EVALUATION SCHEME AND SYLLABUS

FOR

BACHELOR OF COMPUTER APPLICATION (BCA)

as per

NEP-2020

(Effective from the Session: 2023-24)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY

UNIVERSITY OF LUCKNOW, LUCKNOW

NBCA - 201
DATA STRUCTURE

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Learn how to represent arrays, linked lists, stacks, queues in memory using the algorithms and their common applications.

2. Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.

3. Learn the computational efficiency of the sorting and searching algorithms.

4. Learn implementation of Trees and Graphs, and various operations on these data structure.

5. Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.

Unit–I **07**

Introduction: Basic Terminology, Elementary Data Organization, Built in Data Types, Abstract Data Types. **Arrays:** Derivation of Index Formulae for 1D, 2D, 3D & nD Array, Application of arrays. **Linked lists:** Implementation of Singly Linked List and Doubly Linked List.

Unit–II **08**

Stacks: Basic operations: Push & Pop, Array implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, and Evaluation of postfix expression. **Queues:** Basic operations: Create, Add, Delete, Circular queues, and Array implementation of queues in C.

Unit-III **09**

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array and Pointer (Linked List) Representation, Binary Search Tree, Strictly Binary Tree, and Complete Binary Tree. Extended Binary Trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Constructing Binary Tree from given Tree Traversal and Insertion.

Unit–IV **08**

Searching: Sequential search and Binary Search. **Sorting:** Insertion Sort, Selection, Bubble Sort, Quick Sort, and Radix Sort.

Unit–V **08**

Graphs: Basic terminology, Graph Representations: Adjacency Matrices, Adjacency List. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm.

Text Books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data Structures Using C and C++”, PHI

2. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
3. Thareja, “Data Structure Using C” Oxford Higher Education

Reference Books:

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication
2. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
3. Lipschutz, “Data Structures” Schaum‟s Outline Series, TMH

NBCA-202

DATABASE MANAGEMENT SYSTEM

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Understand database concepts, structures and query language.
2. Understand the E R model and relational model.
3. Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
4. Understand concept of transaction processing and concurrency control.
5.

Unit-I **08**

Introduction: An overview of database management system, advantage of database system, database system vs file system, database system concept and architecture, data model schema and instances, data independence, database language and interfaces, and overall database structure.

Unit-II **08**

Data modeling using the entity relationship model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, and relationship of higher degree.

Unit-III **08**

Relational data model and language: Relational data model concepts, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple calculus, and domain calculus. **Introduction to SQL Statements:** Data retrieval, DDL, DML, TCL, DCL, characteristics of SQL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub queries, aggregate functions, joins, unions, intersection, minus, cursors, and triggers.

Unit-IV **08**

Database design & normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, lossless join decompositions, and normalization using FD, MVD and JDs. **Transaction Processing Concept:** Transaction system, testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, log based recovery, checkpoints, and deadlock handling.

Unit-V **08**

Concurrency control techniques: Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, and validation based protocol.

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.

Reference Books:

2. Date C J, " An Introduction to Database Systems", Addision Wesley.
3. Elmasri, Navathe, " Fudamentals of Database Systems", Addision Wesley.

4. O‟Neil, Databases, Elsevier Pub.
5. Leon &Leon, ”Database Management Systems”, Vikas Publishing House.
6. Bipin C. Desai, “ An Introduction to Database Systems”, Gagotia Publications.
7. Majumdar & Bhattacharya, “Database Management System”, TMH.
8. Ramkrishnan, Gehrke, “ Database Management System”, McGraw Hill.

NBCA-203
OPERATING SYSTEM

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Course Outcomes (COs):

1. After the completion of the course, students are expected to have the ability to:
2. Analyze various process scheduling Algorithms and their comparisons.
3. Understand the process synchronization problems.
4. Implement the concept of deadlock detection and avoidance.
5. Compare and contrast various Memory management schemes and Page replacement policies.
6. Understand the concept of File and Disk management.

