# COTTON COLLEGE STATE UNIVERSITY

DEPARTMENT

OF

COMPUTER SCIENCE & INFORMATION TECHNOLOGY

## Master of Computer Application (MCA) Syllabus

DISTRIBUTION OF PAPERS/CREDITS (L+T+P FORMAT)

| SEMESTER I | | | |
|---|---|---|---|
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-701C | Programming in C | 3+1+0 | 4 |
| MCA-702C | Digital Logic | 3+1+0 | 4 |
| MCA-703C | Mathematical Foundation of Computer Science | 3+1+0 | 4 |
| MCA-704C | Accountancy and Financial Management | 3+1+0 | 4 |
| MCA-705L | Lab-I | 0+1+2 | 3 |
| **SEMESTER II** | | | |
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-801C | Data Structure | 3+1+0 | 4 |
| MCA-802C | Object Oriented Programming using C++ | 3+1+0 | 4 |
| MCA-803C | System Programming | 3+1+0 | 4 |
| MCA-804C | Formal Languages and Automata Theory | 3+1+0 | 4 |
| MCA-805L | Lab-II | 0+1+2 | 3 |
| **SEMESTER III** | | | |
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-901C | Operating System | 3+1+0 | 4 |
| MCA-902C | Database Management System | 3+1+0 | 4 |
| MCA-903C | Design and Analysis of Algorithm | 3+1+0 | 4 |
| MCA-904C | Computer Organization and Architecture | 3+1+0 | 4 |
| MCA-905L | Lab-III | 0+1+2 | 3 |
| **SEMESTER IV** | | | |
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-1001C | Computer Networks | 3+1+0 | 4 |
| MCA-1002C | Web Technology | 3+1+0 | 4 |
| MCA-1003C | Software Engineering | 3+1+0 | 4 |
| MCA-1004L | Lab-IV | 0+1+2 | 3 |
| | Elective-I<br>(an elective paper will be offered by the department from the list of elective papers) | 3+1+0 | 4 |

| SEMESTER V | | | |
|---|---|---|---|
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-1101C | Compiler design | 3+1+0 | 4 |
| MCA-1102C | Information storage and retrieval | 3+1+0 | 4 |
| MCA-1103P | Minor Project | 0+1+2 | 3 |
| | Elective-II<br>(an elective paper will be offered by the department from the *list of elective papers*) | 3+1+0 | 4 |
| | Elective-III<br>(an elective paper will be offered by the department from the *list of elective papers*) | 3+1+0 | 4 |
| **SEMESTER VI** | | | |
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-1201P | Major Project | 0+0+20 | 20 |

| LIST OF ELECTIVE PAPERS | | | |
|---|---|---|---|
| **Paper Code** | **Paper Name** | **L-T-P** | **Credit** |
| MCA-1301E | Computer Graphics | 3+1+0 | 4 |
| MCA-1302E | Digital Image Processing | 3+1+0 | 4 |
| MCA-1303E | Advance Database Management System | 3+1+0 | 4 |
| MCA-1304E | Graph Theory | 3+1+0 | 4 |
| MCA-1305E | Machine Learning | 3+1+0 | 4 |
| MCA-1306E | Distributed Computing | 3+1+0 | 4 |
| MCA-1307E | Mobile Computing | 3+1+0 | 4 |
| MCA-1308E | Network Security and Cryptography | 3+1+0 | 4 |
| MCA-1309E | Data Mining | 3+1+0 | 4 |
| MCA-1310E | Computer Oriented Numerical Methods | 3+1+0 | 4 |
| MCA-1311E | Optimization Techniques | 3+1+0 | 4 |
| MCA-1312E | Parallel Algorithm | 3+1+0 | 4 |
| MCA-1313E | Computational Geometry | 3+1+0 | 4 |
| MCA-1314E | Advanced Computer Architecture | 3+1+0 | 4 |
| MCA-1315E | Wireless Network | 3+1+0 | 4 |
| MCA-1316E | Speech Processing | 3+1+0 | 4 |
| MCA-1317E | Multimedia System | 3+1+0 | 4 |
| MCA-1318E | Pattern Recognition | 3+1+0 | 4 |
| MCA-1319E | Artificial Intelligence | 3+1+0 | 4 |

| MCA 701C | Programming in C | 3+1+0=4 |
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**UNIT I: Algorithm [6 Lectures]**

Problem solving approaches: pseudocode, flowchart, algorithm, decision table; bottom-up and top down design strategies, notations of flowchart and algorithm, design and analysis of algorithms.
Asymptotic notations: Definitions, physical representation, performance study and comparative analysis.

**UNIT II: Computer programming language [6 Lectures]**

Artificial vs. natural language, constructed vs. computer language, definition of computer language, how they differ from natural languages, History of computer language, different dimensions and classifications of computer language – high, middle and low level languages; procedural vs. object oriented languages; scripting vs. mark-up languages; functional vs. logic programming languages; syntax and semantics.

**UNIT III: Basics of C – Language [8 Lectures]**

History, constant and variable, data types – primitive and user define; statement and expression; operators, hierarchy of operators and associativity, creation and evaluation of expressions; preprocessor directives, header files, macro, standard C library functions; control structures - decision making and loop; use of break, goto and continue statement.

**UNIT IV: Array and pointer [10 Lectures]**

Array: representation of array – one dimensional, two dimensional and multi-dimensional; passing array elements to a function.
Pointer: pointer and address, pointer arithmetic, pointer array, pointer and function argument
Storage class: automatic, external, static, register, scope and lifetime of variables.

**UNIT V: Functions [8 Lectures]**

Function definition, Declaration and prototypes, Call by Value and Call by Reference, Recursion.

**UNIT VI: Structures and Files [10 Lectures]**

Structure: declaration and use, member resolution operator – structure and structure pointer, arrays of structures.
File operations: opening, closing, reading and writing of files, seeking forward and backward.

**Recommended Books:**


1. G. Dromey, How to solve it by computer, PHI.
2. Byron Gottfried, Programming with C, TMGH.
3. Dennis Ritchie, ANSI-C Programming.
4. Yashavant Kanetkar, Let us C
5. E. Balaguruswamy, Programming in C
6. Reema Thareja : Introduction to C Programming

| MCA 702C | Digital Logic | 3+1+0=4 |
|---|---|---|

**UNIT I: Data Representation [9 Lectures]**

Data encoding: BCD, EBCDIC, ASCII, ISCII, Unicode; Number system: Decimal, binary, octal, hexadecimal and their inter-conversion; Sign data representation; 1's and 2's complement; Binary arithmetic – addition, subtraction and multiplication; Floating point representation and arithmetic.

**UNIT II: Digital Logic [9 Lectures]**

Boolean algebra, Theorems and postulates, de Morgan's theorem, Boolean identity, Duality theorem.
Logic gates: OR, AND, NOT, NAND, NOR, XOR and XNOR.

**UNIT III: Reduction Techniques [10 Lectures]**

Standard representation of Boolean expressions, SOP and POS forms, minterm and maxterm expressions, reduction techniques – Karnaught map, Quine McCluskey method and algebraic simplification.

**UNIT IV: Combinational circuits [10 Lectures]**

Concept and definitions; adders, encoder, decoder, multiplexer, demultiplexer; case study of read only memory and programmable logic array.

**UNIT V: Sequential circuits [10 Lectures]**

Concept and definitions; flip flop – SR, JK, D and T, master-slave and edge triggered; latches; case study of register, counter and random access memory.

**Recommended Books:**

1. Digital Logic and Computer Design, M. M. Mano, PEARSON.
2. Digital Computer Electronics: Malvino; Tata McGraw Hill.

| MCA 703C | Mathematical Foundation of Computer Science | 3+1+0=4 |
|---|---|---|

**Unit I: Sets, Relations and Functions [10 Lectures]**

Sets, set operations; binary relations, types of relations, partitions; partial order relations, Hasse and lattice diagrams for posets; functions, types of functions, composition of functions.

**Unit II: Algebraic Structures [12 Lectures]**

Semi groups, products and quotients of semi groups; groups, cosets, normal subgroups, quotient groups, Lagrange's Theorem, products of groups; use of groups in coding of binary information and error detection, decoding and error correction.

**Unit III: Combinatorics, Recurrence Relations [12 Lectures]**

Combinatorics and Recurrence Relations: Permutation and combination, principles of counting and enumeration; recurrence relations, the Fibbonacci sequence, solutions of recurrence relations by substitution and generating functions, solution of non-recurrence relations by conversion to linear recurrence relations.

**Unit IV: Introduction to Graph Theory [14 Lectures]**

Graph Theory: Introduction to graphs, representation of graphs, graph isomorphisms, subgraphs, directed and undirected graphs; Euclidean paths and circuits; Hamiltonian paths and circuits; colouring graphs.

**Recommended Books:**


1. Discrete mathematics, S Santha, Cengage learning
2. Discrete mathematical structures with application to Computer Science, Tremblay and Manohar, McGraw Hill
3. Discrete mathematics, Veerarajan, TMGH

| MCA 704C | Accountancy and Financial Management | 3+1+0=4 |
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**Unit I: Introduction to Accounting [10 Lectures]**

Utility of Accounting in business enterprises, Double entry system of accounting, accounting equation, accounting principle concepts and conventions, journal, ledger, trial balance, cash book (single, double and triple column).

