physical storage media etc. needed for these file. Introduction to indexing and hashing, various types of indexing techniques using B -Trees, B+ -Trees etc., various types of hashing techniques like static hashing function, dynamic hashing function etc, overview of query processing and cost estimation.

Unit V

Overview of object oriented databases and related concepts, object relational model, distributed databases, parallel databases, temporal databases, spatial databases, web & multimedia databases.

Suggested books:

1. Fundamentals of Database Systems By Elmasri&Navathe
2. Database System Concepts by Silberschatz ,Korth & Sudershan .
3. An introduction to Database Systems By C.J.Date

THEORY OF COMPUTATION

IT255

UNIT I

Introduction to alphabets, strings and languages, finite automata and finite state machines, DFA(deterministic finite automata),NFA(non -deterministic finite automata), NFA with ϵ moves, equivalence among DFA, NFA and NFA with ϵ moves.

UNIT II

Regular expressions, union, concatenation and kleen closure operations on regular expressions, correspondence between finite automata and regular expressions, finite automata and regular expressions, finite automata with output like Moore and Mealy machines, pumping lemma for regular sets, Myhill-nerode theorem and minimization of finite automata.

UNIT III

Context free grammar and languages , derivation trees, simplification of context free grammars,

Chomsky normal form(CNF) , Greibach normal form, ambiguity in grammars, push down automata, deterministic and non- deterministic push down automata, equivalence between push down automata and context free grammars.

UNIT IV

Turing machines, church's hypothesis, ram machines, recursive and recursively enumerable languages, undecidability and rice's theorem.

UNIT V

P, NP, NP-complete and NP-hard problems, examples of these problems like satisfy ability problem, vertex cover problem, Hamiltonian path problem, chromatic number problem, traveling salesman problem, partition problem etc.

Suggested text books and references:

1. Introduction to automata theory , language and computation by John E Hopcroft and Jeffrey D. Ullman, Narosa publishing house 1997.
2. Introduction to language and the theory of computation by john c. martin McGraw hill, international Editions 1991.

Digital Communication IT301

UNIT 1

Sampling theorem , pulse modulation ,multiplexing quantization PCM , companding , inter-symbol interference , Eye patterns ,delta modulation , DPCM ,S/N performance of PCM and delta modulation , Bandwidth of PCM and delta modulation.

UNIT 2

ASK, BPSK, QPSK, M-ary PSK , DKPS, BFSK, M-ary FSK ,Doubinary signaling , base band signal receiver , probability of error , optimum filter , matched filter , coherent and non- coherent detection, bit error rate , QPSK , QAM.

UNIT 3

Random signals , random variables and process , cumulative distribution , FUNCTION, probability density function, average value variance, standard deviation , moment and moment generating function , characteristics function , Tchebycheff's inequality , binary , Poisson and Gaussian distribution , central limit theorem .

UNIT 4

Unit of information , average information , joint and conditional entropy , mutual information, channel capacity, BSC AND BEC, Shannon's theorem , Shannon Hartley theorem , bandwidth-S/N ratio trade off .

UNIT 5

Coding separable codes, prefix property, coding efficiency, source coding, Shannon-Fano code, Huffman code, error correction code, FEC and ARQ, hamming distance, minimum distance channel coding, block code, cyclic code, convolution code.

MICROPROCESSORS IT302

Unit I

Introduction to 16 bit microprocessors, internal architecture of 8086, various types of segments used like CS, DS ES and SS, study of various registers used in 8086, various types of addressing modes like immediate addressing, register addressing, direct addressing mode and indirect addressing modes.

Unit II

Instruction set of 8086, conversion of high level statements like assignment statements, if statements, for loops, while loops, procedures, function etc. to 8086 statements, programming using 8086.

Unit III

Interrupts in 8086, maskable and non-maskable interrupts, hardware and software interrupts, conditional interrupts, types 0, type 1, type 2 and other such types of interrupts, timing diagrams for interrupts, steps for interrupt handling.

Unit IV

Study of peripherals like 8237,8254,8255A, 8259A, 8272A, USART and buses like HPIB.

Unit V

Comparative study of 8086, 8087, 8088, 80386, 80486, Pentium etc., interfacing using 8086.

COMPUTER NETWORKS**IT303****Unit I**

Study of the functions of OSI and TCP/IP reference model in computer networks, circuit, message, packet and hybrid switching, broadband ISDN and ATM, polling techniques, multiplexing and concentration, transmission media used in physical layer, X.25 networks. Queuing theory, introduction to LAN, MAN and WAN.

Unit II

LAN protocols, various types of ALOHA, IEEE standards for LAN and MAN, high speed fiber optic networks like FDDI, SONET etc., satellite networks, packet radio networks. Data link layer protocols, error detection and correction codes in data link layer, protocol performance evaluation, protocol specification and verification.

