Master in Computer Application MCA

SYLLABUS (2023-2024)



M.P.C. (AUTONOMOUS) COLLEGE Takhatpur, Baripada, Odisha

CONTENTS

Semester	Pages
First Semester	5-11
Second Semester	12-18
Third Semester	19-28
Fourth Semester	29-41

MCA 2023-24

Semester-1

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-1.1	Discrete Mathematics	100	3-1-0	4
CA-1.2	Programming in C	100	3-1-0	4
CA-1.3	Computer System Architecture	100	3-1-0	4
CA-1.4	Data Structure	100	3-1-0	4
CA-1.5	Operating System	100	3-1-0	4
CA-1.6	Lab-1:-Data Structure using 'C' Lab	100	0-0-4	4
	Total			24

Semester-2

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit	
CA-2.1	Theory of Computation	100	3-1-0	4	
CA-2.2	Database Management Systems	100	3-1-0	4	
CA-2.3	Computer Network	100	3-1-0	4	
CA-2.4	Design and Analysis of Algorithms	100	3-1-0	4	
CA-2.5	Numerical Methods	100	3-1-0	4	
CA-2.6	Lab-2:- Database Management Systems	100	0-0-4	4	
	Total				

Semester-3

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-3.1	Object Oriented Programming using Java	100	3-1-0	4
CA-3.2	Software Engineering	100	3-1-0	4
CA-3.3	Data Warehousing and Data Mining	100	3-1-0	4
CA-3.4	Artificial Intelligence	100	3-1-0	4
CA-3.5	Elective – 1	100	3-1-0	4
CA-3.6	Lab-3:- Programming using Java	100	0-0-4	4
Total				24

Semester-4

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.1	Elective – 2	100	3-1-0	4
CA-4.2	Elective – 3	100	3-1-0	4
CA-4.3	Elective – 4	100	3-1-0	4
CA-4.4	Project/ Dissertation(Industrial Visit)	300	0-0-12	12
Total				

Total Marks: 2400

Total Credit-96

L - LECTURE

T - TUTORIAL

P - PRACTICAL

Elective - 1

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-3.5 -A	Combinatorics and Graph Theory	100	3-1-0	4
CA-3.5 -B	Computer Security	100	3-1-0	4
CA-3.5 -C	Computer Graphics	100	3-1-0	4
CA-3.5 -D	Internet of Things	100	3-1-0	4

Elective -2

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.1-A	Machine Learning	100	3-1-0	4
CA-4.1-B	Block Chain Technology	100	3-1-0	4
CA-4.1-C	Mobile Computing	100	3-1-0	4
CA-4.1-D	Data Science using Python	100	3-1-0	4

Elective - 3

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.2-A	Digital Image Processing	100	3-1-0	4
CA-4.2-B	Cloud Computing	100	3-1-0	4
CA-4.2-C	Simulation and Modeling	100	3-1-0	4
CA-4.2-D	Compiler Design	100	3-1-0	4

Elective - 4

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.3-A	Organizational Behavior	100	3-1-0	4
CA-4.3-B	Web and Text Mining/ Text Analysis	100	3-1-0	4
CA-4.3-C	Big Data Analytics	100	3-1-0	4
CA-4.3-D	Bioinformatics	100	3-1-0	4

1st Semester

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-1.1	Discrete Mathematics	100	3-1-0	4
CA-1.2	Programming in 'C'	100	3-1-0	4
CA-1.3	Computer System Architecture	100	3-1-0	4
CA-1.4	Data Structure	100	3-1-0	4
CA-1.5	Operating System	100	3-1-0	4
CA-1.6	Lab-1:- Data Structure Using 'C'	100	0-0-4	4
Total				

1st Semester

Discrete Mathematics Paper- CA- 1.1 (Theory)

Unit 1

Logic: Propositions and logical Operations, Conditional statements; Predicate Calculus First order logic, universal and existential quantifiers; Proof Techniques- methods of proof, Mathematical induction. Matrices: Determinant, Matrices, Solving System of Equations-Eigen Values and Eigen Vectors-Inverse of matrix

Unit 2

Graph Theory: Directed and undirected graphs, basic terminology, paths and circuits, bipartite graph, Eulerian graph.

Trees; definition and properties, rooted trees, binary trees, spanning trees, minimal spanning trees

Unit 3

Algebraic structures and application

Binary operations, groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroup, Homomorphism,

Unit 4

Basic properties of lattices, Distributive and complemented lattices, Boolean algebra, disjunctive and conjunctive normal forms.

Text Books:

- 1. Truss, "Discrete Mathematics", Pearson
- 2. Rosen, "Discrete Mathematics", McGraw Hill
- 3. C.L. Liue, "Elements of Discrete mathematics", Mc Graw Hill international Student edition.
- 4. J.K. Mantri & T.K. Tripathy, A Modern Approach to Discrete Mathematics & structure
- 5. Mott: Discrete Mathematics

Programming in 'C'

Paper- CA-1.2 (Theory)

<u>Unit-I</u>

Introduction to Programming Language, Structured programming, C Tokens, Identifiers, Keywords, Constant and Variables, Statements, Expressions, Data Types, Input Output Operations, Operators, Precedence of operators, Control Structures, Decision making and Branching, Decision making and looping.

<u>Unit-II</u>

Arrays, Single dimensional, Multidimensional Arrays, Declarations, Initialization and their Applications, Character Array and String, String-handling functions.

Pointer its importance, Pointers: Concept of Pointer (null pointer, wild pointer, dangling pointer), Declaration of pointer variables, initialization of pointer variables, accessing variables through its pointers, Pointer Arithmetic, Pointer Expression, Pointers and Arrays, Pointer to pointer, Pointer to function, Passing Parameters by Reference.

Unit-III

Function: Function & types (User defined function, library function) Function Definition, Declaration, Function Calls, Function Arguments, Command line arguments, Formal vs. Actual Arguments, Function prototypes. Parameter passing, Recursion, Storage classes, Dynamic Memory Allocations.

Unit-IV

Structure, Defining Structure, Declaring structure variable, Accessing Structure members, Array of structures, Structures within the structures, Structures and functions, Pointer to structure, Size of structures, Unions. Files (Open, Close, I/O operations).

Text Books:

1. E. Balagurusamy, "Programming in ANSI C", 4/e, (TMH)

Reference Books:

- 1. B. Kernighan & Dennis Ritchie, "The C Programming Language".
- 2. Yashavant P Kanetka, "Let Us C".
- 3. P.C. Sethi, P.K. Behera, "Programming using C", Kalyani Publisher.
- 4. Reema Thareja "Computer Fundamentals and Programming in C".

Computer System Architecture

Paper- CA-1.3 (Theory)

<u>Unit -I</u>

Structure of Computer Hardware: Basic function units and their Operational concepts, Single Bus Structure. Logic circuits: Logic functions, Synthesis if logic expression, Using AND, OR and NOT gates, Minimization of logic expressions using Karnaugh maps, don't care conditions, Synthesis using NAND and NOR gates.

Computer Arithmetic: Binary Arithmetic, Addition and Subtraction of signed number, Multiplication of positive number. Signed operand multiplication, Division, Floating point number representation and arithmetic

<u>Unit-II</u>

Basic processing of Instruction: Instruction code, Instruction set, Instruction sequencing, Instruction cycle, Instruction format, Addressing format, Addressing modes, Micro instruction, Data path, Hardwired controlled unit, Micro programmed control unit, Design of Control Unit and ALU.