**Unit II: Final Accounts and Statements [12 Hours]**

Distinction between capital and revenue expenditure, construction of trading, profit and loss accounts and balance sheet of sole proprietorship concerns with adjustments, manufacturing account, simple problems on final accounts of companies.

Preparation of Income and Expenditure account and balance sheet (from receipts and payments account) with common adjustments for non trading institutions.

**Unit III: Techniques of costing [10 Hours]**

Definition of costing and cost accounting, classification of cost, Marginal costing – Basic concepts, break-even analysis, construction of break-even chart, problems on marginal costing, application of marginal costing in decision-making.

**Unit IV: Financial management [8 Hours]**

Financial Statement Analysis- Ratio Analysis – Meaning, Advantages, limitations and types of ratios and their usefulness, simple problems on ratio analysis. Fund Flow Analysis- preparation of statement of changes in working capital, preparation of fund flow statement.

**Unit V: Budget [8 Hours]**

Budget – Different types of budget, Theoretical concept, preparation of flexible budgets and cash budgets.

**Recommended books**


1. Lal, J., Accounting for Management, Mumbai: Himalaya Publishing House
2. Juneja, C. M.; R. C. Chawla; K. K. Saksena, Double Entry Book Keeping(Sixth Edition), Ludhiana: Kalyani Publishers, 1994
3. Jain, S.P.; K. L. Narang, Cost Accounting (Thirteen Edition), Ludhiana: Kalayani Publishers, 1995
4. Shukla; Grewal; Gupta, Advanced Accounts, New Delhi: S. Chand & Sons, 2005
5. Jain; Narang, Advanced Accountancy, Ludhiana: Kalyani Publishers, 1995

| MCA 705L | Lab-I | 0+1+2=3 |
|---|---|---|

*Laboratory work related with PGMCA 7.1 - Programming in C*

Course instructor will assign a list of problems to solve using C programming language. Design suitable algorithm and draw flowchart against each problem.

| MCA 801C | Data Structure | 3+1+0=4 |
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**UNIT I: Introduction [12 Lectures]**

Data Definition, Data Object, Data Types, Built-in Data Type, Derived Data Type, Data Structure and Implementation, Abstract data types.

Array - as Data Structure, insertion and deletion in an array, Storage Representation of Arrays, Applications of Arrays, Polynomial Representation Using Arrays, insertion and deletion operations in an array.

Linked List: Singly, circular, doubly, doubly & circular.

Stack: Representation using array & linked list; operations - push, pop, recursion.

Queue: Representation using array & linked list; operation - insert, delete; circular queue, deque, priority queue implementation

Conversion from infix: to postfix, evaluation of postfix expression;

**UNIT II: Trees [9 Lectures]**

Terminologies, traversal algorithms (preorder, postorder, inorder).

Implementation of binary search tree, threaded tree (one way & two way), AVL tree-balancing

B tree - introduction, operation - insertion, deletion.

**UNIT III: Graph [9 Lectures]**

Introduction**,** Graph Representation, Adjacency Matrix**,** Adjacency List**,** Graph Traversals**,** Depth First Search**,** Breadth First Search, Spanning trees.

**UNIT IV: Hashing [9 Lectures]**

Hashing- definition; functions- midsquare, folding, remainder, collision resolution & linear probing.

**UNIT V: Searching and Sorting [9 Lectures]**

Linear search, Binary search, Hashing method, Hashing functions, Insertion sort, selection sort, Bubble sort, Merge sort , Heap sort, Quick sort, Radix sort.

**Recommended Books:**


1. S. Liptsuz: Data Structure
2. M.T. Goodrich, R. Tamassia and D. Mount: Data Structures and Algorithms in C++, John Wiley & Sons, Inc.
3. Aho, Hopcroft and Ullman:Data Structures and Algorithms, Addision Wesley Publishing Co.

| MCA 802C | Object Oriented Programming using C++ | 3+1+0=4 |
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**UNIT I: Introduction to object oriented programming [5 Lecctures]**

Concepts, Need for OOP, Characteristics of OOP: Data hiding, Data encapsulation, Class, Objects, Inheritance, Polymorphism. Advantage of OOPs over other programming methodologies.

**UNIT II: C++ Programming basics [5 Lectures]**

Getting started with C++ syntax, operators, flow control, simple functions, recursion, library functions, Arrays, pointers, structures, namespace scope, string, iostreams .

**UNIT III: Abstraction mechanisms and Pointers [14 Lectures]**

Classes and Objects, data members and member functions, private, public construction, visibility modes, member function definition inside and outside class, Inline functions, Friend functions. Arrays within a class, Static members, scope of class and its members. Constructors and Destructors, Constructor overloading, Copy constructors, default constructor.
Inheritance: Base and derived classes, Types of inheritance, ambiguity, virtual base classes, constructors in derived classes.
Polymorphism: Operator overloading, assignment operator, function overriding, Virtual functions.

**UNIT IV: Template and Exception handling [10 Lectures]**

Templates: string template, instantiation, template parameters, type-checking, function templates, template argument deduction, specifying template arguments, function template overloading, default template arguments, specialisation, conversions.
Exception handling: Error handling, grouping of exceptions, catching exceptions, catch all, re-throw, resource management, auto ptr, exceptions and new, resource exhaustion, exceptions in constructors, exceptions in destructors, uncaught exception, standard exceptions.

**UNIT V: Pointers and Files [8 Lectures]**

Memory management: new, delete, Pointers to objects, this pointer.
Files and streams: Stream class, I/O operators, File pointers and their manipulation, Sequential files, random access files.

**UNIT VI: Object Oriented Design [6 Lectures]**

Over view of object oriented designing (concepts), steps involved in object oriented designing, advantages of OOD, what is modeling, why modeling is required, UML, different views captured by UML diagrams, Use Case diagram (actors, generalization, association, include dependency, extend dependency etc.),organization of use cases, Use Case Packaging, constraints in use case models, how to find out actors, use cases and use case relationships, Class diagrams, representations, association and links, aggregation, composition, dependency, constraints, interaction diagrams.

**Recommended Books:**


1. E. Balagurusamy: Object Oriented Programming with C++
2. Olshevsky: Revolutionary Guide to Object Oriented Programming Using C++, SPD/WROX
3. Samanta: Object-Oriented Programming With C++ & JAVA, PHI
4. Wu: Object Oriented Programming with JAVA, TMH
5. Doke: Object Oriented Application Development using JAVA
6. Grady Booch: OBJECT Oriented Analysis and Design, Pearson Education.

| MCA 803C | System Programming | 3+1+0=4 |
|---|---|---|

**UNIT I: The general overview [12 Lectures]**

Definition of operating system, working strategy; Definition and classification of system software; case study of translator program – assembler, interpreter and compiler; case study of UNIX/Linux operating system – kernel, shell and application program, internal representation of files, I-node, file attributes, buffering, system calls.

**UNIT II: Linux Utilities [12 Lectures]**

Debugger: Types, features, case study of sdb/dbx and an IDE debugger.
Editors: Type, structure, case study of vi and sed.
Backup, text processing and disk utilities make, rcs, grep, awk, tr, tee.

**UNIT III: Assembly Language Programming [12 Lectures]**

Structure and syntax of Assembly language, Data representation, instruction formats, addressing techniques, flow control, segments – data segment, code segment, stack segment, procedures, input/ output, interrupts and program development in 8085.

**UNIT IV: Shell Programming [12 Lectures]**

Features, environmental variables, options, command history, command execution process, basic script concepts, expressions, decision making, selections, conditional and looping statements, case statements, parameter passing and arguments, repetition, special parameters and variables, changing positional parameters, argument validation, debugging scripts.

**Recommended Books:**


1. D M Dhamdhere : Systems Programming and Operating Systems, TMG
2. S. Chattopadhyay: System Software, PHI
3. A. Forouzan and R. F. Gilberg: Unix and shell Programming Behrouz, Ceneage Learning India Pvt Ltd
4. R. Thomas and J. Yates: A User Guide to The UNIX System, Osborne McGraw-Hill
5. Robert Love : Linux System Programming, O'Reilly

| MCA 804C | Formal Languages and Automata Theory | 3+1+0=4 |
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**UNIT I: Theory of Automata [8 Lectures]**

Alphabets, languages, and grammars. Deterministic and nondeterministic finite automata (DFAs and NFAs):equivalence of DFAs and NFAs, minimization of DFAs. Regular Languages: regular expressions.

**UNIT II: Regular Sets & Regular Grammars [10 Lectures]**

Myhill-Nerode theorem, regular grammars, closure properties of regular languages, Pumping lemma, decidable properties of regular languages.

**UNIT III: Context free languages [8 Lectures]**

Context free grammars (CFGs): derivations, derivation trees, ambiguous grammars, inherently ambiguous languages, normal forms of CFGs: Chomsky Normal Form and Greibach Normal Form.

**UNIT IV: Pushdown automata (PDAs) [12 Lectures]**

Deterministic and nondeterministic PDAs (DPDAs and NPDAs), deterministic CFLs, LL (k) and LALR grammars, closure properties of CFLs, Pumping lemma and Ogden's Lemma, decidable properties of CFLs, Context sensitive languages: context sensitive grammars, linear bounded automata.