Unit III

Introduction to routing and congestion in network layer, routing and congestion control algorithms, inter networking, network layer in internet and ATM networks.

Unit IV

Connection management in transport layer, protocols of transport layer, internet transport protocol like TCP, UDP etc, ATM AAL protocols.

Unit V

Data security and cryptography techniques, access management in application layer, world wide web(www), electronic mail(E-mail), concept of virtual terminals. Study of common types of networks like ARPANET, USENET etc.

OPERATING SYSTEMS

CSE304

Unit I

Introduction to operating systems, computer system levels, application & functions provided by operating systems, operating systems interface, system calls & system calls interface. File system organization, devices as file, access and allocation methods of file, systems directory, structure of file system on a disk. Disk scheduling and their algorithms, device drivers, device driver interface, device driver access strategies.

Unit II

Concept of a process, processes and program, process management, system calls, communication between processors, communication related system calls, CPU/Process scheduling, scheduling algorithms and their evaluation, device numbers, partitioning large logical disk, RAM disk, memory as device presents, tty's disk caching.

Unit III

Introduction to memory management, various memory management schemes like paging, segmentation, demand paging, virtual memory, page replacement algorithms, thrashing and load control, dealing with large page tables, two level paging, starting memory. .

Unit IV

Meaning of deadlocks, condition for deadlocks to occur, deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery, sequence of approach to deadlock handling, two phase locking, stagnation, introduction to concurrent processing, precedence graphs.

Unit V

Process hierarchy, critical section problem, semaphore concept, study of classical co-ordination problem, security and protection, protection of resources like data, file , I/O resources, CPU and memory protection, goals of protection authorization, authentication, dynamic protection structures, security, case study of windows environment.

SOFTWARE ENGINEERING

IT305

Unit I

Introduction to software engineering, software characterization and components, software as a product, software process & process models, capability maturity model (CMM). Software metrics and measurements software project planning(Project scheduling and tracking, cost estimation methods).

Unit II

Requirements analysis: - Analysis principles, complexity, methods, structured analysis method formal specification, data dictionary, software prototyping and specifications, other requirement analysis methods, storage and processing time analysis, data base requirement, SRS documentation.

Unit III

Design principles, design concepts like abstraction, refinement, modularity, control hierarchy, software architecture, structured partitioning, data structure, information hiding etc, modular design, design heuristics for modularity, object oriented design, user interface design, other design methods.

Unit IV

Software coding and testing, influence of implementation language and coding, coding style, coding efficiency, software quality assurance, software testing techniques, software testing strategies, comparison of test methods, choice of test data, classification of test data, other verification & validation methods.

Unit V

Software maintenance process, quality management, maintenance cost and maintainability measures, software risk analysis, configuration management and version control system documentation, software reusability.

Books:

1. Jalote
2. Pressman

UNIX INTERNALS AND SHELL PROGRAMMING

IT352

Unit I

Introduction to the kernel :- Architecture of the Unix, the buffer cache. Internal representation of files:- inode, accessing blocks, releasing blocks, structure of regular files, conversion of a path name to an inode, inode assignment to a new file, allocation of disk-block.

Unit II

System calls for the file systems:- OPEN, READ , WRITE, CLOSE. PIPES:- the pipe system call, opening a named pipes, reading and writing pipes, closing pipes, DUP, mounting and unmounting file system, LINK, UNLINK. System call for TIME and CLOCK.

Unit III

The structure of processes:- process states and transitions, layout of system memory, the context of a process, saving the context of the process, manipulation of the process address space.

Process Control:- process creation, signals, process termination, awaiting process termination, the user id of a process, changing the size of the process, the system BOOT and INIT process.

Unit IV

Shell Programming:- Study of different types of Shell like C Shell, Bourne Shell etc. Shell variable, Shell Script, Shell Command. Looping and Making choices:- For Loop, While and Until, Passing Arguments to Scripts. Programming in different shells.

Unit V

Inter Process Communication:- Process Tracing ,Network Communication Sockets. Multiprocessor System:- Problem of multiprocessor systems, Solution with Master and Slave Processor, Solution with Semaphores. Study of Distributed Unix System.

Books:

1. “The Design of Unix Operating System “ by Maurice J Bach.
2. “Advanced Unix-A Programmer Guide” by Stephen Prata.

DATA WAREHOUSING AND DATA MINING

IT353

Unit I

Introduction to data mining:- Kinds of data, relational databases, traditional databases, advanced database systems. Data Mining functionalities and patterns generated.

Data warehouse and operational databases, multidimensional data model. Data warehouse architecture:- process flow, extract & load process, clean & transform data. Backup and archive process load and warehouse manager

Unit II

Data Warehouse Design:- Identifying facts & dimensions. Designing:- fact tables, dimension tables, star flake schema query redirection. Multidimensional schemes:- partitioning strategy, aggregation, data marting, metadata. Capacity planning, tuning the data warehouse. Testing the data warehouse: developing test plan, testing operational environment, database, application.