Unit-III

Memory: Memory Hierarchy, RAM, ROM, Cache memory organization, Mapping techniques, Virtual memory, Mapping technique, Associative memory, Memory Interleaving, Secondary Storage, Flash drives. Design

Unit-IV

Input/Output: Accessing I/O devices. Programmed I/O. Memory mapped I/O. Interrupt Driven I/O. Standard I/O interfaces. Synchronous and Asynchronous Data Transfer, DMA Data transfer.

Reference Books:

- 1. M. Morris Mano, "Computer System Architecture", Pearson Education
- 2. William Stallings, "Computer Organization and Architecture", Pearson Education
- 3. V. Rajaraman and T. Radhakrishnan, "Computer Organization and Architecture", PHI
- 4. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, Mc Graw Hill Education
- 5. A. S. Tanenbaum, "Structured Computer Organization", Pearson Education

DATA STRUCTURE Paper- CA-1.4 (Theory)

<u>Unit-I</u>

Introduction to Data Structures, abstract data types, Basic Terminology, Time complexity, Review of Array, Structures, Pointers, Dynamic memory allocation, Sparse matrices.

Linked lists: Linked List. Doubly Linked List, Circularly Linked List, Linked List Operations: Insertion, Deletion, Search, Reverse and Traversal.

<u>Unit-II</u>

Stacks: Representation & Operations, Implementation of Stacks as an array and Linked List, Applications of Stack: Postfix expression evaluation, Infix to Postfix Conversion.

Queue: Representation and Operations, as a Linked List, Circular Queue, Implementation of Queues as an array and Linked List.

<u>Unit-III</u>

Trees: Preliminaries, Representation & Implementation. Binary Search Trees: Representation & Operations – Insert, Delete And Binary Tree Traversals.

AVL Trees: Single Rotation, Double Rotation.

Graph: Introduction to Graph, Graph representation: Adjacency matrix, Adjacency list, Graph Traversals: DFS, BFS.

<u>Unit-IV</u>

Search: Sequential and Binary search,

Sorting Algorithms: Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Heap Sort, Quick Sort. **Hashing:** Hash Functions, Separate Chaining, Open Addressing - Linear Probing, Quadratic Probing.

References:

- 1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Publications, 2000.
- 2. *Amiya* Kumar *Rath*, "Data Structure Using C", SCITECH PUBLICATION
- 3. Sastry C.V., Nayak R, Ch. Rajaramesh, Data Structure & Algorithms, I. K. International Publishing House Pvt. Ltd, New Delhi.
- 4. Peter van der Linden, "Expert C Programming: Deep C Secrets", Pearson India
- 5. Mark Allen Weiss, "Data Structure and Algorithm Analysis in C", 2nd Edition, Pearson Education.
- 6. Samir Kumar Bandyopadhyay, "Data Structures using C", 1st Edition, Pearson Education
- 7. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, Cengage Learning
- 8. Nick Parlante, "Linked List Problems", Stanford University

Operating System Paper- CA-1.5 (Theory)

<u>Unit -I</u>

Introduction to Operating Systems. User View & System View of OS. Operating System

Concepts, Interrupts & System Calls. Operating System Services. Processes. Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, Priority, Round-Robin, Multilevel Queue, Multilevel Feedback Queue).

<u>Unit-II</u>

Inter Process Communication. Process Synchronization: Background, The Critical-Section Problem, Semaphores, Counting Semaphores & Binary Semaphores. The Dining-Philosophers Problem. Monitors.

<u>Unit-III</u>

Deadlocks: Basic cause of deadlock, Conditions for deadlock, Resource-Allocation graph. Deadlock Prevention, Deadlock Avoidance with Banker's algorithm. Deadlock Detection.

Unit-IV

Memory Management Strategies: Background (Address Binding, Logical vs Physical Address space), Swapping, Contiguous Memory Allocation: Dynamic Memory Allocation (First-fit, Best-fit, Worst-fit), Fragmentation. Paging, Page Tables. Segmentation. Virtual Memory Management: Background (Virtual Memory & Virtual Address Space). Demand Paging, Page faults, Page replacement techniques: FIFO, Optimal, LRU. Frame allocation techniques, Thrashing.

Reference Books:

- 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 8th Edition, Wiley India
- 2. Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, "Operating Systems", 3rd Edition, Pearson Education
- 3. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, PHI Learning / Pearson Education
- 4. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd Edition, PHI Learning / Pearson Education.

Lab-1:- Data Structure Using 'C' Paper- CA-1.6 (Practical)

- 1. Creating and editing simple C programs, compilation and execution.
- 2. Program on Expressions, Operators, Simple Arithmetic, Decision and Loop Control Statements.
- 3. Program demonstrating Single & Multidimensional arrays
- 4. Program demonstrating Functions, recursion,
- 5. Program demonstrating structure and union
- 6. Program demonstrating Pointers and dynamic memory allocation
- 7. Program demonstrating Array based Stacks: Postfix expression evaluation, Infix to Postfix Conversion.
- 8. Program demonstrating Array based Queues: Queue operations, Circular queue
- 9. Program demonstrating Linked List, Doubly Linked List, Circularly Linked List, Linked List Operations: Insertion, Deletion, Search, Traversal.
- 10. Implementing Stacks & Queues using Linked List.
- 11. Program demonstrating Binary Search Trees: Representation & Operations Find, Insert, Delete. Binary Tree Traversals: inOrder, preOrder, postOrder
- 12. Implementation of Binary search.
- 13. Sorting Implementations: Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, Heap Sort, Quick Sort, Counting Sort.
- 14. Simple Hash Table implementation

2nd Semester

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-2.1	Theory of Computation	100	3-1-0	4
CA-2.2	Database Management Systems	100	3-1-0	4
CA-2.3	Computer Network	100	3-1-0	4
CA-2.4	Design and Analysis of Algorithms	100	3-1-0	4
CA-2.5	Numerical Methods	100	3-1-0	4
CA-2.6	Lab-2:- Database Management Systems	100	0-0-4	4
Total				

2nd Semester

Theory of Computation Paper- CA-2.1 (Theory)

Unit -I

Introduction: Alphabets, Strings, Languages, Finite Automata (FA). Types of FA: Deterministic Finite Automaton and Nondeterministic Finite Automaton, Transition Diagrams, Transition Tables, Equivalence Of DFA And NFA. NFA With and Without ε -Moves, Minimization of Finite Automata.

UNIT – II

Regular Languages: Regular Sets, Regular Expressions, Identity Rules, Constructing Finite Automata for A Given Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma of Regular Language, Closure Properties of Regular Sets. Regular Grammars–Right Linear and Left Linear Grammars, Derivation Trees, Right Most and Leftmost Derivation.

UNIT – III

Context Free Grammars: Simplification of Context Free Grammars, Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for Context Free Languages, Closure properties of CFL (proofs omitted), Ambiguity in Context Free Grammars.

Push Down Automata (PDA): Definition, Model, Acceptance of CFL, Acceptance by Final State And Acceptance By Empty State And Its Equivalence. Equivalence of PDA's And CFL's, Inter Conversion (Proofs Not Required).

UNIT - IV

Turing Machine (TM): Turing Machine Definition, Types of Turing Machines, Model, Design of TM, Computable Functions, Unrestricted Grammars, Recursively Enumerable Languages. Church's Hypothesis, (Proofs Omitted). Linear Bounded Automata and Context Sensitive Language.