Unit-I **08**

Introduction: Operating system and its functions, classification of operating systems- batch, interactive, time sharing, real time system, multiprocessor systems, multiuser systems, multithreaded systems, operating system structure- layered structure, system components, and operating system services.

Unit-II **08**

Process Management: Process Concept, Process Scheduling, CPU Scheduling Criteria and Scheduling Algorithms, Cooperating Processes, Threads, and Inter-process Communication.

Unit-III **08**

Process Synchronization and Deadlocks: The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Deadlock-System Model, Characterization, Deadlock Prevention, Avoidance and Detection and Recovery from Deadlock.

Unit-IV **08**

Memory Management: Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames and Thrashing.

Unit-V **08**

File Management: File Systems, Secondary Storage Structure, File concept, Access methods and Directory implementation. **Disk Management:** Disk Structure, Disk scheduling, Disk management and Recovery.

Text Books:

1. Abraham Siberschatz and Peter Galvin “Operating System Concepts”, Wiley.
2. Tannenbaum, “Operating System”, TMH.
3. William Stallings, “Operating Systems: Internals and Design Principles ”, 6th Edition, Pearson Education

Reference Books:

1. Milan Milankovic, “Operating Systems, Concept and Design”, McGraw Hill.
2. Harvey M Deital, “Operating System”, Addison Wesley.
3. D M Dhamdhere, “Operating Systems: A Concept based Approach”, 2nd Edition, TMH.

NBCA-204
DISCRETE MATHEMATICL STRUCTURES

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Apply logical skills developed in this course, in various computer applications.
2. Apply the computing skills to formulate, solve and analyse interdisciplinary real-world problems for higher study and research.
3. Apply various algebraic structures in different branches of computer science
4. Apply Graph theoretical concepts to modal, analyse and solve real-world problems.

Unit-I **08**

Set Theory: Introduction, Combination of sets, Multi sets, ordered pairs, Set identities. **Relations**: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations. **Functions**: Definition, Classification of functions, Operations on functions, Recursively defined functions.

Unit-II **08**

Propositional Logic: Proposition, Logical connectives, Truth tables, Well formed formula, Tautology, Contradiction, Algebra of proposition, Normal forms, Modus ponens, Modus tollens, Validity. **Predicate Logic**: First order predicate, Well formed formula of predicate, Quantifiers, Inference theory of predicate logic. **Notion of Proof**: Proof by implication, converse, inverse, contra-positive, Negation and contradiction, Direct proof, Proof by using truth table, Proof by counter example.

Unit-III **08**

Combinatories: Mathematical induction, Basics of counting, Pigeonhole principle, Permutations, Combinations, Inclusion-exclusion. **Recurrence Relations & Generating function**: Recurrence relation of order n with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation, Generating function Closed form expression, Properties of G.F., Solution of recurrence relation using G.F.

Unit-IV **08**

Algebraic Structures: Binary composition and its properties, Definition of algebraic structure, Semi group, Monoid, Group, Abelain group, Properties of groups, Permutation group, Sub group, Cyclic group, Rings and Fields(definition and standard results), and Integers modulo n.

Unit-V **08**

Elements of coding theory: Introduction, Definitions, Error detecting & correcting code, Harmonic Code and distance, Theorems. Group (Linear) Codes, Decoding methods. Parity check and Generator matrix, Definition parity check Matrix decoding, Coset decoding. **Hamming's Codes:** Concept, implementation as error correcting code, SEC Code and SEC- DED.

Text Books:

1. Liu and Mohapatra, " Elements of Discrete Mathematics", McGraw Hill
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley India, New Delhi, 2010.

3. R.P. Grimaldi, Discrete and Combinatorial Mathematics, Addison Welsy,
4. S.K. Sarkar, “A Text Book of Discrete Mathematics”, S.Chand & Company Ltd., 2012.