Unit III

Data preprocessing, data cleaning, data integration & transformation, data reduction. Data mining primitives, languages & systems, architecture of data mining systems.

Unit IV

Concept description, characterization & comparison. Mining and association rules in large databases, Mining single dimension and multilevel association rules for transactional databases, relational databases and Data Warehouses.

Unit V

Issues regarding classification & prediction, Methods of Classification & prediction. Cluster analysis:- types of data in cluster analysis clustering methods. Multidimensional analysis & descriptive mining of complex objects. Mining spatial databases, multidimensional databases, text databases and world wide web.

Books:

1. "Data Mining Concepts and technique " by Jimali Klan and Micheline Kamber
2. "Data Warehousing in the real world " by Sam Anahory and Dennis Murray

SYSTEM PROGRAMMING AND COMPILER DESIGN

IT354

Unit I

Function of an assembler, phases of an assembler, pass structure, study of various tables used like symbol table, op-code table etc. Introduction to macros, macro definition and call, macro expansion, nested macro, macro facilities like flow of control, expansion time variables etc, design of a macro pre-processor.

Unit II

Introduction to loading, linking and relocation, design of the linker, relocation factor and types of relocation. Various types of software tools like editors, debug monitors etc.

Unit III

Functions of a compiler, various phases of a compiler, bookkeeping, Boot Strapping in a compiler. Basic Parsing technique like Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsing, LR parsers etc, SLR and LALR parsing table.

Unit IV

Syntax directed translation schemes, intermediate code generation, syntax trees, three address code, quadruple and triples, translation of various type of statements like assignment, while, case, for etc.

Introduction to symbol table generation, data structure used for symbol table generation, error detection and recovery in a compiler, removal of lexical, syntactic, semantics errors and errors encountered in other phases.

Unit V

Introduction to code optimization, loop optimization, techniques using DAG, reducible flow graphs, depth first search etc, data flow analysis. Introduction to code generation, code generation using DAG, register allocation and assignment in code generation, problems in code generation.

Books:

1. "System Programming and Operating System" by D.M Dhamdhare 2nd edition
2. "Principle of compiler design" by Alfred V. Aho and Jeffery D. Ullman

ANALYSIS AND DESIGN OF ALGORITHMS

IT355

Unit I

Concepts of algorithm, asymptotic complexity, examples of analysis use of recurrence relation in analysis of algorithms, removal of recursion, heap and heap sort, disjoint set structure.

Unit II

Divide and conquer technique, analysis and design of algorithms base on this technique for binary search, merge sort, quick sort, selection problem matrix multiplication.

Unit III

Study of greedy strategy, solutions based on greedy strategy for knap sack problem, minimum spanning trees, scheduling problem, shortest paths optimal merge patterns. Concept of dynamic programming and problems based on this approach such as O/I knapsack problem, multi-stage graphs, shortest paths, travelling sales person problem, reliability design problem.

Unit IV

Depth-first search, breadth search, bi-connected components. Backtracking concept and its example like 8-queen's problem, Hamiltonian cycle problem, introduction to branch and its examples like 8-puzzle problem travelling sales-person problem.

Unit V

Binary search trees, height balanced trees, AVL trees, 2-3 trees, B-trees hashing. Introduction to lower-bound theory introduction to NP-Complete and NP Hard problems, examples of NP complete problem like Hamiltonian path and circuits, Eulerian paths and circuits etc.

EMBEDDED SYSTEM

IT401

Unit I

Hardware fundamentals:-Gates, timing diagram, memory, microprocessor, buses, DMA.
Interrupts:- Microprocessor architecture, interrupt basics, interrupt latency, shared data problem.
System partitioning, building the architectural model, Input and output processing, Hardware and software partitioning, Timing requirements

Unit II

Microprocessor selection, Microprocessor versus Micro-controller analysis CISC versus RISC
Study of major embedded processor architectures Memory system design. System optimization.
Architecture for embedded software:- Round robin, round robin with interrupts, function- queue-scheduling and real time operating system.

Unit III

Real time operating system:- Tasks and task states, task and data, semaphores and shared data. Operating system services:- Inter task communication, timer services, memory management, events and interaction between interrupt routines and real time operating system. Software selection issues, selecting an RTOS, RTOS performance metrics. RTOS scalability and tool support, Compiler selection.

Unit IV

Embedded system design using a real time operating system: Encapsulating semaphores and queues, hard real time scheduling considerations saving memory space.