Computability Theory: Chomsky Hierarchy of Languages, Definitions of P and NP Problems, NP Complete and NP Hard Problems.

Text Book:

Elemets Of The Theory Of Computation, Harry R Lewis, Cristos h. Papadimitriou, Pearson Education / Prentice-Hall of India Private Limited.

Reference Books:

- 1. Hopcroft. J.E, J.D.Ullman, "Introduction to Automata Theory, Languages, and Computation", Addison-Wesley
- 2. Kamala Krithivasan, Rama R., "Introduction to Formal Languages, Automata Theory and Computation", Pearson India
- 3. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning

Database Management Systems Paper- CA-2.2 (Theory)

Unit- I

Data Abstraction - Data models and data independence. Instances and Schemas. Components of a DBMS and overall structure of a DBMS- Life Cycle of a DBMS application- Database terminology. Database systems Architecture.

Basic concepts- Types of data models- Conceptual, physical and logical, database models- E-R data model and Object-oriented data model. Components of ER Model- ER Modelling symbols. Entity and entity sets- Relations and relationship .

Unit- II

Relation Query Languages, Relational Algebra ,Relational calculus:Unary. Query Processing and Optimization: Evaluation of relational algebra Expressions, Query optimization algorithms.

Unit – III

Transaction processing: introduction to Transaction processing, properties of Transaction Recovery and Concurrency control, Locking and Timestamp .Relational database Design: Domain and Data dependency, Database Design Theory and Normalization : 1NF,2ND,3RD,BCNF,4TH,5TH

Unit - IV

Structured Query Language: introduction, Data Definition Language and Data Manipulation Language,data control language data type (char(n), varchar(n), int, float, date), constraints (not null, unique, primary key) clause, group by, order by

Distributed Databases: Introduction, DDBMS architectures, Homogeneous and Heterogeneous Databases, Distributed data storage.

Text books:

- 1. Elmaski & Navathe, "Fundamentals of database systems", 4th edition, Pearson education
- 2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, Mcgraw Hill Education
- 3. C.J. Date, "An introduction to database systems", Pearson Education.
- 4. Bipin Desai, "An introduction to database system", Galgotia Publications
- 5. Raghu Ramkrishnan, Johannes Gehrke, "Database Management Systems", 2nd Edition, McGraw Hill International

Computer Network Paper- CA-2.3 (Theory)

Unit- I

Introduction: Data Communication, Networks, Protocols and standards. Point to Point and Multipoint Line Configuration, Network Topologies, Transsmission Modes: Simplex, half Duplex, Full Duplex, Networks: LAN, WAN, MAN, The OSI model: Function of the layers.

Transmission Media: Guided Media, Unguided Media, Switching Techniques: Packet Switching, Circuit Switching, Datagram Networks, Virtual-Circuit Networks.

Unit- II

Multiplexing: Frequency division, Wave division and time division multiplexing, Error Detection and Correction: Type of errors, Redundancy Checks- CRC, Data Link Control: Line Discipline, Flow Control, Error Control. Local Area Networks: IEEE 802 standards, Ethernet, Token Bus, Token Ring.

Unit- III

Integrated Services Digital Network (ISDN): Services, History Subscriber access to ISDN, The ISDN Layers. Frame Relay: Introduction, Frame Relay Operation, Frame Relay Layers, Congestion Control, Leaky Bucket Algorithm, and Traffic Control.

Unit- IV

Networking and Internetworking Devices: Repeaters, Bridges, Routers, Gateways, domain names, URL, website, web browser, web servers, Client-Server Model

Logical Addressing, IPv4 Addresses, IPv6 Addresses, MAC addresses, Protocols : UDP, TCP. Application layers: DNS, SMTP, POP, FTP, HTTP

Text books:

- 1. Forouzan B.A., "Data Communication and Networking", 4th Edition, McGraw Hill Education (India)
- 2. Black, U., "Computer Networks-Protocols, Standards and interfaces". 2nd Edition, Prentice Hall

Design and Analysis of Algorithms Paper- CA-2.4 (Theory)

<u>Unit- I</u>

Introduction to analysis and design of algorithm, Growth of functions, Asymptotic notations, Recurrences, Solution of recurrences by substitution, Recurrence tree and the master method. Divide and conquer algorithms (Worst case analysis of merge sort, quick sort and heap sort algorithms), Priority queue, Data structure for disjoint sets (Disjoint set operations, linked list representation, disjoint set forests)

<u>Unit- II</u>

Dynamic programming approach: Matrix chain multiplication, longest common subsequence. Greedy method: Activity solution problem, Greedy verses dynamic programming, Huffman codes. Concept of backtracking, branch & bound design techniques

<u>Unit-III</u>

Graph algorithms: Minimal spanning tree (Kruskal and Prim's algorithms), Single source shortest paths (Bellman-Ford and Dijkstra's algorithm), Floyd's algorithm, Flow Network, Ford-Fulkerson method

Unit-IV

Rabin-Karp string matching algorithm, NP-Completeness, Polynomial time solvability, Verification and Reducibility, NP complete problems (without proof), Approximation algorithm for the traveling salesman problem

Textbooks :

- 1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and L.Stein, "Introduction to Algorithms", Second Edition, PHI Learning
- 2. E. Horowitz, S. Sahani, S. Rajsekharan, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2007
- 3. Mark Allen Weiss, "Data Structure and Algorithm Analysis in C", 2nd Edition, Pearson Education.
- 4. J. Kleinbers, E. Tardos, Algorithm design, Pearson Education Inc., New Delhi, 2006
- 5. R. Johnsonbaugh, M. Schaefer, "Algorithms", Pearson Education Inc., New Delhi, 2004
- 6. Kenneth A. Berman & Jerome L. Paul, "Algorithms", Revised Edition, 2005, CENGAGE Learning India Pvt. Ltd., New Delhi.
- 7. Anany V. Levitin, "Introduction to the Design and Analysis of Algorithms", Second Edition, 2007, Pearson Education Inc., New Delhi.
- 8. Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, analysis, and Internet Examples", 2nd Edition, Wiley India Pvt. Ltd., New Delhi

Numerical Methods Paper- CA-2.5 (Theory)

<u>Unit- I</u>

Number System and Errors: Introduction, Binary Number, Octal Numbers, Hexadecimal Number, Floating point representation, Approximation of numbers, Polynomial Interpolations: Existence and Uniqueness of Interpolating polynomial, Lagrange's Interpolating Formula, Error in Interpolation, Interpolation points for minimizing the error bound

<u>Unit- II</u>

Newton's Divided Difference Interpolating polynomial, Properties of divided Differences, Forward Difference Operator. Newton's Forward Difference Interpolating formula, Backward Difference Operator Newton's Backward Difference Interpolation formula

<u>Unit-III</u>

Method of bisection, Secant Method & Regular falsie Method, Newton-Raphson Method& convergence, Fixed point of a function, Fixed point iteration method, Some simple Quadrate Rules, Newton-Cotes Rules, Compound quadrate Rules, Gauss legendre-2 & 3 point

Unit-IV

Numerical solution of ordinary differential equation -Euler method, Modification ofEuler's method, Runge-Kutta method of order two and four

Text Books:

1. B.P. Acharya & R.N. Das, "A Course On Numerical Analysis", Kalyani Publishers

Reference Books:

- 1. Elementary Numerical Analysis By J.K.Mantri
- 2. Numerical Analysis By S.S. Sastry.