**UNIT V: Turing machines [10 Lectures]**

Definition, Designing of Turing machine, computable function, Church's hypothesis, Recursively enumerable languages: unrestricted grammars.

**Recommended Books:**


1. An introduction to Formal Languages and Automata, Peter Linz, Narosa.
2. Introduction to Automata Theory, Languages and Computation, Hopcroft and Ullman, Addison Wesley.
3. K. L. P. Mishra, N. Chandrasekaran; Theory of Computer Science (Automata, Languages and Computation), P. H. I.
4. T. H. Cormen, SC. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Tata-Mcgraw Hill Publishers.

| MCA 805L | Lab-II | 0+1+2=3 |
|---|---|---|

*Laboratory work related with PGMCA 8.1- Data Structure*

1. Search an element in a two dimensional array
2. Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.
3. Perform following operations on tables using functions only - Addition, Subtraction, Multiplication, Transpose.
4. Use iteration and recursion concepts for quick sort.
5. Implement various operations on strings.
6. Swap two numbers using call by value and call by reference strategies.
7. Implement Linked List, Circular and Doubly Linked Lists and perform operations such as insert, delete, update and reverse.
8. Implement Stacks and Stack application, Queues
9. Write a program to simulate various sorting and searching algorithms: Linear Search, Binary Search and Hashing. Selection Sort, Insertion Sort, Bubble Sort, Merge Sort, Heap Sort, Quick Sort, Radix Sort, and Merge-Sort.
10. The course instructor may assign additional questions if s/he feels necessary.

*Laboratory work related with PGMCA 8.2 - Object Oriented Programming*

1. Program on concept of classes and objects.
2. Programs on use of memory management.
3. Programs using polymorphism – i) operator overloading ii) Dynamic binding
4. Programs on use of operator overloading.
5. Programs on exception handling and use of templates.
6. Programs on file handling in C++.
7. Design problem on stock and accounting of a small organization, railway reservation, payroll preparation and optimization problem.
8. The course instructor may assign additional questions if s/he feels necessary.

*Laboratory work related with PGMCA 8.3 – System programming*

1. Course instructor will assign a list of problems to solve using shell script, sed and awk.
2. Course instructor will assign a list of problems to solve using Assembly language.

| MCA 901C | Operating System | 3+1+0=4 |
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**UNIT I: Introduction [4 Lectures]**

Operating systems overview: Operating systems as an extended machine & resource manager, operating systems classification; Operating systems and system calls; Operating systems architecture.

**UNIT II: Processes [6 Lectures]**

Process Concept, Thread, design issues of thread, user space thread and kernel space thread; Usage of thread; Process states, Operation on Processes - creation and termination. Implementation of process - process table

**UNIT III: Process Synchronization [6 Lectures]**

Race condition, Critical-Section, mutual exclusion. Solution to race condition and synchronization: - disabling interrupt, test-and-set-lock, Peterson's solution, semaphore, mutex, monitor, message passing;

**UNIT IV: Scheduling [6 Lectures]**

Basic concepts, preemptive and non-preemptive scheduling, scheduling algorithms; types of scheduling- batch, interactive and real-time; goals of scheduling algorithms. FCFS, SJF, RR, priority, multiple queues, and three-level scheduling.

**UNIT V: Deadlocks [6 Lectures]**

System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock; banker's algorithm

**UNIT VI: Memory management [8 Lectures]**

Multiprogramming, address binding (relocation) and protection. swapping, virtual memory - logical versus physical address space,paging, page fault, page table and its entries, demand paging, multi-level page table, TLB, its entries and working; Page replacement algorithms - LRU, optimal, NRU, FIFO, second chance, clock, NFU; Working set; What is segmentation, what are its benefits and drawbacks

**UNIT VII: File system [6 Lectures]**

What is file, file naming, file types(directory, regular, device), sequential access and random access files, file attributes, operations on file, hierarchical directory structure, path name(relative and absolute), operation on directories, disk layout, disk partition, file system layout, disk block allocation-contiguous allocation linked list allocation, FAT, i-nodes, directories in UNIX, file system security

**UNIT VIII: I/O management [6 Lectures]**

Basic principles and overall structure of I/O management subsystem, Device controllers, layers of the I/O subsystem - interrupt handlers device driver, device independent I/O software and user space I/O software.

**Recommended Books:**


1. Modern Operating System, Tanenbaum, PHI Publication.
2. Operating System by Galvin
3. G. Nutt Operating Systems: A Modern Perspective, Pearson Education.
4. W. Stallings Operating Systems, Prentice Hall of India.

| MCA 902C | Database Management System | 3+1+0=4 |
|---|---|---|

**UNIT I: Basic Concepts [6 Lectures]**

Data modeling for a database, abstraction and data integration, three level architecture of a DBMS, overview of relational, network and hierarchical data models. Overview of DBMS software framework: MySql, Oracle.

**UNIT II: Database Design [10 Lectures]**

Entity Relationship model, Extended Entity Relationship model. Relation, integrity constraints, relational algebra, relational domain & tuple calculus, conversion of ER diagrams to relations.

**UNIT III: Structured Query Language [8 Lectures]**

DDL, DML, Views, Embedded SQL.

**UNIT IV: Relational Database Design Concepts [8 Lectures]**

Functional dependencies, determining keys; normalization – $1^{st}$, $2^{nd}$, $3^{rd}$, BCNF, $4^{th}$ and $5^{th}$ normal forms, lossless join and dependency preserving decomposition.

**UNIT V: Transaction Processing concepts [10 Lectures]**

Transactions, Serializability, Concurrency Control Techniques, locking protocols, 2PL, Timestamp based protocols.
Recovery Techniques and protocols. Brief overview of object relational databases, client-server models, distributed databases, Spatial and temporal databases, deductive databases, multimedia databases.

**UNIT VI: Database storage structures [6 Lectures]**

Indexing, hashing and grid files.

**Recommended Books:**


1. Silberschatz, H. Korth and S. Sudarshan: Database System Concepts, McGraw Hill
2. R. Elmasri and S. B. Navathe: Fundamentals of Database Systems, Addison Wesley
3. R. Ramakrishnan and J. Gehrke: Database Management Systems, McGraw Hill,
4. P. Rob and C. Coronel: Database Systems: Design, Implementation, and Management, Thomson Learning

| MCA 903C | Design and Analysis of Algorithms | 3+1+0=4 |
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**UNIT I: Complexity Notations [7 Lectures]**

Algorithm, analysis, time and space complexity, O-notation, omega notation and theta notation, sets and disjoint set, union and find algorithms, RAM model, O(log n) bit model

**UNIT II: Algorithm Design Techniques [7 Lectures]**

Iterative techniques, divide and conquer, dynamic programming, greedy algorithms, backtracking and branch and bound. Lower bounding techniques: decision trees.

**UNIT III: Searching and Sorting Techniques [8 Lectures]**

Searching techniques – linear and binary, Elementary sorting techniques-selection sort, bubble sort, insertion sort; more sorting techniques-quick sort, heap sort, merge sort, shell sort, radix sort; external sorting.

**UNIT IV: Introduction to randomized algorithms [6 Lectures]**

Random numbers, randomized Quicksort, randomly built BST.

**UNIT V: Number Theoretic Algorithms [7 Lectures]**

GCD, addition and multiplication of two large numbers, polynomial arithmetic, fast-fourier transforms.

**UNIT VI: Graphs [6 Lectures]**

Analysis of graph algorithms depth-first search and its applications, minimum spanning trees and shortest paths.

**UNIT VII: Case study [7 Lectures]**

knapsack problem, job sequencing with deadlines, optimal merge patterns, minimal spanning trees and dijkstra's algorithm, 0/1 knapsack problem, traveling salesman problem, 8 queen's problem, graph coloring, hamiltonian cycles.

**Recommended Books:**


1. Corman et al.: Introduction to Algorithms, McGrawHill.
2. Aho A, Hopcroft J., Ullman J.: The Design and Analysis of Algorithms, Addison-Wesley.

| MCA 904C | Computer Organization and Architecture | 3+1+0=4 |
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**UNIT I: Introduction to Digital Computer [6 Lectures]**

Functions and Block Diagram of a Computer, Types of Software – System software, Application software , Utility Software.
Compilers, Interpreters, Assemblers, Linker, Loader & Programming Language Paradigm.

**UNIT II: Data Representation and Boolean Algebra [8 Lectures]**

Binary, Octal, HEX and their inter-conversion,1's and 2's complement, Binary Arithmetic, Number Systems – BCD, EBCDIC, ASCII, De-Morgan's Theorem, Duality Theorem, Algebra Rules, Laws, Logic Circuits, NOT, AND, OR, NAND, NOR, XOR, XNOR.

**UNIT III: Combinational Circuits [8 Lectures]**

Half Adder, Full Adder, Binary Adder and Subtractor, Decoder, Encoder,Multiplexer, Demultiplexer, Sequential Circuits, Flip Flops - SR, D, JK, Master – Slave, Introduction to Counters: Synchronous as well as Asynchronous Counter.

**UNIT IV: Memory System [8 Lectures]**

Memory Hierarchy, Primary Memory – DRAM, SDRAM, DDR, RDRAM. ROM, PROM, EPROM, EEPROM , Concepts of Auxiliary, Associative, Cache and Virtual Memory, DMA.