Unit V

Development tools and debugging:- Host and target machines, linker/locators, target system, testing, instruction set, assert macro. Establishing a software development environment C runtime environments Embedded debuggers Cross-development methods Embedded file formats, readers Creating object files - the build process Loading software into remote targets

Books:-

1. "An Embedded Software Primer" by David E. Simon ISBN 0-201-61569-X
2. "Embedded Systems Design" by Arnold S. Berger ISBN 1-57820-073-3

Computer Graphics & Multimedia IT402

UNIT 1

Introduction to random graphics fundamentals, Display devices & comparison point plotting lines drawing & circle drawing & their algorithms like DDA & Bresenham's. 2-D Transformation, clipping .Windows graphics, view point.

UNIT 2

Video basic, Adapter Cards (MCA, CGA, EGA, VGA, etc) Graphics input output devices. Multimedia input and output technology .Pen input, video and image display system, images scanner .Digital Voice and audio, Digital camera, hardware for video image and animation, Full motion video hardware.

UNIT 3

Raster graphics , Character Displaying , Natural image , Solid Area Scan conversion Algorithms .Raster display hardware , Filling areas aliasing & anti-aliasing .Perspective View ,hidden surface elimination , Depth Algorithms , Scan line coherence Algorithm , Area coherent Algorithm etc Shading Devices , dragging , inking & painting.

UNIT 4

Curve generation methods and algorithms like B-Spline & Bezier curve methods, 3-D graphics, surface generation, 3-D clipping & transformation. Viewing transformations.

UNIT 5

Introduction to multimedia ,Elements of a multimedia system , Multimedia interface standards, data and file format standard .

Need for data compression ,compression techniques for binary image, color and grey and still video image . full motion video compression , audio compression Multimedia authoring system and tools.

Reference:

1. Principles of Interactive Computer Graphics by William M. Newman
2. Computer Graphics By D. Hern and M.P. Baker
3. Multimedia system design by Prabhat K Andleigh and Kiran Thakra (PHI Publications) .

ARTIFICIAL INTELLIGENCE

IT403

Unit I

Meaning and definition of artificial intelligence, various types of production systems, characteristics of production systems, study and comparison of breadth first search and depth first search techniques, other search techniques like hill climbing, best first search, A* algorithm, AO* algorithm etc, various types of control strategies.

Unit II

Knowledge representation, problems in representing knowledge, knowledge representation using propositional and predicate logic, resolution and refutation, deduction, theorem proving. Introduction to reasoning, various types of reasoning methods like forward, backward, monotonic, nonmonotonic, probabilistic reasoning, Baye's theorem, Bayesian network, fuzzy logic.

Unit III

Various types of slot and filler structures like semantic networks, frames, conceptual dependency, scripts etc.

Introduction to game playing, game playing techniques like minimax procedure, alpha beta cutoffs etc.

Unit IV

Planning, various types of planning techniques like goal stack planning, hierarchical planning etc, study of blocks world problem in robotics, understanding, natural language processing and common sense.

Unit V

Introduction to learning, various techniques used in learning, neural networks, applications of neural networks and expert systems.

Books

1. Artificial Intelligence by Elaine Rich and Kevin Knight, Tata McGraw Hill Edition.
2. Introduction to Artificial Intelligence by Eugene Charniak and Drew McDermott, Addison Wesley.
3. Principles of Artificial Intelligence by Nils J. Nilson.

**Bio-informatics
IT411(Elective III)****Unit I**

Introduction to Bioinformatics and Computational Genomics, Biological databases, Kinemages for biological structure, Dynamic Programming Sequence Alignment, BLAST, FASTA.

Unit II

3D structure computations, NMR, Xtallography , RNA secondary structure, Intro to Microarrays, review of structural genomics, Microarray Clustering and Classification, vector machine applications in Bioinformatics.

Unit III

Terminologies and Ontologies, Multiple Sequence Alignment, 1D Motifs, Algorithms and Databases, 3D structure alignment, MUSTA algorithm for geometric hashing and multiple alignment

Unit IV

Hidden Markov models, Molecular energetics and dynamics, Protein structure prediction, Genetic networks, Gene finding algorithms.

Unit IV

Comparative genomics algorithms, Genome Alignment, Phylogenetic algorithms , Natural Language Processing, Proteomics, 3D motifs & Final Thoughts

Text book: BioInformatics: Sequence and Genome analysis, 2ed, by David Mount, Cold Spring Harbor Laboratory Press.

FAULT TOLERANT AND REAL TIME SYSTEMS

IT412(Elective-I)

Unit I

Introduction to Real time system:- Definition, components of a real system, sensors and transducers, signal conditioning, computer input and output, the processor output conditioning and power control, actuators. Computer hardware requirements for real time systems, general purpose computer, CPU, memory, RAM, ROM, cache memory, DMA selection of memory, buses, computer input & output. Real time operating system:- Concepts, basic elements of an operating system, operating system facilities, real time operating systems, tasks and task scheduling, task synchronization and data transfer factors in selecting a real time operating system

Unit II

Design of a real time system:- Prelude to the design process:- General approach component, design Specifications, development environment, hardware development, system software. Analysis and design:- Analysis of required documents, response time specification on human interface, preliminary system design, block diagram, representation of control flow and data flow, Functional decomposition and relationship among them, modular design, estimation of cost, required development time, program length, execution time and required memory. Software Design:- Structured flowcharts, stepwise development and programming, testing the model.