Lab-2:- Database Management Systems Paper- CA-2.6 (Practical)

ASSIGNMENT QUESTIONS:

Q1. Database Schema for a employee scenario

Consider the following tables namely "Departments", "Employees" and "Salary"

Departments (DEPTNO , DEPTNAME , DEPTLOC);

Employees (EMPNO, EMPNAME , JOB, DEPTNO, DOJ); Salary (EMPNO, MONTH/YEAR, SAL)

For the above schema, perform the following-

1. Create all above tables.

2. Rename Employee table as Employee Master

3. Add column Date of Birth to Employee Master

4. Delete Date of Birth for Employee Master

5. Modify EMPNAME field to accept 100 characters.

6. Insert around 10 records in each of the tables

7. List all the employees with their EMPNO.

8. List all the employee numbers whose salary is above 20000.

9. List all the employees who have joined in the year 2002.

10. List all the department numbers where department location is Odisha.

11. Truncate the Employee_Master table.

Q2. Database Schema for a Student Library scenario Student(Stud_no : integer, Stud_name: string) Membership(Mem_no: integer, Stud_no: integer) Book(book_no: integer, book_name:string, author: string) Iss_rec(iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer) For the above schema, perform the following—

1. Create the all above tables .

2. Insert around 10 records in each of the tables

3. Add column S Address to student

4. List all the student names with their student numbers.

5. List all the issues for the current date with Book number.

6. List the book names whose author is CJ DATE.

7. Give number student with book no. 5.

8. Truncate the table Iss_rec.

Q3. Considering Database Schema for a employee scenario

Departments (DEPTNO, DEPTNAME, DEPTLOC);

Employees (EMPNO, EMPNAME , JOB, DEPTNO, DOJ); Salary (EMPNO, MONTH/YEAR, SAL)

Q1. Create the table with all the required constraints.

Q2. Display all the details of the records whose employee name starts with "A".

Q3. Display all the details of the records whose employee name does not start with A'.

Q4. Display the rows whose salary ranges from 15000 to 30000.

Q5. Calculate the total and average salary amount of the salary table.

Q6. Count the total records in the emp table.

Q7. Determine the max and min salary and rename the column as max_salary and min salary.

Q9. Display the last day of that month in 05-Oct-09.

Q10. Find how many job titles are available in the employee table.

Q11. What is the difference between maximum and minimum salaries of employees in the organization?

Q12. Display the maximum salary of a group by month year.

AIM OF THE EXPERIMENT :

To perform nested Queries and join Queries using DML command.

Semester-3

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-3.1	Object Oriented Programming using Java	100	3-1-0	4
CA-3.2	Software Engineering	100	3-1-0	4
CA-3.3	Data Warehousing and Data Mining	100	3-1-0	4
CA-3.4	Artificial Intelligence	100	3-1-0	4
CA-3.5	Elective – 1	100	3-1-0	4
CA-3.6	Lab-3:- Programming using Java	100	0-0-4	4
Total				

Object Oriented Programming using Java Paper - CA-3.1

Unit-1

Basics of Java. JDK & JRE. Writing, Compiling, and running Java programs. Data Types. Variables. Type conversion and casting. Arrays. Operators. Control Statements. Classes and Objects, Methods, constructors. Keywords: this, static, final. Access control.

Unit-2

Inheritance in Java. Use of super keyword. Multilevel inheritance. Calling of constructors. Polymorphism: Method overloading and overriding. Abstract class. Runtime Polymorphism through Inheritance. Polymorphism using interface. Generics in Java: Generics, Generic methods and constructors. Primitive Type Wrappers.

Unit-3

Exception Handling in Java: Understanding Exception handling, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch, Nested try statements, Understanding of throw, throws and finally, Java's Built-in Exceptions, Chaining Exceptions. Packages: Defining a package, Access Protection, Importing packages.

Unit-4

I/O in Java: I/O Basics, Streams and Stream Classes: Byte Stream Classes, Character Stream Classes. Reading and Writing Files. Multithreading programming with java: Understanding Java Thread Model, The Thread class and Runnable interface, Thread creation, Synchronization, Interthread communication.

Reference Books:

- 1. Herbert Schildt, "Java: The Complete Reference", Tenth Edition, Oracle Press
- 2. E. Balagurusamy, "Programming with Java ", 6th Edition, McGraw-Hill Education
- 3. Harvey M. Deitel & Paul J. Deitel, "Java How to Program", 8th Edition, PHI
- 4. Debasish Jana, "Java and Object-Oriented Programming Paradigm", PHI

Software Engineering Paper - CA-3.2

Unit-1

Introduction to Software Engineering, Software Lifecycle Models: Waterfall Model, Spiral Model, Prototype Model, Evolutionary Model, Rapid Application Development (RAD) Model.

Software Project Management: Responsibilities of a Software Project Manager, Project Planning, Metrics for Project Size Estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO. Software Configuration Management.

Unit-2

Requirement Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specifications, Formal System Specification Axiomatic Specification.

Software Design: Design Process, Characterize a Good Software Design, Cohesion and Coupling, Approaches to Software Design-Function Oriented & Object-Oriented.

Unit-3

Coding and Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black Box and White Box Testing, Debugging, Program Analysis Tools Integration Testing, System Testing.

Unit -4

Software Reliability and Quality Management: Software reliability, Software Quality. ISO-9000, SEI Capability Maturity Model. Computer-Aided Software Engineering (CASE). Software Maintenance, Characteristics, Types, Software Reverse Engineering. Software Maintenance Process Model.

Text Books:

- 1. Mall Rajib, "Fundamentals of Software Engineering", PHI.
- 2. Roger S. Pressman, "Software Engineering A practitioner's Approach", 5th Edition, McGraw-Hill Higher Education.

Data Warehousing and Data Mining Paper - CA-3.3

Unit-1

Concept of Data warehousing, 3-tier architecture, multidimensional data model, OLAP, ROLAP, and MOLAP operations. Commercial Importance of Data Warehouse, Data Mart structure, Usage of Data Mart, Security in Data Mart, Data warehouse and Data Mart.

Unit-2

Basic Elements of Data Warehouse & ETL: Source System, Data Staging Area, Presentation Server, data Cleaning, Extraction of Data, Transformation of Data, Loading of Data

Unit-3

Introduction to data mining, knowledge discovery, DBMS vs. Data Mining. Concept hierarchies, Interestingness measures, Data generalization and Summarization-based characterization, Mining Association Rules, Apriori algorithm for finding frequent item-sets, Mining Multilevel Association Rules, Mining distance-based Association Rules, Correlation Analysis.

Unit-4

Classification and prediction: decision tree based classification, Bayesian classification, classification by back propagation, k-nearest neighbor classifier. Cluster analysis: categorization of clustering methods, partitioning methods, k-Means and k-Medoids, hierarchical methods, Density-based clustering (DBSCAN)

Reference Books:

- 1. Jain Pei, Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier/Morgan Kaufmann
- 2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", 1st Edition, Pearson India
- 3. A.K.Pujari, "Data Mining", University Press
- 4. Ian H. Witten, Eibe Frank, "Data Mining Practical Machine Learning Tools and Techniques", 2nd Edition, Elsevier/Morgan Kaufmann
- 5. Ralph Kimball , Margy Ross, "The Data Warehouse Toolkit : The Definitive Guide to Dimensional Modeling", 3rd Edition, Wiley India
- 6. Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, Wiley India
- 7. S. Anahory, D. Murray, "Data Warehousing", Pearson Education

Artificial Intelligence Paper - CA-3.4

Unit 1

Problems and Search: What is Artificial Intelligence?, The AI Problems, The Underlying Assumption, What is an AI Technique, The Level of the Model, Criteria for Success, Problems, Problem Spaces, and Search: Defining the Problem as a State Space Search, Problem Characteristics.