Reference Books

1. Kenneth H. Rosen, “ Discerete Mathematics and its Applications”, Mc Graw Hill, 2002.
2 J.P. Tremblay & R. Manohar, “ Discrete Mathematical Structure with Applications to Computer Science” Mc Graw Hill, 1975.
3. V. Krishnamurthy, “Combinatories: Theory and Apllications”, East-West Press.
4. Seymour Lipschutz, M.Lipson, “Discrete Mathematics” Tata Mc Graw Hill, 2005.
5. Kolman, Busby Ross, “Discrete Mathematical Structures”, Prentice Hall Internatinal.

NBCA-205

DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

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COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

1. Design various logic gates and simplify Boolean functions.
2. Design various flip flops, shift registers and determining outputs.
3. Analyze, design and implement combinational logic circuits.
4. Perform computer arithmetic operations.
5. Understand the Control unit, memory design and I/O organization of computer system.

Unit-I **08**

Basics of Digital Electronics: Number System– Decimal, Binary, Octal, Hexa-Decimal Representation for their Conversion, Coding System and Arithmetic of Number System. Character Codes and its arithmetic, Error detecting and correcting codes. **Boolean algebra**: Definition, axioms, basic theorems, and properties. Boolean functions and their simplification: Canonical and standard forms, K- map method up to five variables, and don't care conditions.

Unit-II **08**

Logic Gates: AND, OR, NOT, XOR, XNOR, NAND, NOR gates and their truth tables. Implementation of Boolean Functions using NAND and NOR gates. **Combinational Logic:** Combinational circuits, analysis and design procedures, adders, subtractor, Introduction to decoders, encoders, multiplexers and De-multiplexers.

Unit-III **08**

Sequential logic: Sequential circuits, Latches, Flip flops: RS, clocked RS, JK, D and T flip-flops, Master slave flip-flop, edge and level triggering. Registers and Counters: Shift registers, Ripple counters, Johnson & Ring Counter. Introduction to Synchronous and Asynchronous Circuits.

Unit-IV **08**

Basics of Computer Organization: Introduction, bus architecture, bus and memory transfer, processor organization, general register organization, stack organization, and addressing modes. **Arithmetic and logic unit:** Introduction, Fixed and floating point representation, IEEE standard for floating point representation, Multiplication: Signed operand multiplication, and Booth's algorithm.

Unit-V **08**

Control Unit: Instruction types, formats, instruction cycles and sub-cycles, micro-operations, and execution of a complete instruction. **Memory:** Introduction, semiconductor RAM memories, ROM memories, and Cache memories. **Input / Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts, and standard communication interfaces.

Text Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Education India.

2. W. Stallings, “Computer Organization”, PHI.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education India.

Reference Books:

1. DP Kothari and JS Dhillon, “Digital Circuit and Design”, Pearson Education.
2. Vravice, Zaky & Hamacher, “Computer Organization”, TMH Publication.
3. John P.Hayes, “Computer Organization”, McGraw Hill.

NBCA-206P
DATA STRUCTURE LAB

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1. To implement addition and multiplication of two 2D arrays.

2. To transpose a 2D array.

3. To implement stack using array.

4. To implement stack using linked list.

5. To implement queue using array.

6. To implement queue using linked list.

7. To implement circular queue using array.

8. To implement circular queue using linked list.

9. To implement binary tree using linked list.

10. To implement binary search tree using linked list.

11. To implement tree traversals using linked list.

12. To implement BFS using linked list.

13. To implement DFS using linked list.

14. To implement Linear Search.

15. To implement Binary Search.

16. To implement Bubble Sorting.

17. To implement Selection Sorting.

18. To implement Insertion Sorting.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-207P
DBMS Lab

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LIST OF PRACTICALS

Part I: Getting familiar with SQL (Maximum number of turns allotted: 3)

1) Creating tables.
2) Insertion, Deletion, Updation and Retrieval of data.
3) Arithmetic operations, Logical operations and Pattern matching.
4) Concept of Grouping (Group by clause, Having Clause).
5) Use Aggregate function in query.
6) Write commands for Joins, Union and Intersection.
7) Concept of Sub-query.
8) Concept of Data constraints (Unique Key, Primary Key, Foreign Key).
9) Creating Views and Indexes.
10) Creating Trigger.