Unit III

Selection of programming languages:- machine and assembly languages, limitations of assembly language, high level languages, advantages and disadvantages of high level languages, real time languages, choosing a language. Integrated assembly language components:- Processor background information required, Subroutine calls and returns, subroutine parameters, linking high and low level programs, Start up routines, computer interrupt system and service routines.

Unit IV

Interface and control:- Parallel input and output interface, D to A and A to D conversion interface, digital representation of analog voltage, full scale voltage, successive approximation A/D, dual slope A/D, flash converter, sample and hold circuit, the multiplexer, real time clock interfaces, direct memory access interface. Input systems:- Sensors with binary state supports, sensors that produces, continuous analog signals, signal conditioning circuits, transmission circuitry, bus compatible input systems. Output systems:-Output systems involving two-state actuators, output system with continuous actuators.

Unit V

Board-based microcomputer systems:- The back plane bus, address and data transfer lines, interrupt lines, microprocessor control lines, power supply lines, characteristics, boards or bus systems, CPU board, memory board, peripheral device controller and I/O board, selecting a bus system. Study of fault tolerant system:- Concept of fault tolerant in a system, different characteristics and features of fault tolerant systems.

PATTERN RECOGNITION

CSE413(Elective I)

Unit I

Introduction to pattern recognition, types of images, regular pattern, irregular pattern, fuzzy methods.

Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non supervised learning methods.

Unit II

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods.

Unit III

Boundary description detection, matching, merging segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

Unit IV

Explanation of how fuzzy approach can be applied to pattern recognition, classificatory analysis preprocessing, feature detection and primitive extraction, adaptive classification of fuzzy grammar.

Unit V

Algorithms for pattern recognition, neural network fundamentals, approaches for pattern recognition.

Advance Computer Architecture

IT414(Elective I)

Unit I

Introduction to parallel processing and pipelining, array computers, multiprocessor systems, dataflow diagrams and applications of parallel processors.

Unit II

Various types of pipeline processors like arithmetic pipelines, instruction pipelines etc., reservation table, design of various types of pipelines, instruction pre-fetching and branch handling in pipelines, data buffering and busing structures in pipelines.

Unit III

Meaning of instruction streams and data streams, classification of computers based on these as SISD, SIMD, MISD and MIMD, SIMD computer organization, various types of SIMD interconnected networks like static and dynamic networks, mesh-connected, networks, cube connected networks etc., SIMD matrix multiplication and parallel sorting algorithms.

Unit IV

Various types of array and associative processors, loosely and tightly coupled microprocessors, various types of interconnection networks like time shared or common bus, crossbar switch, multi-port memories etc.

Unit V

Control flow and data flow computers, data flow computers, data flow graphs and languages, static and dynamic data flow computers, systolic array architecture.

DISTRIBUTED SYSTEMS

IT421(Elective II)

Unit I

Introduction to distributed systems, examples of distributed systems, various types of system models, introduction to distributed objects, method of communication between distributed objects.

Unit II

Introduction to distributed file systems, various types of distributed file systems, file service architecture, design and implementation issues in distributed shared memory, various types of consistency models for distributed shared memory systems.

Unit III

Introduction to processes and threads, process states in distributed systems, clocks, various types of clocks, synchronization of processes using clocks, global states, introduction to distributed mutual exclusion, election of a process, multicast communication required for selecting a process to act as superior, consensus and related problems.

Unit IV

Transaction management in distributed systems, various types of transaction management methods, transaction recovery mechanisms, concurrency control, locks, timestamping, distributed deadlocks and methods to handle them.

Unit V

Protection and security in distributed systems, various types of security techniques, cryptographic algorithms and their pragmatics, use of digital signature methods for security enhancement.

Books

1. Distributed Systems Concepts and Design by George Coulouris, Jean Dollimore and Tim Kindberg, Pearson Education.

E-BUSINESS

IT422(Elective II)

Unit I

Evaluation of e-business:

Introduction to e-business, high technology, semiconductors, the internet, history development, characteristics, features, definition of EDI, e-commerce, e-business types, Web services, Web based market, Understanding and measuring the Digital Economy.

Unit II

E-business Architecture:

E-business Architecture, framework, characteristics, models, standardization, security issues-vulnerability management, threat management, Infrastructure Security.

Unit III

E-business plan and Strategies:

Fundamentals of e- business plans, types, features, importance, business logic, procedures, process, data integration, customer information, security, routing, approvals and reports. Introduction to e-business procurement, e-sourcing, e-marketplace, e-payment schemes.