Heuristic Search Techniques: Generate-and- Test, Hill Climbing, Best- First Search, Problem Reduction, Constraint Satisfaction, A* algorithm.

Unit 2

The Prepositional Calculus : Introduction – Syntax of the Prepositional Calculus – Truth-Assignments – Validity and Satisfiability – Equivalence and Normal Forms – resolution in Prepositional Calculus.

Using Predicate Logic:- Representing Instance and Is A Relationships, Computable Functions and Predicates, Resolution ; Truth Maintenance Systems

Unit 3

Historical notes- human Brain, Al and NN. Learning process: Supervised and unsupervised learning, adaptation, statistical nature of the learning process. Perceptron.

Multilayered network architecture, Back Propagation Algorithm, Approximation properties of RBF networks and comparison with multilayer perceptron.

Unit 4

Introduction to AI Programming: MATLAB Programming: Overview, Environment ,Syntax, Commands, Variables, Datatypes, Operators, Control Statements-Decision making, Looping, Arrays and Function, MATLAB Plot- 2D, 3D, Linear Algebra, MATLAB vs Octave, WEKA Tool

Reference Books:

- 1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, 2010, Pearson Education, New Delhi.
- 2. Joseph Giarratano and Gary Riley, "Expert Systems: Principles and Programming", Fourth Edition, CENGAGE Learning India Pvt. Ltd., New Delhi.
- 3. Elaine A. Rich and Kevin Knight, "Artificial Intelligence", 3rd Edition, 2009, McGraw-Hill Education (India), New Delhi.
- 4. Nills J. Nilsson, "Artificial Intelligence: A New Synthesis", 2nd Edition, 2000, Elsevier India Publications, New Delhi.
- 5. Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Second Edition, 2005, Pearson Education, Inc. New Delhi.
- 6. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", 1st Edition, 1996, PHI Learning Pvt. Ltd., New Delhi.
- Ben Coppin, "Artificial Intelligence Illuminated", 2005, Narosa Publication, New Delhi. ISBN: 978-81-7319-671-3

Combinatorics and Graph Theory Paper - CA-3.5 -A

Unit 1

Fundamental principles of counting, permutation and combinations, binomial theorem, generating functions, the exponential generating function, recurrence relations-first order and second order- non homogeneous recurrence relations.

Unit 2

Basic Terminology of Graph theory, Walks, Paths, Circuits, Connectedness, Handshaking Lemma, Isomorphism, Sub Graphs, Reach Ability, Union and Interaction of Graphs. Euler Graph, Shortest Path Problem, Hamiltonian Graph, Bipartite Graphs

Unit 3

Introduction to Trees, Rooted Trees, Path Length in Rooted Trees, Spanning Trees, Fundamental Circuits, Spanning Trees of a Weighted Graph, Cut Sets and Cut Vertices, Fundamental Cut Set, Minimum Spanning Tree

Unit 4

Directed Graphs and Connectedness, Directed Trees, Network Flows, Max Flow-Mincut Theorem, Matrix Representation of a Graph, Planar Graphs: Combinational and Geometric Duals, Kuratowski's Graphs, Detection of Planarity, Thickness and Crossing.

Reference:

1. C.L. Liu, Elements of Discrete Mathematics, Tata McGraw Hill, 2nd Edition, 2000.

2. J.K. Mantri & T.K. Tripathy, A Modern Approach to Discrete Mathematics & structure

3. N. Deo, Graph Theory with Applications to Engineering and Computer Science, PHI publication, 3rd edition, 2009

Computer Security Paper - CA-3.5 -B

Unit 1:

The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense; Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption Algorithms, Private-Key Cryptosystems, The Data Encryption Standard, The AES Encryption Algorithm, Public-Key Cryptosystems, Public Key Encryptions, Uses of Encryption

Unit 2:

Program Security : Secure Programs, Non-malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General-Purpose operating system protected objects and methods of protection memory and address protection, File protection Mechanisms.

Unit 3:

Database Security: Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database, proposals for multilevel security Network Security: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-mail.

Unit 4:

Administering Security: Security Planning, Risk Analysis, Organizational Security policies, Physical Security; The Economics of Cyber security; Privacy in Computing; Legal and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and Employers, Software failures, Computer Crime.

Reference Books:

Charles P. Pfleeger & Shari Lawrence Pfleeger, "Security in Computing", 4th Edition, Pearson Education
 Josef Pieprzyk, Thomas Hardjono, Jennifer Seberry, "Fundamentals of Computer Security", Springer & Universities Press India

3. Dieter Gollmann, "Computer Security", 2nd Edition, Wiley India

4. William Stallings & Lawrie Brown, "Computer Security: Principles and Practice", 1st Edition, Pearson Education 5. Charlie Kaufman, Radia Perlman & Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, PHI Learning

6. Chuck Easttom, "Computer Security Fundamentals", 1st Edition, Pearson Education

7. Alfred Baasta, "Computer Security", 1st edition, CENGAGE Learnin

Computer Graphics Paper - CA-3.5 -C

Unit 1

Introduction: Application areas of Computer Graphics, overview of graphics systems, video-display devices, raster-scan systems, random scan systems, graphics monitors and work stations and input devices. Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

Unit 2

2-D and 3D geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 3D viewing and General projection transforms (Parallel & Perspective Projections and their Transformations)

Unit 3

Viewing and Clipping: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

Unit 4

Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods. Illumination models: Basic Models, Displaying Light Intensities, halftone patterns and Dithering Techniques Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting. Surface Rendering Methods: Polygon Rendering Methods, Gouraud shading Phong Shading

Text Books:

- 1. Donald **Hearn** & M. Pauline **Baker**, "Computer Graphics with OpenGL", Third Edition, 2004, Pearson Education, Inc. New Delhi.
- 2. Ze-NianLi and Mark S. Drew, "Fundamentals of Multimedia", First Edition, 2004, PHI Learning Pvt. Ltd., New Delhi.
- 3. Jennifer **Burg**, "The Science of Digital Media", First Edition, 2009, Pearson Education Inc., New Delhi.
- 4. Francis S. Hill & Stephen M. Kelly, "Computer Graphics using OpenGL", Third Edition, 2007, PHI Learning Pvt. Ltd., New Delhi.

INTERNET OF THINGS Paper - CA-3.5 -D

UNIT – I

Introduction to Internet of Things: Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates, Domain Specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Agriculture, Health & Lifestyle. UNIT – II

IoT and M2M: Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT. IoT System Management with NETCONF-YANG: Need for IoT Systems Management, SNMP, Network Operator requirements, NETCONF, YANG, IoT Systems Management with NETCONFYANG. IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT system for weather Monitoring. Motivation for Using Python. Python Packages for IoT. UNIT – III

IoT Physical Devices & Endpoints: What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Introduction to Arduino, Arduino Board Structure, Arduino Family. IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage Models & Communication APIs, WAMP AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework-Django, Amazon Web Services for IoT UNIT – IV

Case Studies of IoT Design: Home Automation, Cities, Environment, Agriculture, Productivity Applications, Health Monitoring Case study. Introduction to Data Analytics for IoT: Apache Hadoop, Oozie, Spark, Storm.