**UNIT V: CPU Organization. [10 Lectures]**

CPU Building Blocks, CPU Registers and BUS Characteristics, Registers & System Bus.
Characteristics, Interface Basics (Only Block Diagram) , Local Bus features & Types should be covered, Addressing Modes.
Interrupts: Concepts and types Instruction and Execution Interrupt cycle, Hardwired and Micro Program control ,RISC and CISC ,Pipelining – Data Path, Time Space Diagram, Hazards. Instruction Set, Arithmetic Pipelining, RISC Pipelining.

**UNIT VI: Multi-Processor Organization [8 Lectures]**

Parallel Processing, Concept and Block Diagram Types (SISD, SIMD, MIMD, MISD), Future Directions for Parallel Processors ,Performance of Processors.

**Recommended Books:**

1. Carpinel, Computer Organization & Architecture
2. Morris Mano ,Computer System Architecture
3. Kaithwang , Ad. Computer Architecture
4. Malvino , Digital Computer Electronics
5. Yu Cheng Liu & Glann Gibson , Micro Computer Systems
6. Bartee , Digital Electronics

| MCA 905L | Lab-III | 0+1+2=3 |
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*Laboratory work related with PGMCA 9.1 - Operating System*

1. Simple C programs in Unix platform: Programs using system calls, library function calls to display and write strings on standard output device and files.
2. Programs using fork system calls.
3. Programs for error reporting using errno, perror( ) function.
4. Programs using pipes.
5. Basic Shell programming.
6. Programs to simulate process scheduling like FCFS, Shortest Job First and Round Robin.
7. Programs to simulate page replacement algorithms like FIFO, Optimal and LRU.
8. Programs to simulate free space management.
9. Programs to simulate virtual memory.
10. Programs to simulate deadlock detection.
11. The course instructor may assign additional questions if s/he feels necessary.

*Laboratory work related with PGMCA 9.2 - Database Management System*

1. Creation, altering and droping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.Queries using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT, Constraints.
2. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.Queries implementing various joins (left,right,full ). Implemention of complex queries: nested queries,sub queries.
3. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions(Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date).
4. i) Creation of simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
   ii) Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
5. Develop a program that includes the features NESTED IF, CASE and CASE expression.
6. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
7. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
8. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
9. Program development using creation of package specification, package bodies, private objects, package variables and cursors and calling stored packages.

10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. The course instructor may assign additional questions if s/he feels necessary.

*Lab programs related with PGMCA 9.3: Design and Analysis of Algorithms*

1. Using Graph notation to prove that bubble sort algorithm has time complexity ($n^2$).
2. Implement the Dynamic programming technique and analyze the algorithm using the graph notation.
3. Implement the Greedy programming technique and analyze the algorithm using the graph notation.
4. Implement the Divide and Conquer technique and analyze the algorithm using the graph notation.
5. Design a small file compressor and de-compressor by using Huffman coding technique.
6. The course instructor may assign additional questions if s/he feels necessary.

| MCA 1001C | Computer Networks | 3+1+0=4 |
|---|---|---|

**UNIT I: Introduction to Computer Networks [6 Lectures]**

Uses of Computer Networks; Wired and wireless Networks; Types of networks – LAN, MAN, WAN; Network Topology; OSI Reference Model – Outline, Protocol hierarchies, Design considerations; TCP-IP Reference Model; Comparison among these reference models.

**UNIT II: Physical Layer [6 Lectures]**

Fourier Analysis (Qualitative), Maximum data rate of a Channel, Bit rate and Baud; Baseband and Broadband; Guided Transmission Media- Magnetic, Twisted pair, Coaxial cable, Fibre Optics, Wireless transmission – Electromagnetic Spectrum, Radio transmission, Microwave Transmission, Infrared transmission; Comparison among the different transmission media – guided and unguided.

**UNIT III: Data Link Layer [8 Lectures]**

Design Issues - Services provided to the higher layer, Framing, Error Control, Flow Control; Error Detection and Correction – Error Correcting Codes, Error-Detecting Codes; Elementary Data Link Protocols – Unrestricted simplex protocol, Simplex stop-and-wait protocol, Protocol for Noisy Channel; Sliding Window protocols – One bit sliding window, Go Back n protocol, Protocol using Selective Repeat.

**UNIT IV: Medium Access Control Sublayer [6 Lectures]**

Random Access Protocols-ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization; X.25, ATM, LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11.

**UNIT V: Network Layer [8 Lectures]**

Design Issues – Store and forward packet switching, Services provided to higher layer, Connection Oriented and Connectionless services, Virtual Circuits and Datagram subnets; Routing Algorithms – Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Congestion Control Algorithms – General Principles, Congestion Prevention Policies, Congestion control in Virtual Circuit and Datagram Subnets; Internetworking – Tunneling, Fragmentation; Internet Protocol – IP addresses, Subnets, CIDR, Network address translation,; Internet Control Protocol – ICMP, ARP, RARP, BOOTP, DHCP.

**UNIT VI: Transport layer [6 Lectures]**

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

**UNIT VII: Application Layer [8 Lectures]**

Domain Name System – name space, resource records, name servers; Electronic Mail-architecture and services, user agent, Message formats – MIME, Message Transfer - SMTP, Message Delivery – POP3 and IMAP, Web mail.

Cryptography, Substitution Ciphers, Transposition Ciphers, One time pads, Cryptographic principles; Symmetric Key Algorithms – Data Encryption Standard, Advanced Encryption Standard, Public Key Algorithms – RSA.

**Recommended Books:**


1. A.S. Tanenbaum: Computer Networks, PHI
2. William Stallings, Data and Computer Communications, Pearson Education
3. Behrouz Forouzan and S.C. Fegan: Data Communications and Networking, McGraw Hill
4. W. Tomasi: Introduction to Data Communications and Networking, Pearson Education
5. P.C. Gupta, Data Communications and Computer Networks, PHI

| MCA 1002C | Web Technology | 3+1+0=4 |
|---|---|---|

**UNIT I: E-Commerce [8 Lectures]**

Internet Basics - overview, history, architecture, URL; protocol basics - HTTP, HTTPS, FTP, Telnet; HTTP request & response, cookies
E-commerce as business need, types, advantages, disadvantages, architecture

Internet payment systems - characteristics, payment methods, protocols related to payment, e-cash, e-check, smart card

E-commerce security - need, current trend, encryption - public, private & hybrid, digital signature, other authentication tools

**UNIT II: PHP [12 Lectures]**

Introduction to PHP, Environment, syntax overview, variable types, constants, operator types, decision making, loop types,arrays,strings,web concepts, GET & POST,file Inclusion, files I/O,Functions,Cookies,Sessions,Sending mails, File uploading, coding standard.

**UNIT III: Advanced PHP [9 Lectures]**

Predefined Variables, Regular Expression, Error Handling, Bugs Debugging, Date &Time, PHP & MySQL,PHP & AJAX,PHP &XML,Object Oriented,PHP Function referenc,Built-in Functions, connection to database, selecting a db, building & sending query, retrieving, updating & inserting data.

**UNIT IV: JSP [10 Lectures]**

Introduction, Life cycle of JSP JSP-API JSP in Eclipse, scripting elements, scriplet tag JSP expression tag JSP , declaration tag, implicit Objects, SP Request JSP Response JSP Config JSP, page JSP Exception, Directive Elements, taglib directive, JSP Exception, Action Elements

**UNIT V: Advanced JSP [9 Lectures]**

Jsp:forward jsp:include java Bean class,VC in JSP,JSTL,Custom tags. Example of Custom Tag Attributes Iteration, Custom URI, Development in JSP,Registration Form, Login Form, Uploading File, Downloading File.

**Recommended Books:**


1. E-Commerce Fundamentals & Application, Wiley publications
2. Teach Yourself PERL in 21 days, Pearson Education.
3. Robert W. Sebesta: Programming the World Wide Web
4. Ivan Bayross: Web enabled commercial application development using HTML, DHTML, JavaScript, PERL-CGI
5. Dustine R. Callway: Inside Servlets
6. James Goodwill: Developing Java Servlets

| MCA 1003C | Software Engineering | 3+1+0=4 |
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**UNIT I: Software Engineering [6 Lectures]**

The software crisis, principles of software engineering, programming in-the-small vs. programming-in-the-large

**UNIT II: Software process [7 Lectures]**

The software lifecycle, approaches and models - waterfall, prototyping, spiral, evolutionary, RAD and JAD; agile process models

**UNIT III: Project management [7 Lectures]**

Project planning, project control, project organization, risk management, cost models, configuration management, version control, quality assurance

**UNIT IV: Software requirements analysis [7 Lectures]**

Fundamental problems in defining requirements, requirements analysis, functional and non-functional requirements elicitation, analysis tools, requirements definition, requirements specification, static and dynamic specifications, requirements review.