Unit IV

E-business Application and Application development

CRM, SCM, ERP, sales CM, Financial Value Chain Management system, BPR its definition, characteristics, Tools of e-business application, search engines, portals, online shopping, ORM solutions, Web technologies: XML, plug-ins, JavaScript, Open source, Oracle e-business suite, IBM e-business suite, Micro Strategy, Silver line solutions etc.

Unit V

E-Business marketing strategies and knowledge management:

Internet marketing technologies, Web designs, content management Promotion mix, Virtual societies, localization, one to one marketing, Introduction to knowledge management and internet data using extended enterprise.

Books:

1. "E-Business (R) Evolution" by Daniol Amor
2. "E-Business 01/02 " by Robert W. Price
3. "E-Business: roadmap for Success" by Ravi Kalakota, Marcia Robinson, Don Tapscott

ADVANCE ALGORITHMS DESIGN & ANALYSIS

IT423(Elective II)

Contact Hours - Lectures - 3, Tutorial - 1

Unit 1: Introduction: - Computational Demands of Modern Science, Advent of Practical Parallel Processing, Parallel Processing Terminology.

Unit 2 and 3: PRAM Algorithms: - A model of Serial Computation, Pram model of Parallel Computation, Pram Algorithms, Parallel Reduction, Prefix Sums, list Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Coloring.

Unit 4: Sorting: - Enumeration Sort, Lower Bounds on Parallel Sorting, Odd Even Transposition Sort, Bitonic Merge Sort, Parallel Quick Sort.

Unit 5: Graph Algorithms: - Searching a Graph, Breadth First Search, Breadth Depth Search, Connected Components, All Pairs Shortest Paths, Minimum Cost Spanning Tree.

Unit 6: Processor Organizations: - Mesh Networks, Binary Tree Networks, Hyper Cube Networks, Butterfly Networks, Hyper Tree Networks, Cube Connected Cycles, Shuffle Exchange Networks, de Bruijn Networks.

References:

Parallel Algorithms by Joseph Jaja.

Object Oriented Analysis & Design

IT424(Elective III)

UNIT 1

Overview of Object Oriented concepts : Objects and classes , abstraction , generalization and inheritance , encapsulation , multiple inheritance, aggregation .abstraction classes , polymorphism , link and association , Need for object oriented approach

UNIT 2

System design life cycle , object oriented s/w development process model , Object Oriented Analysis , object Modeling Technique (OMT): object model, function model, relationship among models , object diagrams , state diagrams , data flow diagrams , analysis

UNIT 3

Object oriented Design : Overview of object design , Combination the models , Designing algorithms , design optimization , Implementation of control , Adjustment ,Design of association , object representation , physical packaging. Documenting design decision , comparison of use case driven approach – Responsibility driven design

UNIT 4

Translation OO design into implementation , characterization of object oriented languages : Comparison of object oriented language like smart talk, Eiffel , CLOS ,C++,JAVA ,object programming : An overview of C++ programming , Loops and decision , Structure and functions , object and classes , arrays and pointing , inheritance , virtual functions files and stream

UNIT 5

Unified Modeling Language (UML) : Class diagram – sequence diagram – Use case diagram – Collaboration diagram –state chart diagram – Activity diagram–component diagram –deployment diagram
Object oriented Database :Relational Vs .object oriented database , the architecture of object oriented database , query language for OO database , gemstone /02/orion\

Book References:

- Object oriented Modeling and design by Rumbaugh , PHI
- Object Oriented Design with Application By Grady Booch
- OOP in C++ by Lafore, Galgotia Pub.
- Modern database system by Kim W ,ACM press ,Addlson Wesley
- Unified Modeling Language References Manual by James Rumbaugh et.al.

ARTIFICIAL INTELLIGENCE CSE354 /IT403

Unit I

Meaning and definition of artificial intelligence, various types of production systems, characteristics of production systems, study and comparison of breadth first search and depth first search techniques, other search techniques like hill climbing, best first search, A* algorithm, AO* algorithm etc, various types of control strategies.

Unit II

Knowledge representation, problems in representing knowledge, knowledge representation using propositional and predicate logic, resolution and refutation, deduction, theorem proving.
Introduction to reasoning, various types of reasoning methods like forward, backward, monotonic, nonmonotonic, probabilistic reasoning, Baye's theorem, Bayesian network, fuzzy logic.

Unit III

Various types of slot and filler structures like semantic networks, frames, conceptual dependency, scripts etc.
Introduction to game playing, game playing techniques like minimax procedure, alpha beta cutoffs etc.

Unit IV

Planning, various types of planning techniques like goal stack planning, hierarchical planning etc, study of blocks world problem in robotics, understanding, natural language processing and common sense.

Unit V

Introduction to learning, various techniques used in learning, neural networks, applications of neural networks and expert systems.