Textbook

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", 1st Edition, Universities Press, 2015, ISBN: 978-8173719547.

Reference Books

1. Graham Meikle and Mercedes Bunz, "The Internet of Things: Digital Media and Society Series", 1st Edition, Polity Press, 2017, ISBN: 978-1509517466.

2. Rajkumar Buyya and Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", 1st Edition, Morgan Kaufman Publisher, 2016, ISBN: 978-0128053959.

3. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", 1st Edition, Wiley Publisher, 2013, ISBN: 978-118430620.

4. Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Student Edition, Wiley Publisher, 2015, ISBN: 978-8126557653.

5. Ovidiu Vermesan and Peter Friess, "Internet of Thinks Converging Technologies for Smart Environments, and Integrated Ecosystem", River Publisher, 2013, ISBN: 978-8792982735.

Lab-3:- Programming using Java Paper - CA-3.6

- 01. Introduction, Compiling & executing a java program.
- 02. Program with data types & variables.
- 03. Program with decision control structures: if, nested if etc.
- 04. Program with loop control structures: do, while, for etc.
- 05. Program with classes and objects.
- 06. Implementing data abstraction & data hiding.
- 07. Implementing inheritance.
- 08. Implementing and polymorphism.
- 09. Implementing packages.
- 10. Implementing Generics

Semester-4

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.1	Elective - 2	100	3-1-0	4
CA-4.2	Elective - 3	100	3-1-0	4
CA-4.3	Elective - 4	100	3-1-0	4
CA-4.4	Project/ Dissertation(Industrial Visit)	300	0-0-12	12
Total				24

Total Marks: 2400

Total Credit-96

Elective - 1

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-3.5 -A	Combinatorics and Graph Theory	100	3-1-0	4
CA-3.5 -B	Computer Security	100	3-1-0	4
CA-3.5 -C	Computer Graphics	100	3-1-0	4
CA-3.5 -D	Internet of Things	100	3-1-0	4

Elective -2

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.1-A	Machine Learning	100	3-1-0	4
CA-4.1-B	Block Chain Technology	100	3-1-0	4
CA-4.1-C	Mobile Computing	100	3-1-0	4
CA-4.1-D	Data Science using Python	100	3-1-0	4

Elective - 3

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.2-A	Digital Image Processing	100	3-1-0	4
CA-4.2-B	Cloud Computing	100	3-1-0	4
CA-4.2-C	Simulation and Modeling	100	3-1-0	4
CA-4.2-D	Compiler Design	100	3-1-0	4

Elective - 4

Paper	Subjects	Full Mark	Contact Hrs. (L-T-P)	Credit
CA-4.3-A	Organizational Behavior	100	3-1-0	4
CA-4.3-B	Web and Text Mining/ Text Analysis	100	3-1-0	4
CA-4.3-C	Big Data Analytics	100	3-1-0	4
CA-4.3-D	Bioinformatics	100	3-1-0	4

Machine Learning Paper - CA-4.1-A

<u>UNIT – 1</u>

Basics of Python:Data Types and Associated Operations,String, List, Array, Tuples, Dictionary, Sets. Control Statements, Function, Python Libraries : Numpy, Pandas, Keres, Tensorflow, Matplotlib. Data Preprocessing Techniques.

<u>UNIT – 2</u>

Introduction: Machine Learning, Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning.

Supervised Learning: Decision Tree Induction, Naïve Bayes Classification, Rule based Classification, K-Nearest Neighbour, Performance evaluation metrics of Classifiers.

<u>UNIT – 3</u>

Unsupervised Learning: Clustering, Partitioned Clustering (K-Means), Hierarchical Clustering, BIRCH, CURE, Density based Clustering (DBSCAN). Performance evaluation metrics of Clustering and Cluster Indices

<u>UNIT – 4</u>

Regression: Linear Regression, Multivariate Regression

Artificial Neural Networks: Feedforward & Feedback, Multi-Layer Feed Forward Networks, Delta Learning Rule for Multi-Perceptron Layer, Generalized Delta Learning Rule, Error Back-Propagation Training Networks.

Textbooks

- 1. T. Hastie, R. Tibshirani and J. Friedman, "The Elements of Statistical Learning: Data Mining, Inference and Prediction", 2nd Edition, Springer Publisher, 2017, ISBN: 978-0387848570.
- 2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", 1st Edition, Springer Publisher, 2006, ISBN: 978-0387310732.
- 3. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, MIT Press, ISBN: 978-02620112430.

Reference Books

- 1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", 2nd Edition, CRC Press, 2014, ISBN: 978-1466583283.
- 2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", 1st Edition, Springer, ISBN: 978-1493938438.
- 3. Tom Mitchell, "Machine Learning", Indian Edition, McGraw Hill Education, 2017, ISBN: 978-1259096952

Courses of Studies M.C.A

Block Chain Technology Paper - CA-4.1-B

Unit 1

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Unit 2

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit 3

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - MINING strategy and rewards

Unit 4

Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin Blockchain Applications: Internet of Things, Medical Record Management System and future of Blockchain

References:

1. Daniel Drescher, Block chain basics A non-technical introduction in 25 steps, Apress, 2017.

2. Paul Vigna and Michael J.Casey. The Age of Cryptocurrency, 2015.

3. Narayanan, Bonneau, Felten, Miller and Goldfeder, —Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction, Princeton University Press

Mobile Computing Paper - CA-4.1-C

Unit 1

Introduction to Mobile Communications and Computing: 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 2

Wireless Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA. Spreading techniques. Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations).

Unit 3

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP. Transaction oriented TCP. Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation. Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push based mechanisms, pull-based mechanisms.

Unit 4

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, routing and various routing algorithms, security in MANETs. Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking).

Reference:

1. Jochen Schiller, Mobile Communications, Pearson Education.

2. Stojmenovic and Cacute, Handbook of Wireless Networks and Mobile Computing, Wiley.

3. Reza Behravanfar, Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Cambridge University Press.

4. Frank Adelstein, Sandeep K.S Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, TMH.

5. Uwe Hansmann, Lothar Merk, Martin S, Nicklous, Thomas Stober, Principles of Mobile Computing, Springer.

6. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley.

Data Science using Python Paper - CA-4.1-D

Unit 1

Python basics: Modules, Arithmetic, Control Flow, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries, Sets, Idea about Python Libraries.

Unit 2

Data Visualization with matplotlib. Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, P-hacking. Gradient Descent: The idea behind Gradient Descent, Estimation of Gradient, Applying Gradient Descent. Machine Learning: Modeling, types, Over fitting and Under fitting, Correctness, The Bias-Variance Trade-off.

Unit 3

k-Nearest Neighbors: The Model, Application, The Curse of Dimensionality. Implementing a spam filter with Naive Bayes. Correlation and Regression. Simple Linear Regression: The Model, Using Gradient Descent, Maximum Likelihood Estimation. Logistic Regression: Applying the Logistic Function model, Goodness of Fit.

Unit 4

Decision Trees: Decision Tree, Entropy. Neural Networks: Perceptrons, Feed-Forward Neural Network, Back propagation. K-Means Clustering.