Part II: Relational Database Implementation

Implement the following mini-project's database schemas and give an expression in SQL for each of the queries.

Project 1. Library Management System:
Create the following schema, enter at least 5 records in each table and answer the queries given below.

LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price**)**
IssuedBooks (Accession number, Borrower**)**

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
b) Delete the record of book titled "Database System Concepts".
c) Change the Department of the book titled "Discrete Mathematics" to "CSE".
d) List all books that belong to "CSE" department.
e) List all books that belong to "CSE" department and are written by author "Navathe".
f) List all computer (Department="CSE") that have been issued.
g) List all books which have a price less than 500 or purchased between "01/01/2015" and "01/01/2019".

Project 2. Student Management System:
Create the following schema, enter at least 5 records in each table and answer the queries given below.

Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)
Paper Details (Paper code, Name of the Paper)
Academic_details (College roll number, Paper code, Attendance, Marks in home examination)

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.

b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper 2.

c) List all students who live in "Lucknow" and have marks greater than 60 in paper 1.

d) Find the total attendance and total marks obtained by each student.

e) List the name of student who has got the highest marks in paper 2.

Project 3. Customer Management System:

Create the following schema, enter at least 5 records in each table and answer the queries given below.

Customer (CustID, email, Name, Phone, ReferrerID)
Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)
BicycleModel (ModelNo, Manufacturer, Style)
Service (StartDate, BicycleID, EndDate)

a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.

b) List all the customers who have the bicycles manufactured by manufacturer "Honda".

c) List the bicycles purchased by the customers who have been referred by customer "C1".

d) List the manufacturer of red colored bicycles.

e) List the models of the bicycles given for service.

Project 4. Human Resource Management System:

Create the following tables, enter at least 5 records in each table and answer the queries given below.

EMPLOYEE (Person_Name, Street, City)
WORKS (Person_Name, Company_Name, Salary)
COMPANY (Company_Name, City)
MANAGES (Person_Name, Manager_Name)

a) Identify primary and foreign keys.

b) Alter table employee, add a column "email" of type varchar(20).

c) Find the name of all managers who work for both Samba Bank and NCB Bank.

d) Find the names, street address and cities of residence and salary of all employees who work for "Samba Bank" and earn more than $10,000.

e) Find the names of all employees who live in the same city as the company for which they work.

f) Find the highest salary, lowest salary and average salary paid by each company.

g) Find the sum of salary and number of employees in each company.

h) Find the name of the company that pays highest salary.

Project 5. Supplier Management System:

Create the following tables, enter at least 5 records in each table and answer the queries given below.

Suppliers (SNo, Sname, Status, SCity)
Parts (PNo, Pname, Colour, Weight, City)
Project (JNo, Jname, Jcity)
Shipment (Sno, Pno, Jno, Qunatity)

a) Identify primary and foreign keys.

b) Get supplier numbers for suppliers in Paris with status>20.

c) Get suppliers names for suppliers who do not supply part P2.

d) For each shipment get full shipment details, including total shipment weights.

e) Get all the shipments where the quantity is in the range 300 to 750 inclusive.

f) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.

g) Get the names of cities that store more than five red parts.

h) Get full details of parts supplied by a supplier in Delhi.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-208P
OPERATING SYSTEM LAB

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1. WAP to implement first come first serve (FCFS) CPU Scheduling Algorithms in C.
2. WAP to implement shortest job first (SJF) CPU Scheduling Algorithms in C.
3. WAP to implement shortest remaining time First (SRTF) CPU Scheduling Algorithms in C.
4. WAP to implement PRIORITY CPU Scheduling Algorithms in C.
5. WAP to implement ROUND ROBIN Scheduling Algorithms in C.
6. WAP to implement BANKER'S Algorithms in C.
7. WAP to implement FIFO Page Replacement Algorithm in C.
8. WAP to implement LRU Page Replacement Algorithm in C.
9. WAP to implement OPTIMAL Page Replacement Algorithm in C.
10. Simulate Paging Technique of Memory Management.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.