Books

1. Artificial Intelligence by Elaine Rich and Kevin Knight, Tata McGraw Hill Edition.

2. Introduction to Artificial Intelligence by Eugene Charniak and Drew McDermott, Addison Wesley.
3. Principles of Artificial Intelligence by Nils J. Nilson.

INTERNET TECHNOLOGY

IT451

Unit I

Internetworking :- Concept, Architecture and Protocols. IP Addressing scheme, Routers and IP addressing principles, Binding protocol address (ARP). IP Datagrams and Datagram forwarding. IP encapsulation. Fragmentation and reassemble, IPv6- motivation, frame format and addressing.

Unit II

Internet Control Message Protocol :-Introduction and usage for testing reachability, route tracking, MTU determination, TCP introduction, application, segment format.

Unit III

Domain name system:- Introduction, DNS Client server Model, Server hierarchy, server architectures, optimization of DNS performance, DNS entry types, electronic mail paradigm ,message format, SMTP, Mail Gateways, Mailbox access, FTP commands, Filename translation examples, TFTP, NFS.

Unit IV

World Wide Web:- Introduction, HTML format, Client-server interaction, Browser architecture, CGI, Java techniques for Dynamic Web documents, Network Management :- SNMP, NMS.

Unit V

Network security, protocol startup procedure, BOOTP, DHCP, Intranet contents, security aspects, hardware software features, setting up internet site and troubleshooting, Extranet.

Books:

1. "Computer Networks and Internet" by D.E.Comer
2. "Internet" by Coleman & Dyson

NETWORK SECURITY

IT452

Unit I

Introduction to Network security. Network security needs. Threats to network security. Effect of Virus on Network security. Modern security management, goals of network security, sources of danger, elements of a security plan. Types of computer criminal, types of computer crime-scavenging, leakage, wire tapping etc.

Unit II

Controlling physical access: kind of computer security. Role of physical security. Weakness of physical security. Types of identification badges, types of badges. Site security factors.

Desktop security:- challenges of PC security. Desktop security techniques:- physical security & procedural methods. Procedural steps for PC. Protecting data- hardware & software problems & their solutions.

Unit III

Building security procedures:- role of procedural security, security goals, keys to security procedures. Organizational controls:- personnel, programming & operating. Security training & its objectives. Role of password in network security. strength & weakness of password. Administering a password system.

Unit IV

Hardware & Software security:- role of technical security, types of technical security, technical security goals, technical security applications, Data Encryption. LAN security, challenges of securing networks, technical security for LANs, NetWare security system. Firewalls. Filters- Junk Email Filters, Web Filters.

Unit V

Enterprise network security, building an Enterprise security plan, major security functions for networks, principles of network security. hardware security for network. Principles of Database security. Role of Encryption:- private & public key encryption, protecting identity, verification, digital signature, access authorization principles, range of capabilities, composite authorizations.

Books :-

1. “ Network Security” by Richard H. Baker
2. “ Information Warfare & Security” by Dorothy E. Denning

NEURAL NETWORKS **CSE 461(Elective-III)**

Unit I

Introduction to neural networks, working of a biological and an artificial neuron, neural network architectures, single and multi-layer neural networks, perceptron, linear separability, perceptron training algorithm, backpropagation algorithm.

Unit II

Adalines, madalines, adaptive multi-layer networks, prediction networks, radial basis functions, polynomial networks and regularization.

Unit III

Difference between supervised and unsupervised learning, winner takes all networks, counter-propagation networks, adaptive resonance theory, neocognitron, Hopfield networks, Boltzmann's training.

Unit IV

Various types of optimization methods like gradient descent, simulated annealing etc, bi-directional associative memory networks.

Unit V

Introduction to fuzzy logic, neuro-fuzzy systems, applications of neural networks.

Books

1. Elements of artificial neural networks by Kishan Mehrotra, Chilukuri K. Mohan and Sanjay Ranka.
2. Neural networks and fuzzy systems by Bart Kosko, Prentice Hall of India.
3. Fundamentals of artificial neural networks by Mohammad H. Hassoun, Prentice Hall of India.

DIGITAL IMAGE PROCESSING

CSE 462(Elective-III)

Unit I

Introduction to Image Processing Systems, Digital Image Fundamentals:- Image model, Relationship between Pixels, Imaging geometry, Camera model.

Manipulation on Images:- Images transformation : Introduction to FT, DFT and FFT. Walsh transformation, Hadamard transformation, Hotelling transformation, Histogram.

Unit II

Image Smoothing:- Neighborhood Averaging, Median Filtering, Low Pass Filters, Average of Multiple Images, Image Sharpening by Differentiation Technique, High Pass filtering.

Image Restoration:- Degradation models for continuous function, effect of diagonalization, on-degradation, algebraic approach to restoration, interactive restoration, Gray level interpolation.