Reference Books:

1. Joel Grus. "Data Science from Scratch: First Principles With Python", O'Reilly

2. Jake vanderplas. "Python data science handbook: essential tools for working with data",O'Reilly

3. Davy Cielen, Arno D. B. Meysman, Mohamed Ali. "Introducing Data Science", ManningPublication

4. Cathy O'Neil and Rachel Schutt. "Doing Data Science, Straight Talk From The Frontline".O'Reilly.

5. Sinan Ozdemir, "Principles of Data Science", Packt.

Digital Image Processing Paper- CA-4.2-A (Theory)

Unit 1

Introduction: The digitized image and its properties: Applications of image processing, image function, image representation, sampling, quantization, color images, metrics and topological properties of digital images, histograms, image quality, noise image.

Unit 2

Image preprocessing: Pixel brightness transformation, position dependent brightness correction, gray scale transformation; geometric transformation, local preprocessing- image smoothening, edge detectors, zero-crossing, scale in image processing, canny edge detection, parametric edge models, edges in multi spectral images, local preprocessing and adaptive neighborhood pre processing; image restoration.

Unit 3

Image Segmentation: Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation, edge image thresholding, edge relaxation, border tracing, border detection.

Unit 4

Mathematical Morphology: Basic morphological concepts, four morphological principles, binary dilation, erosion, Hit or miss transformation, opening and closing; thinning and skeleton algorithms; Morphological segmentation -particles segmentation and watersheds, particles segmentation. Image textures: Statistical texture description, methods based on spatial frequencies, cooccurrence matrices, edge frequency, and texture recognition method applications. Image representation and description: Representation, boundary descriptors, regional descriptors

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, —Digital Image Processing^{II}, 3rd Edition, 2008, Pearson Education, Inc. New Delhi.

2. Milan Sonka, Vaclav Hlavac, Roger Boyle, —Image Processing, Analysis, and Machine Vision^{II}, 3rd Edition, 2008, CENGAGE Learning, New Delhi.

3. William K. Pratt, —Digital Image Processing: PIKS Scientific Insidel, 4th Edition, 2008, Wiley India Pvt. Ltd., New Delhi.

4. Bernd Jähne, —Digital Image Processing^I, 6th Revised and Extended Edition, 2006, Springer Science. ISBN 978-3-540-24035-8.

5. Anil K. Jain, —Fundamentals of Digital Image Processing^{II}, 1989, PHI Learning Pvt. Ltd. New Delhi.

Cloud Computing Paper- CA-4.2-B (Theory)

Unit-I

Basics of Cloud Computing: Introduction, Evolution of Cloud Computing, Cluster Computing, Grid Computing, Characteristics of Cloud Computing. Introduction to Cloud Computing: Need for Cloud Computing, Types of Cloud Deployment Models, Types of Cloud Service Models.

Unit-II

Cloud Architecture services and storage : Layered cloud architecture design, NIST Cloud computing reference architecture – Public, Private and Hybrid clouds – PaaS, SaaS, IaaS, architectural design challenges, cloud storage, Storage as a service, Advantages of cloud storage, cloud storage providers, S3. Service Oriented Architecture (SOA), Life Cycle of Services in SOA Integrating SOA and the Cloud.

Unit-III

Resource management and security in cloud : Inter cloud resource managements, Resource provisioning and resource provisioning methods, Global exchange of cloud resources, Security overview, cloud security challenges, software as a service security, Security Governance, virtual machine security, IAM, security standards.

Unit-IV

Virtualization: Introduction and characteristics ,Types of Virtualization, Needs of Virtualization in Cloud Computing Environment, Architecture of Virtualization, Advantages and Disadvantages of Virtualization Technique in Cloud Computing Environment, Virtual Machine.

Text Books

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, TMH.

2. George Reese Cloud Application Architectures, First Edition, O'Reilly Media.

References Books:

 Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum, Pearson.
 Cloud Computing, Dr. Kumar Saurabh, Wiley India.

Simulation and Modeling Paper- CA-4.2-C (Theory)

Unit 1

Introduction to Systems and Simulation; Discrete Event Simulation; Mathematical and Statistical Models- useful models and Distributions; Poisson Process; Random Numbers and Random Variate Generation

Unit 2

Queuing Theory and Models – Characteristics, Notations, Long run Performance Measures, Steady state behavior of Finite and Infinite Markovian Models

Unit 3

Monte-Carlo Simulation - Need and importance; Simulation Software - Input Modeling and Output Analysis; SPSS / MATLAB/ NS2

Unit 4

Verification and Validation of Simulation Models; Comparison of alternative Designs; Simulation of Network Models; Applications

Reference:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, Discrete Event System Simulation, Prentice Hall International Series in Industrial & Systems Engineering, Fourth Edition.

2. Sankar Sengupta, System Simulation and Modeling, Pearson Publishing, Edition-1.

Compiler Design Paper- CA-4.2-D (Theory)

UNIT – I

Introduction: Language Processors, Phases of A Compiler, A Model for A Compiler Front End, Syntax-Directed Translation, Parsing, A Translator for Simple Expressions, Lexical Analysis: Role of Lexical Analyzer, Input Buffering, Specification Of Tokens, Lexical Analyzer Generator, Data Structures In Compilation. Top-Down Parsing: Introduction, Context Free Grammars, Writing A Grammar, Recursive-Descent Parsing, LL (1) Grammars, Predictive Parsing, Preprocessing Steps Required for Predictive Parsing.

UNIT – II

Bottom-Up Parsing: Shift Reduce Parsing, SLR Parsing, CLR Parsing and LALR Parsing, Error Recovery In Parsing, Handling Ambiguous Grammar, Parser Generator – YACC, Semantic Analysis: Syntax-Directed Definitions, Evaluation Order For SDD's, Application Of SDT. UNIT – III

Intermediate-Code Generation: Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking. Runtime Environment: Storage Organization, Stack Allocation of Space, Heap Management, Storage Allocation for Arrays, Strings and Records, Introduction to Garbage Collection and Trace-Based Collection UNIT – IV

Code Generation: Issues in The Design of Code Generator, Target Language, Addresses in The Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.

Textbook

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, J. D. Ullman, "Compilers: Principles, Techniques, & Tools", 2nd Edition, Pearson Education, 2013, ISBN: 978-9332518667.

Reference Books

1. Dick Grune, Henry E. Bal, Ceriel J. H. Jacobs, Koen G. Langendoen, "Modern Compiler Design", John Wiley & Sons Publisher, 2000, ISBN: 978-0471976974.

2. Kenneth C. Louden, "Compiler Construction: Principles and Practice", 2003, S. Chand Publisher, ISBN: 978-9812436948.

3. Thomas W. Parsons, "Introduction to Compiler Construction", 1992, W.H. Freeman Publisher, ISBN: 978-0716782612.

4. Andrew W. Appel, "Modern Compiler Implementation in C", Revised Edition, 2004, Cambridge University Press, 2004, ISBN: 978-0521607650.