**UNIT V: Software design [6 Lectures]**

Design for reuse, design for change, design notations, design evaluation and validation

UI design: Elements of good design, design issues, features of modern UI

**UNIT VI: Implementation and Maintenance [7 Lectures]**

Programming standards and procedures, modularity, data abstraction, static analysis

Testing - unit, integration, system, regression; blackbox vs. whitebox testing, verification and validation, tools for testing, fault tolerance,

Maintenance - the problem, nature, planning

Documentation – role, types

**UNIT VII: Current Trends [8 Lectures]**

CASE tools – Introduction, types - project management tools, analysis tools, design tools, programming tools, prototyping tools, maintenance tools; advantages and disadvantages of CASE tools; reverse engineering

**Recommended Books:**


1. Pressman, R.S., Software Engineering: A Practitioner's Approach, McGraw Hill.
2. Shooman, M, Software Engineering, McGraw Hill.
3. Fairley, R.E.: Software Engineering Concepts, McGraw Hill.

| MCA 1004L | Lab-IV | 0+1+2=3 |
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*Lab programs related with PGMCA 10.2: Web Technology*

1. Create a registration form which contains fields name, RollNo, Gender and a submit button. You need to validate all the fields of the form, using JavaScript and use My Sql to save and retrieve data. All the details of the input form should be displayed in the server page when the user clicks the submit button.
2. Using PHP print a "Hello World" message in the Web browser
3. Using PHP calculate the sum of numbers collected from a user.
4. Using PHP to display the current date and the session Id.
5. Write PHP code for welcoming the user to Online Banking Website.
6. Using PHP display the hostname and the path of the PHP file.
7. Create a PHP page that passes three parameters to another PHP page. In addition, override a request parameter when a PHP page is called. Specify the three parameters as param1, param2 and param3.
8. Using JSP print a "Hello World" message in the Web browser
9. Using JSP to display the current date and the session Id.
10. Write JSP code for welcoming the user to Online Banking Website.
11. Using JSP display the hostname and the path of the JSP file.
12. Create a JSP page that passes three parameters to another JSP page. In addition, override a request parameter when a JSP page is called. Specify the three parameters as param1, param2 and param3.
13. Create a struts-blank.war blank application. Use the blank application to create a Web page that displays the title and author of a book. The page includes a Submit button. After the user clicks the Submit button, a page should appear indicating that the request is being processed. The example requires two JSP pages and two JavaBeans. Update struts-config.xml file to associate the Web pages with the JavaBeans.

14. The course instructor may assign additional questions if s/he feels necessary.

| MCA 1101C | Compiler Design | 3+1+0=4 |
|---|---|---|

**Unit I: Introduction to Compilers & Programming Languages [9 Lectures]**

Compilers & translators, Phases of a compiler, compiler-writing tools; High-level programming languages, Definition of programming languages, Lexical & syntactic structure of a language, Data elements, Data structure, Operators, Assignment, Statements, Program units, Data environments, Parameter transmission, Storage management.

**Unit II: Finite Automata, Lexical Analysis & Syntactic-specification [10 Lectures]**

The role of the lexical analyzer, a Simple approach to the design of lexical analyzers, Regular expression, Finite automata; Context-free grammars, Derivations & parse trees, Capabilities of context-free grammars

**Unit III: Basic Parsing Techniques & Constructions [9 Lectures]**

Parsers, Shift-reduce parsing, operator-precedence parsing, Top-down parsing, Predictive parsers; LL(1), LL(K) Grammar, Construct LR, SLR & LALR parsers.

**Unit IV: Syntax-directed Translation , Symbol Tables & Run-time Storage [10 Lectures]**

Syntax-directed translation schemes, Implementation of syntax-directed translators, Intermediate code, Postfix notation, Parse trees and Syntax trees, Three-address code, quadruples and triples, Boolean translations, Case statements; The contents of a symbol table, Data structure for symbol tables, Representing scope information; Implementation of a simple stack allocation scheme; Lexical & Syntactic-phase errors, Semantic errors;

**Unit V: Codes Optimization & Generation [10 Lectures]**

The principal sources of optimization, loop optimization, the DAG representation of basic blocks, value numbers and algebraic laws, Global data-flow analysis; Issue in the design of a code generator (input to the code generator, Target programs, Memory management, Instruction selection, Register allocation.)

**Recommended Books:**


1. A.V. Aho. J.D.Ullman: Principles of compiler design; Pearson Education.
2. Andrew N. Appel: Modern Compiler Implementation in C, Cambridge University Press.
3. Levine, J. R., *Lex & Yacc*, O'Reilly Publications, 2005

| MCA 1102C | Information Storage and Retrieval | 3+1+0=4 |
|---|---|---|

**Unit I: Introduction to Storage Technology [8 Lectures]**

Data proliferation, evolution of various storage technologies, Overview of storage infrastructure components, Information Lifecycle Management, Data categorization.

**Unit II: Storage Systems Architecture [8 Lectures]**

Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, RAID levels & parity algorithms, hot sparing, Front end to host storage provisioning, mapping and operation.

**Unit III: Introduction to Networked Storage [10 Lectures]**

JBOD, DAS, NAS, SAN & CAS evolution and comparision. Applications, Elements, connectivity, standards, management, security and limitations of DAS, NAS, CAS & SAN.

**Unit IV: Hybrid Storage solutions [10 Lectures]**

Virtualization: Memory, network, server, storage & appliances. Data center concepts & requirements, Backup & Disaster Recovery: Principles Managing & Monitoring: Industry management standards (SNMP, SMI-S, CIM), standard framework applications, Key management metrics (Thresholds, availability, capacity, security, performance).

**Unit V: Information storage on cloud [12 Lectures]**

Concept of Cloud, Cloud Computing, storage on Cloud, Cloud Vocabulary, Architectural Framework, Cloud benefits, Cloud computing Evolution, Applications & services on cloud, Cloud service providers and Models, Essential characteristics of cloud computing, Cloud Security and integration.

**Recommended Books:**


1. G. Somasundaram & Alok Shrivastava (EMC Education Services) editors; Information Storage and Management: Storing, Managing, and Protecting Digital Information; Wiley India.
2. Ulf Troppens, Wolfgang Mueller-Friedt, Rainer Erkens, Rainer Wolafka, Nils Haustein; Storage Network explained : Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE, Wiley India.
3. John W. Rittinghouse and James F. Ransome; Cloud Computing : Implementation , Management and Security, CRC Press, Taylor Frances Pub.
4. Nick Antonopoulos, Lee Gillam; Cloud Computing : Principles, System & Application, Springer.

| MCA 1103P | MINOR PROJECT | 0+1+2=3 |
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In minor project the students are expected to consolidate the concepts and practices that were learned during the course and to serve as a record of competence.

| MCA 1201P | MAJOR PROJECT | 0+0+20=20 |
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In the Major Project students are expected to have a thorough understanding of the theoretical principles learned in earlier five semesters through a prolonged practical experience in a real life project. The major project is oriented towards developing requisite skills, knowledge of latest technologies and an entrepreneurial attitude in a student which are needed to make an effective start as a computer/IT professional.

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| MCA 1301E | Computer Graphics | 3+1+0=4 |
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**UNIT I: Development of computer Graphics [9 Lectures]**

Raster Scan and Random Scan graphics storages, displays processors and character generators, colour display techniques, interactive input/output devices.

**UNIT II: Points, lines and curves [10 Lectures]**

Scan conversion, line-drawing algorithms, circle and ellipse generation, conic-section generation, polygon filling, anti-aliasing.

**UNIT III: Transformation [10 Lectures]**

Translation, Rotation, Scaling, Mirror Images, Coordinate system, 3D- Transformation, Rotation about an arbitrary axis, Orthogonal Projections, Multiple Views, Isometric Projection, Perspective Projections (one ,two and three vanishing points), Wire Frame Perspective Depth.

**UNIT IV: Two-dimensional viewing [9 Lectures]**

Co-ordinate systems, linear transformations, line and polygon clipping algorithms.

**UNIT V: Three-dimensional concepts [10 Lectures]**

3-D representations, transformations, perspective and parallel projections, spline curves and surfaces, Hidden Surface and hidden - line removal algorithms, Shading models and colour models for solid objects.

**Recommended Books:**


1. Hearn and M. P. Baker, Computer Graphics, PHI .
2. J.D. Foley, A van Dam, S.K. Feiner and J.F.Hughes, Computer Graphics: Principals and Practices, Addison-Wesley.
3. J.D. Foley and A.D. Van, Fundamentals of Interactive Computer Graphics, Addison-Wesley.
4. D.F. Rogers, Procedural Elements for Computer Graphics, McGraw-Hill.

| MCA 1302E | Digital Image Processing | 3+1+0=4 |
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**UNIT I: Introduction [10 Lectures]**

Image Acquisition, Image Model, Sampling, Quantization, Basic relationship between pixels, distance measures, connectivity, Image Geometry, Photographic film.

Histogram: Definition, decision of contrast basing on histogram, operations basing on histograms like image stretching, image sliding, Image classification, Definition and Algorithm of Histogram equalization.

Image Transforms: A detail discussion on Fourier Transform, DFT, FFT, properties. A brief discussion on WALSH Transform, WFT, HADAMARD Transform, DCT.

**UNIT II: Image Enhancement [10 Lectures]**

SPATIAL Domain Methods: Arithmetic and logical operations, pixel or point operations, size operations, Smoothing filters-Mean, Median, Mode filters.

Edge enhancement filters – Directorial filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF Filters, Prewitt filter, Contrast Based edge enhancement techniques. Low Pass filters, High Pass filters, sharpening filters, Color image processing.

FREQUENCY Domain Methods: Design of Low pass, High pass, EDGE Enhancement, smoothing filters in Frequency Domain. Butter worth filter, Homomorphic filters in Frequency Domain. Advantages of filters in frequency domain, comparative study of filters in frequency domain and spatial domain.