Unit III

Image Encoding and Segmentation:- Encoding, Mapping, Quantizer and Coder.

Segmentation:- Detection of discontinuation by point detection, line detection, edge detection.

Unit IV

Edge linking and boundary detection:- Local analysis, global by graph, theoretic techniques.

Thresh-holding:- definition, global thresh-holding.

Unit V

Filtering:- median, gradient, simple method of representation signatures, boundary segments, skeleton of region.

Books:-

1. "Digital Image Processing" by Gonzalez & Wood
2. "Digital Image Processing" by A.K.Jain

SOFTWARE REUSABILITY

CSE 463(Elective III)

Unit I

Introduction to Software reuse: Software reuse success factors

Re-use driven software engineering: Business characteristics of reuse business.

Architect components & applications, Software engineering process.

Unit II

Architectural style: Object oriented software engineering, Application and component systems, 'Use case' components, Object components, Layered architecture.

Unit III

Processes: Object oriented business engineering, Processes & organization of the Reuse Business match architecture, Application Family Engineering.

Unit IV

Component System Engineering & Application System Engineering:

Analyzing requirements, Performing robustness analysis, Designing, Implementing, Testing and Final Packaging of the component system, Expressing system engineering in terms of workers.

Unit V

Organizing a Reuse business:

Transition to a Reuse business, Managing the Reuse business, Making the Reuse business work.

Books :-

1. "Software Reuse" by Ivar Jacobson, Martin Griss, Patrik Jonsson

MOBILE COMPUTING

IT471

Unit I

Introduction to wireless technology, comparison of wired and wireless mechanism, various types of wireless communication technologies used in Mobiles, Antennas etc. Concept of spread spectrum, various types of spread spectrum, spreading sequences.

Unit II

Introduction to wireless networking, cellular wireless networks, TDMA, CDMA, working of a cordless system, wireless local loops.

Unit III

Introduction to Mobile-IP, wireless access protocols, various types of wireless LAN technologies like infrared, microwave LANs etc.

Unit IV

IEEE standards for wireless LANs, various types of Blue tooth specifications and protocols.

Unit V

Introduction to VoIP, wireless VoIP solution, procedures, message flow etc. Introduction to WAP, WAP protocols.

Books:-

1. "Wireless Communication and Networks" by William Stallings, 1st edition.
2. "Wireless and Mobile Network Architectures" by Yi-Bing Lin and Imrich chlamtac

Random Algorithms

IT472 Elective IV

Introduction, A min-cut algorithm, Las Vegas and Monte Carlo, Binary planar partition, A probabilistic recurrence, Computational models and time complexity.

Markov Chains and Random Walks: A 2-sat example, Markov chains, Random Walks on graphs, Cover times, Graph connectivity.

Random Data Structure : The fundamental data structure problem, Treaps, skip lists, Hash tables, Hashing with $O(1)$ time.

Geometric algorithms and Linear programming:

Randomized incremental construction, Convex Hulls in the plane, Duality, Half space Intersection, Delanuy triangulation, Trapeziodal decomposition, Binary Space partition, The diameter of point set, Random sampling, Linear programming.

Graph algorithms: All pairs shortest paths, The min cut problem, Minimum Spanning tree,

Parallel and Distributed Computing: The PRAM Model, Sorting on a PRAM, Maximal independent sets, Perfect Matching, The choice coordinate problem, Byzantine Agreement.

References:

Randomized Algorithm by Motwani and Raghavan, Cambridge press.

DISTRIBUTED DATABASE SYSTEMS

IT473(Elective IV)

Contact Hours - Lectures - 3, Tutorial - 1

Introduction to distributed databases, comparison of distributed and centralized systems, DDBMS, global relations, fragment and physical image, types of schemas, methods of fragmentation of a relation, levels of transparency in a distributed system, integrity constraints.

Representation of database operation in form of a query, operation in form of a query, operations on a query, unary and binary tree in a query, converting a global query into fragment query, join and union operations involving a query, aggregate functions, parametric queries.

Introduction to query optimization, estimation of profiles of algebraic operations, optimization graphs, reduction of relation using semi-join and join operation.

Properties and goals of transaction management, distributed transactions, recovery mechanism in case of transaction failures, log based recovery, check pointing, communication and site failures in case of a transaction and methods to handle them, serializability and timestamp in distributed databases.

Introduction to distributed deadlocks, local and global wait for graphs, deadlock detection using centralized and hierarchical controllers, prevention of deadlocks, 2 and 3 phase locking and commitment protocols, reliability in commitment and locking protocols, reliability and concurrency control, reliability and removal of inconsistency.

Distributed database administration, authorization and protection in distributed databases, distributed database design, heterogeneous database system.

Books:

1. Distributed Databases Principles and Systems by Stefano Ceri and Guisepppe Pelagatti, McGraw-Hill International Editions.