5. John R. Levine, Tony Mason, and Doug Brown, "LEX & YACC", 2nd Edition, Shroff Publisher, 1992, ISBN: 978-8173660627.

6. Keith D. Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publisher, 2003, ISBN: 978-1558606982.

Organizational Behavior Paper - CA-4.3-A

Unit 1

Basics of OB—History of OB: Stages of development- Pre-Scientific, Classical, Behavioural, Modern Organization structure & process: Components and their interaction Approaches: Traditional & Modern: Contributing disciplines Emerging Issues: Globalization, Diversity, Demographics, Ethical behaviour

Unit 2

The Individual—Personality: Factors (Big Five), Attributes, Measurement (Myers-Briggs Type Indicator); Job Attitude: Components, Major attitudes, Job satisfaction & its measurement, Dissatisfaction; Motivation: Early theories (Need hierarchy & Two-factor) & Recent Theories (ERG & Expectancy)

Unit 3

Personnel Management—Personnel Function: Its evolution, objectives, principles, philosophies and policies, duties and responsibilities of the personnel manager, position of the personnel department on the organization, Line and staff relationship. Manpower planning: Its uses and benefits, problems. limitations, manpower skill analysis and practices. Recruitment: Job specification, selection process, psychological testing, interviewing techniques, transfers, promotion and its policies. Training and Developments: Its objectives and places, planning and organizing then training department, training manager and his job. On and off the job training, techniques, career planning, objectives of Performance appraisal and its methods.

Unit 4

The Group—Groups: Types, Roles, Norms, Size, Group vs. Team, Cohesiveness, Group Decision Making Leadership: Theories (Trait, Behavioural & Contingency), Finding and Creating Effective Leaders. Conflict: Approach, Sources & Negotiation: Stages in the process and remedial strategies; The Organization—Structure: Basics, Common Designs: Simple, Bureaucratic and Matrix structures Culture: Basics, Functions: Boundary, Identity, Commitment & Stability and Management Change: Agents, Resistance, Management: Lewin's 3-step and Kotter's 8-step models

Reference Books:

1. Robbins, Sanghi & Judge, Essentials of Organisational Behaviour, PHI

2. Kavita Singh, Organisational Behaviour : Text and cases, Pearson

3. Fiona Wilson, Organisational Behaviour and Work, Oxford.

Web and Text Mining Paper - CA-4.3-B

Unit - 1:

Basic Concepts of Information Retrieval, Information Retrieval Models: Boolean Model, Vector Space Model, Statistical Language Model. N-Gram Language Model: Simple (Unsmoothed) N-grams, Smoothing: Add-one Smoothing, Witten Bell Discounting, Good Turing Discounting.

<u>Unit - 2:</u>

Text and Web Page Pre-Processing: Stopword Removal, Stemming, Web Page Pre-Processing, Duplicate Detection. Inverted Index and Its Compression: Inverted Index, Search Using an InvertedIndex, Index Construction, Index Compression.

<u>Unit - 3:</u>

Web Search: Searching and Ranking. Web Crawling, Basic Crawler Algorithm: Breadth-First Crawlers, Preferential Crawlers, Craweler Implementation Issues: Fetching, Parsing, Stopword Removal and Stemming, Link Extraction and Canonicalization, Spider Traps.

<u>Unit - 4:</u>

Introduction to Social Network Analysis, Social Networks Preliminaries and Properties: Homophily, Triadic Closure and Clustering Coefficient, Dynamics of Network Formation, Power-Law Degree

Distributions, Measures of Centrality and Prestige: Degree Centrality and Prestige, Closeness Centrality and Proximity Prestige, Betweenness Centrality, Rank Centrality and Prestige.

Reference:

- Liu, Bing. Web data mining: exploring hyperlinks, contents, and usage data. Vol.
 Berlin:springer, 2011.
- 2. Jurafsky, Dan. Speech & language processing. Pearson Education India, 2000.
- 3. Aggarwal, Charu C. Data mining: the textbook. Vol. 1. New York: springer, 2015.
- 4. Christopher, D. Manning, Raghavan Prabhakar, and Schutze Hinrich. An Introduction toinformation retrieval. Cambridge University Press, 2008.
- 5. Chakrabarti, Soumen. Mining the Web: Discovering knowledge from hypertext data. MorganKaufmann, 2002.
- 6. Zong, Chengqing, Rui Xia, and Jiajun Zhang. Text Data Mining. Vol. 711. Springer, 2021.
- 7. Scime, Anthony, ed. Web Mining: applications and techniques. IGI Global, 2005.

BIG DATA ANALYTICS Paper - CA-4.3-C

Unit 1

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics

Unit 2

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing mapreduce calculations.

Unit 3

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

Unit 4

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats. Hbase, data model and implementations, Hbase clients, praxis. Cassandra

Reference:

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, Preeti Saxena, McGraw Hill, 2018.

2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013 2. Hudawa The Definition Children Wiley Third Edition Of Difference 2012

3. Hadoop: The Definitive Guide, Tom White , Third Edition, O'Reilley, 2012.

BIOINFORMATICS Paper - CA-4.3-D

Unit 1

Molecular Biology and Biological Chemistry: The Genetic Material, Gene structure and Information Content, Protein Structure and Function, The nature of Chemical bonds, Molecular Biology Tools, Genomic Information Content, Data Searches and Pairwise Alignments: Dot Plot, Simple Alignments, Gaps, Scoring Matrices, Needleman and Wunsch Algorithm, Global and local Alignments, Database searches, Multiple sequence Alignments,

Unit 2

Substitution Patterns: Patterns of substitutions within Genes, Estimating Substitution numbers, Variations in evolutionary rates between Genes, Molecular clocks, evolution in Organelles. Distance based methods of Phylogenetics: History of Molecular Phylogenetics, Phylogenetic trees, Distance matrix methods, Maximum likelihood approaches, Multiple sequence Alignments. Character Based methods of Phylogenetics: Parsimony, Inferred ancestral sequences, Strategies for Faster searches, Consensus trees, tree confidence, Comparison of Phylogenetic methods, Molecular Phylogenetics.

Unit 3

Genomics and Gene Recognition: Prokaryotic genomes, Prokaryotic gene structure, GCcontent Prokaryotic genomes, Prokaryotic gene density, Eukaryotic genomes, Eukaryotic gene structure, Open reading frames, GC-content Eukaryotic genomes, Gene expression, Transposition, Repetitive elements, Eukaryotic gene density, Protein and RNA structure prediction: Amino acids, Polypeptide composition, Secondary structure, Tertiary and quaternary structure,

Unit 4

Algorithms for Modeling Protein Folding, Structure prediction, Predicting RNA secondary structures, Proteomics: from Genomes to Proteomes, Protein classification, Experimental techniques, Inhibitors and drug design, Ligand screening, X-ray crystal structures, NMR structures, Empirical methods and prediction techniques, Post-translational modification prediction.

Reference:

1. Dan E. Krane, Michael L. Raymer, —Fundamental Concepts of Bioinformatics, First Edition, 2003, Pearson Education, Inc. New Delhi.

2. Teresa Attwood, David Parry-Smith, —Introduction to Bioinformatics^{II}, 1999, Pearson Education, Inc. New Delhi.

3. Shuba Gopal, A. Haake, R. P. Jones, P. Tymann, —Bioinformatics: A Computing Perspectivell, First Edition, 2009, McGraw-Hill Education (India), New Delhi.

4. Yi-Ping P. Chen, —Bioinformatics Technologies, 2006, Springer India Pvt. Ltd., New Delhi.

5. Arthur Lesk, —Introduction to Bioinformatics^{II}, 2009, Oxford University Press, ISBN-13: 978-

0199208043. 4. Bryan Bergeron, —Bioinformatics Computing^{II}, 2003, PHI Learning. New Delhi.

6. Zoe Lacroix, Terence Critchlow, —Bioinformatics: Managing Scientific datal, 2009, Elsevier India Pvt. Ltd., New Delhi.