**UNIT III: Image compression [9 Lectures]**

Definition, A brief discussion on – Run length encoding, contour coding, Huffman code, compression due to change in domain, compression due to quantization Compression at the time of image transmission. Brief discussion on- Image Compression standards.

**UNIT IV: Image Segmentation and Representation [10 Lectures]**

Definition, characteristics of segmentation. Detection of Discontinuities, Thresholding Pixel based segmentation method. Region based segmentation methods – segmentation by pixel aggregation, segmentation by sub region aggregation, histogram based segmentation, spilt and merge technique. Use of motion in segmentation (spatial domain technique only)

Boundary representation: chair codes- Polygonal approximation – Boundary segments boundary descriptors: Simple descriptors-Fourier descriptors- Regional descriptors- Simple descriptors Texture.

**UNIT V: Morphological Image Processing [9 Lectures]**

Dilation, Erosion, Opening, closing, Hit-and-Miss transform, Boundary extraction, Region filling, connected components, thinning, Thickening, skeletons, Pruning Extensions to Gray – Scale Images. Application of Morphology in Image Processing.

**Reference Books:**


1. Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods.
2. Image Processing, Analysis and Machine Vision by Milan Sonka, Vaclav Hlavac and Roger Boyle.
3. Fundamentals of Digital Image Processing by Anil K. Jain.

| MCA 1303E | Advance Database Management System | 3+1+0=4 |
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**UNIT I: Relational Database Design [10 Lectures]**

Features of good database design, Enhanced ER tools :Subclasses, Super class, and Inheritance ,Specialization and Generalization, Constraints and Characteristics of Specialization and Generalization, Converting EER diagram to tables, Use of UML and its support for database design specifications, Representing specialization and generalization in UML Class diagram, Functional dependency theory and normalization, Multi value dependency and 4NF,Join Dependency and 5NF, Inclusion Dependencies and Template Dependency, PJNF/DKNF.

**UNIT II: Advanced SQL [9 Lectures]**

Assertion and views, Cursors, triggers and stored procedures ,Embedded SQL, dynamic SQL, SQLJ, Advanced Features of SQL

**UNIT III: Transaction Management and Recovery [10 Lectures]**

Advanced feature of Transactions, Enhanced Lock Based and timestamp based Protocols, Multiple Granularity ,Multi-version Schemes ,Deadlock Handling, Weak Levels of Consistency, Concurrency in Index Structures, Recovery and Atomicity, Recovery with Concurrent Transaction, Buffer Management.

**UNIT IV: Database Security, Authorization and Distributed Databases [10 Lectures]**

Levels of database security,Access control,Multilevel security, Statistical database security, Audit trails in the databases, Examples of e security,Centralised versus non centralized Databases,Homogeneous and Heterogeneous DDBMS and their comparison,Functions and Architecture,Distributed database design, query processing in DDBMS,Distributed concurrency management, deadlock management,Distributed Commit Protocols: 2 PC and 3 PC, Concepts of replication servers.

**UNIT V: Emerging Database Models [9 Lectures]**

Object Oriented Database, Multimedia database, Geography databases, Gnome databases Knowledge databases, Semantic databases, Spatial database, Mobile databases, Web databases.

**Recommended Books:**


1. Fundamentals of Database Systems by R. Elmasri and S. Navathe, pearson ,Addison Wesley.
2. Foundations of Databases by Serge Abiteboul, Richard Hull and Victor Vianu, Addison-Wesley Longman Publishing Co.
3. Database System Concepts by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGraw Hill Education.

| MCA 1304E | Graph Theory | 3+1+0=4 |
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**UNIT I: Graph [8 Lectures]**

Incidence and degree; Handshaking Lemma; Isomorphism; Sub graphs and Union of graphs; Connectedness; Walks, Paths and Circuits; Components and Connectedness; Walks, Paths and Circuits; Components and Connectedness algorithms; Shortest Path Algorithms, Eulerian graph, Fleury's algorithm and Chinese postman problem; Hamiltonian graph - necessary and sufficient conditions; Travelling salesman; Bipartite graph.

**UNIT II: Tree [8 Lectures]**

Properties of trees; Pedant vertices in a tree; Centre of a tree; Rooted binary trees; Spanning trees - Spanning tree algorithms; Fundamental circuits; Spanning trees of a weighted graph; cut-sets and cut-vertices; Fundamental cut-sets; Connectivity and separativity; network flow; max-flow min-cut theorem.

**UNIT III: Planar graph [8 Lectures]**

Combinatorial and geometric duals; Kuratowski's graph; detection of planarity; Thickness and crossings

**UNIT IV: Matrix representations of graph [8 Lectures]**

Incidence; Adjacency; matrices and their properties
Colorings: Chromatic number: Chromatic polynomial; The six and five color theorems; The four color problem.

**UNIT V: Directed graphs: [8 Lectures]**

Binary relations; Directed graphs and connectedness; directed trees; Aborecence; Polish method; Tournaments.

**UNIT VI: Counting of labeled trees [8 Lectures]**

Cayley's theorem; Counting methods; Polya theory. Switching and coding theory and VLSI design

**Recommended Books:**

1. Deo, N, Graph theory with applications to Engineering and Computer Science, PHI
2. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, TMH
3. Robin J. Wilson, Introduction to Graph Theory, Pearson Education
4. Harary, F, Graph Theory, Narosa

| MCA 1305E | Machine Learning | 3+1+0=4 |
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**UNIT I: Introduction [9 Lectures]**

Definition of learning systems. Goals, applications, aspects, Concept representation, Function approximation. Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. Inductive bias.

**UNIT II: Decision Tree Learning [10 Lectures]**

Entropy and information gain. Occam's razor. Overfitting, noisy data, and pruning. Ensemble Learning: Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles. Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

**UNIT III: Computational Learning Theory [9 Lectures]**

Learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension. Rule Learning: Propositional and First-Order: Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain.

**UNIT IV: Artificial Neural Networks [10 Lectures]**

Neurons, Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Support Vector Machines: Maximum margin linear separators. Quadractic programming solution to finding maximum margin separators. Kernels for learning non-linear functions. Bayesian Learning: Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression.

**UNIT V: Instance-Based Learning [10 Lectures]**

k-Nearest-neighbor algorithm. Case-based learning. Text Classification: Bag of words representation. Vector space model and cosine similarity. Relevance feedback and Rocchio algorithm. Clustering and Unsupervised Learning: Clustering. Hierarchical Aglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data. Language Learning: Hidden Markov models (HMM's). Veterbi algorithm for determining most-probable state sequences. Forward-backward EM algorithm for training the parameters of HMM's.

**Recommended Books:**


1. Tom Mitchell, Machine Learning, McGraw-Hill.
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 2004.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. Richard O. Duda, Peter E. Hart & David G. Stork, Pattern Classification, Wiley & Sons, 2001.

| MCA 1306E | Distributed Computing | 3+1+0=4 |
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**UNIT I: Fundamentals [12 Lectures]**

Introduction, Models and Features, Concept of distributed operating system, Issues in design of a distributed operating system. Message Passing: Good message passing system, IPC, Synchronization, Buffering, Multi datagram messages, Encoding & decoding techniques, Process addressing, Failure handling, Group communication; Remote procedure calls (RPC) - Models, Communication protocols, RPC, Lightweight RPC.

**UNIT II: Distributed Shared Memory [12 Lectures]**

Architecture, Thrashing, Granularity, Advantages. Synchronization: Introduction, Clock Synchronization, Event handling, Mutual Exclusion; Deadlock – Conditions, Avoidance, Prevention, Recovery.

**UNIT III: Resource and Process Management [12 Lectures]**

Features of a good scheduling algorithm, Task assignment approach, Load balancing and load sharing approach, Introduction to process management, Process migration, Threads. Distributed File Systems: Introduction, Features, Models, Accessing models; sharing Semantics & caching schemes, replication, Fault Tolerance, Atomic transactions.

**UNIT IV: Naming [12 Lectures]**

Introduction, Features, Fundamental Terminologies & concepts, System oriented names, Human oriented names, Name caches. Security: Potential attacks to computer system, Cryptography, Authentication, digital signatures, Access Control.

**Recommended Books:**


1. P.K.Sinha, Distributed Operating Systems: Concepts & Design, PHI.
2. A.S. Tanenbaum, Distributed Operating System, Pearson.
3. G. Coulouris, J. Dollimore and T. Kindberg, Distributed Systems: Concepts & Design, Pearson.
4. A. Silberschatz and P. Galvin, Operating System Concepts, John Wiley.

| MCA 1307E | Mobile Computing | 3+1+0=4 |
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**UNIT I: Introduction to Mobile Communications and Computing: [7 Lectures]**

Introduction to Mobile Computing, novel applications, limitations, and architecture. GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

**UNIT II: Medium Access Control: [6 Lectures]**

Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

**UNIT III: Mobile Network Layer: [7 Lectures]**

Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

**UNIT IV: Mobile Transport Layer: [7 Lectures]**

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

**UNIT V: Database Issues: [7 Lectures]**

Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

**UNIT VI: Data Dissemination: [7 Lectures]**

Communications asymmetry, classification of new data delivery mechanisms, pushbased mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

**UNIT VII: Protocols and Tools: [7 Lectures]**

Wireless Application Protocol-WAP(Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

**Recommended Books:**


1. Jochen Schiller, "Mobile Communications", Addison-Wesley, second edition, 2004.
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML",Cambridge University Press, October 2004.
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden ,Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional, 2005.

| MCA 1308E | Network Security and Cryptography | 3+1+0=4 |
|---|---|---|

**UNIT I: Introduction to the concepts of Security [12 Lectures]**

Introduction, The Need for Security, Security approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of attacks.

**UNIT II: Computer Based Symmetric Key Cryptographic Algorithms [12 Lectures]**

Introduction, Algorithm Types and modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC5, Blowfish, Advanced Encryption Standard (AES), Differential and Linear Cryptanalysis. Computer Based Asymmetric Key Cryptographic Algorithms: Introduction, Brief history of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, the RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm.

**UNIT III: Public Key Infrastructure [12 Lectures]**

Introduction, Digital Certificates, Private Key Management, the PKIX, Public Key Cryptography Standards (PKCS) XML, PKI and Security. Internet Security Protocols: Basic Concepts, Secure Socket Layer (SSL), Secure Hyper Text Transfer Protocols (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), SSL versus SET, 3-D Secure Protocol, Electronic money, Email Security, Wireless Application Protocol (WAP), Security in GSM.

**UNIT IV: User Authentication Mechanisms [12 Lectures]**

Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Biometric Authentication, Kerberos, Single Sign On (SSO) Approaches. Network Security: Brief Introduction to TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN)

**Recommended Books:**


1. Bruce Schneier, Applied cryptography: protocols, algorithms, and source code in C, John Wiley & Sons
2. A. Kahate, Cryptography and Network Security, PHI.
3. W. Stallings, Cryptography and Network Security, PHI.
4. B. A. Forouzan, Cryptography and Network Security, McGraw Hill.
5. W. Stallings, Network Security Essentials: Applications and Standards, Pearson.

| MCA 1309E | Data Mining | 3+1+0=4 |
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**UNIT I: Overview [10 Lectures]**

The process of knowledge discovery in databases, predictive and descriptive data mining techniques, supervised and unsupervised learning technique.
Techniques of Data Mining: Link analysis, predictive modeling, database segmentation, score functions for data mining algorithms, Bayesian techniques in data mining.
Issues in Data Mining: Scalability and data management issues in data mining algorithms, parallel and distributed data mining, privacy, social, ethical issues in KDD and data mining, pitfalls of KDD and data mining.
Applications: Application and trends in Data Mining: Data Mining Application, Data Mining system products and research prototypes, additional themes on data mining and social impacts of Data Mining.

**UNIT II: Clustering [10 Lectures]**

Partitional versus Hierarchical Clustering, types of data in clustering. Partitional clustering methods – k-means, k-medoids, PAM,CLARA, CLARANS.Hierarchical clustering methods – BIRCH, CURE. Density based clustering methods- DBSCAN. Categorical clustering – ROCK, QROCK.

**UNIT III: Rule Mining [10 Lectures]**

Definition, Mining association rules, frequent sets and border sets, algorithms for mining association rules – Apriori algorithm, Pincer-Search algorithm, Border algorithm. Generalized association rule, quantitative association rule, association rule with item constraint.
Decision Trees: Introduction, tree construction principle, decision tree generation algorithms – CART, ID3.

**UNIT IV: Data Warehousing: [10 Lectures]**

Introduction to Data warehousing, Architecture, Dimensional data modeling- star, snowflake; schemas, fact constellation, OLAP and data cubes, Operations on cubes; Data preprocessing - need for preprocessing, data cleaning, data integration and transformation, data reduction

**UNIT V: Information Retrieval & XML data: [8 Lectures]**

Introduction to information retrieval, Indexing for Text search, Web search engines, Managing text in DBMS, Data model for XML, XML DTD's, Domain specific DTD's, Querying XML data

**Recommended Books:**


1. A. K. Puzari, Data Mining Techniques, University Press.
2. J. Han and M. Kamber. Data Mining: Concepts and Techniques. Morgan Kaufman. 2001.
3. P. Tan, M. Steinbach and V. Kumar; Introduction to Data Mining; Pearson Education (LPE); 2009.

| MCA 1310E | Computer Oriented Numerical Methods | 3+1+0=4 |
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**UNIT I: Solution to Transcendental and Polynomial Equations [10 Lectures]**

Iterative methods, bisection method, secant method, Newton-Raphson method, fixed point iteration, methods for finding complex roots.

Matrices and Linear System of Equations: LU decomposition method for solving systems of equations, Symmetric positive definite matrices and least square approximation, iterative algorithms for linear equations.

**UNIT II: Interpolation [8 Lectures]**

Polynomial interpolation, Newton-Gregory, Stirling's, Bessel's and Lagrange's interpolation formula, Newton's divided differences interpolation formulae

Curve fitting: B-spline and Approximation: Fitting linear and non-linear curves, weighted least square approximation, method of least square for continuous functions.

**UNIT III: Numerical Differentiation and Integration [10 Lectures]**

Numerical differentiation and errors in numerical differentiation, Newton-Cotes formulae, trapezoidal rule, Simpson's rule, Gaussian integration

Numerical Solutions of Ordinary Differential Equations: Picard's and Taylor's series, Euler's and Runge-Kutta (RK) methods, Predictor-corrector's, Milne-Simpson's, Adams-Bashford, Adams-Moulton methods

**UNIT IV: Finite Element Method [8 Lectures]**

Boundary value problems, Rayleigh and Galerkin methods of approximation, applications

**UNIT V: Optimization Technique [12 Lectures]**

Simplex Method, Duality Method, Assignment Problem, Transportation Problem. Integer Programming: Cutting Plane, Branch & Bound Dynamic Programming: Characteristics, Deterministic & Probabilistic Dynamic Programming. Queuing Theory: Basic Structure, Exponential distribution, Birth-and-Death Model, M/M/I Queue

Game Theory: Two person Zero Sum game, saddle point determination, algebraic method, graphical method etc.

PERT & CPM: Basic differences between PERT and CPM, Arrow Networks, time estimates, earliest, expected time, Pass Computation, Backward Pass Computation,Representation in Tabular Form Critical Path, Probability of meeting scheduled date of completion, Calculation on CPM network.

**Recommended Books:**


1. K.E. Atkinson, W. Han, Elementary Numerical Analysis, 3rd Edition, Wiley
2. C. Xavier, S. S. Iyengar, Introduction to Parallel Algorithms (Wiley Series on Parallel and Distributed Computing, Wiley-Interscience
3. Kharab, R.B.Guenther, An Introduction to Numerical Methods: A MATLAB Approach, Chapman & Hall/CRC

| MCA 1311E | Optimization Techniques | 3+1+0=4 |
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**UNIT I: Introduction and Classical Optimization Techniques [5 Lectures]**

Statement of an Optimization problem - design vector - design constraints - constraint surface - objective function - objective function surfaces - classification of Optimization problems.

**UNIT II: Classical Optimization Techniques [7 Lectures]**

Single variable Optimization - multi variable Optimization without constraints - necessary and sufficient conditions for minimum/maximum - multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers - multivariable Optimization with inequality constraints - Kuhn - Tucker conditions.

**UNIT III: Linear Programming [7 Lectures]**

Standard form of a linear programming problem - geometry of linear programming problems - definitions and theorems - solution of a system of linear simultaneous equations - pivotal reduction of a general system of equations - motivation to the simplex method - simplex algorithm.

**UNIT IV: Transportation Problem [5 Lectures]**

Finding initial basic feasible solution by north - west corner rule, least cost method and Vogel's approximation method - testing for optimality of balanced transportation problems.

**UNIT V: Unconstrained Nonlinear Programming [4 Lectures]**

One - dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method

**UNIT VI: Unconstrained Optimization Techniques [4 Lectures]**

Univariate method, Powell's method and steepest descent method.

**UNIT VII: Constrained Nonlinear Programming [8 Lectures]**

Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.

**UNIT VIII: Dynamic Programming [8 Lectures]**

Dynamic programming multistage decision processes - types - concept of sub optimization and the principle of optimality - computational procedure in dynamic programming - examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

**Recommended Books:**


1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. " Introductory Operations Research" by H.S. Kasene & K.D. Kumar, Springer(India), Pvt .Ltd.
3. "Optimization Methods in Operations Research and systems Analysis" - by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
4. Operations Research - by Dr. S.D.Sharma.

| MCA 1312E | Parallel Algorithm | 3+1+0=4 |
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**Unit I [12 Lectures]**

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

**Unit II [8 Lectures]**

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost-optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

**Unit III [8 Lectures]**

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array.

**Unit IV [12 Lectures]**

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding**.**

**Unit V [8 Lectures]**

Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms Permutation, Combinations, Derrangements.

**Recommended Books:**


1. M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer" by Mc Graw Hill.
2. S.G. Akl, "Design and Analysis of Parallel Algorithms"
3. S.G. Akl, "Parallel Sorting Algorithm" by Academic Press

| MCA 1313E | Computational Geometry | 3+1+0=4 |
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**UNIT I: Convex hulls and Triangulations [8 Lectures]**

Convex hulls: construction in 2d and 3d, lower bounds; Triangulations: polygon triangulations, representations, point-set triangulations, planar graphs;

**UNIT II: Voronoi diagrams and Delayney triangulations [10 Lectures]**

Voronoi diagrams: construction and applications, variants; Delayney triangulations: divide-and-conquer, flip and incremental algorithms, duality of Voronoi diagrams, min-max angle properties;

**UNIT III: Geometric searching and Visibility [10 Lectures]**

Geometric searching: point-location, fractional cascading, linear programming with prune and search, finger trees, concatenable queues, segment trees, interval trees; Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems;

**UNIT IV: Arrangements of lines and Combinatorial geometry [8 Lectures]**

Arrangements of lines: arrangements of hyper planes, zone theorems, many-faces complexity and algorithms; Combinatorial geometry: Ham-sandwich cuts.

**UNIT V: Sweep techniques and Randomization [12 Lectures]**

Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements; Randomization in computational geometry: algorithms, techniques for counting; Robust geometric computing; Applications of computational geometry;

**Recommended Books:**


1. Computational Geometry: An Introduction by Franco P. Preparata and Michael Ian Shamos; SpringerVerlag, 1985.
2. Computational Geometry, Algorithms and Applications by Mark de Berg, Marc van Kreveld , Mark Overmars , and Otfried Schwarzkopf ; Springer-Verlag, 1997. from Springer.
3. Algorithmische Geometrie (auf deutsch)by Rolf Klein Addison-Wesley, 1996
4. Computational Geometry and Computer Graphics in C++ by Michael J. Laszlo ( Nova Southeastern University ) Prentice-Hall, 1996.

| MCA 1314E | Advanced Computer Architecture | 3+1+0=4 |
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**UNIT I: Fundamentals Of Computer Design [3 Lectures]**

Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.

**UNIT II: Pipelining [3 Lectures]**

Introduction; Pipeline hazards; Implementation of pipeline; What makes pipelining hard to implement?

**UNIT III: Instruction –Level Parallelism – 1 [6 Lectures]**

ILP: Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with 74 prediction; Overcoming Data hazards with Dynamic scheduling; Hardware based speculation.

**UNIT IV: Instruction –Level Parallelism – 2 [6 Lectures]**

Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation; The Intel Pentium 4 as example.

**UNIT V: Multiprocessors and Thread –Level Parallelism [8 Lectures]**

Introduction; Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency

**UNIT VI: Review of Memory Hierarchy [4 Lectures]**

Introduction; Cache performance; Cache Optimizations, Virtual memory

**UNIT VII: Memory Hierarchy design [8 Lectures]**

Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

**UNIT VIII: Hardware and Software for VLIW and EPIC [10 Lectures]**

Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions.

**Recommended Books:**


1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, 4th Edition, Elsevier, 2007.
2. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability**,** 2nd Edition**,** Tata Mc Graw Hill, 2010
3. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, A Hardware / Software Approach, Morgan Kaufman, 1999.

| MCA 1315E | Wireless Network | 3+1+0=4 |
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**UNIT I: Multiple Radio Access [10 Lectures]**

Medium Access Alternatives*:* Fixed-Assignment for Voice Oriented Networks Random Access for Data Oriented Networks, Handoff and Roaming Support, Security and Privacy.

**Unit II: Wireless WANs [10 lectures]**

First Generation Analog, Second Generation TDMA – GSM, Short Messaging Service in GSM, Second Generation CDMA – IS-95, GPRS - Third Generation Systems (WCDMA/CDMA 2000)

**UNIT III: Wireless LANs [10 Lectures]**

Introduction to wireless LANs - IEEE 802.11 WLAN – Architecture and Services,Physical Layer- MAC sublayer- MAC Management Sublayer, Other IEEE 802.11 standards, HIPERLAN, WiMax standard.

**UNIT IV: Adhoc and Sensor Networks [10 Lectures]**

Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks- Classification, MAC and Routing protocols.

**UNIT V: Wireless MANs and PANs [8 Lectures]**

Wireless MANs – Physical and MAC layer details, Wireless PANs – Architecture of Bluetooth Systems, Physical and MAC layer details, Standards.

**Recommended Books:**


1. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
2. Dharma Prakash Agrawal & Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, Thomson India Edition, 2nd Ed., 2007.
3. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, 2007.
4. Kaveth Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks",Pearson Education Asia, 2002.

| MCA 1316E | Speech Processing | 3+1+0=4 |
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**UNIT I: Basic Concepts: [10 Lectures]**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

**UNIT II: Speech Analysis: [10 Lectures]**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

**UNIT III: Speech Modeling: [10 Lectures]**

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

**UNIT IV: Speech Recognition: [10 Lectures]**

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

**UNIT V: Speech Synthesis: [8 Lectures]**

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

**Recommended Books:**


1. Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education.
3. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
4. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.

| MCA 1317E | Multimedia System | 3+1+0=4 |
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**UNIT I: Introduction: [8 Lectures]**

Definition - CD-ROM and multimedia. Multimedia applications: business - schools - homes - public places and virtual reality. Introduction to making of multimedia: hardware - software - creativity - and organization.

**UNIT II: Multimedia Tools: [10 Lectures]**

Macintosh and windows production platforms - 3-d modeling and animation - image-editing tools - sound editing tools - animation - video - and digital movie tools - linking multimedia objects - office suites - word processors - spread sheets - databases - presentation tools. Authoring tools - Card and Page-based authoring tools - Icon Based authoring tools - time based authoring tools - object oriented authoring tools - cross platform-authoring tools

**UNIT III: Multimedia Building Blocks: [12 Lectures]**

Text: - About fonts and faces - text in multimedia - computers and text - Font editing and design tools: Hypermedia and Hypertext.
Sound: -Multimedia system sounds - MIDI versus digital audio - digital audio - making MIDI audio :- audio file format - working with sounds in windows - working with sounds on the Macintosh - NIFF - Adding sounds to multimedia - Towards professional sounds - production tips.
Images: -Making still images - Colors - Image file format. Animation: Principals of animation: Making animation that works. Video: How video works - Broadcast video standards - Integrating computers and television - Shooting and Editing - Video tips - Recoding formats - Digital video

**UNIT IV: Multimedia and the Internet: [10 Lectures]**

Internet fundamentals: Internetworking - Connections - Internet services - The World Wide Web - Tools for the World Wide Web: Web serves - Web browsers - Web page makers and Site builders - Plug-ins and Delivery vehicles - Beyond HTML

**UNIT V: Designing For The World Wide Web: [8 Lectures]**

Working on web - Text for web - Images for web - Sound for web - Animation for web.

**Recommended Books:**


1. Multimedia System Design- K. Andleigh and K. Thakkrar
2. Multimedia: Computing, Communication & Application - Ralf stein Metz and Klara Nahrstedt
3. Advanced multimedia programming - Steve Rimmer
4. Multimedia Literacy - Fred T.Hofstetter MGHill

| MCA 1318E | Pattern Recognition | 3+1+0=4 |
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**UNIT I:Introduction [5 Lectures]**

Applications of pattern recognition, statistical decision theory, image processing and analysis.

**UNIT II: Probability [5 Lectures]**

Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators

**UNIT III: Statistical Decision Making [8 Lectures]**

Introduction, Baye's Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leaving-one—out technique. Characteristic curves, estimating the composition of populations.

**UNIT IV: Nonparametric Decision Making [8 Lectures]**

Introduction, histograms, Kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate Functions, minimum squared error discriminate functions, choosing a decision making technique.

**UNIT V: Clustering [5 Lectures]**

Introduction, hierarchical clustering, partitional clustering.

**UNIT VI: Artificial Neural Networks [8 Lectures]**

Introduction, nets without hidden layers. nets with hidden layers, the back Propagation algorithms, Hopfield nets, an application.

**UNIT VII: Processing of Waveforms and Images [9 Lectures]**

Introduction, gray level sealing transfoniiations, equalization, geometric image and interpolation, Smoothing, transformations, edge detection, Laplacian and sharpening operators, line detection and template matching, logarithmic gray level sealing, the statistical significance of image features.

**Recommended Books:**


1. Eart Gose, Richard Johnsonburg and Steve Joust, "Pattern Recognition and Image Analysis", Prentice-Hall of India2003.
2. Duda and Hart, "Pattern recognition (Pattern recognition a scene analysis)".
3. Robert J Schalkoff, "Pattern recognition: Statistical, Structural and neural approaches", John Wiley.

| MCA 1319E | Artificial Intelligence | 3+1+0=4 |
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**UNIT I: Introduction and Problem Solving [7 Lectures]**

Various definitions of AI, Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning - forward & backward chaining.

**UNIT II: Intelligent Agents [7 Lectures]**

Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, the environment in which a particular agent operates.

**UNIT III: Search and Game Playing [7 Lectures]**

Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minmax& game trees, refining minmax, Alpha – Beta pruning, constraint satisfaction.

**UNIT IV: Knowledge Representation [7 Lectures]**

First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies

**UNIT V: Planning [6 Lectures]**

Basic representation for planning, symbolic-centralized vs. reactive-distributed, partial order planning algorithm.

**UNIT VI: Uncertainty [8 Lectures]**

Different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic.

**UNIT VII: Natural language processing [6 Lectures]**

Component steps of communication, contrast between formal and natural languages in the context of grammar, parsing, and semantics.

**Recommended Books:**


1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Pearson Education
2. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill
3. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers
4. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI