BCA NEP 4 years (NEP-AICTE) 2nd Semester NEP

Scheme Examination, May-2026

Mathematics Foundations to Computer Science-II

Paper : 25BCA402DS01

Time allowed : 3 Hours] *[Maximum marks : 50*

Note : *Attempt **five** questions in all. **Question No. 1 is compulsory.** In addition to compulsory question, attempt **four** more questions selecting **one** question from each unit. All questions carry equal marks.*

1. Compulsory Question : 5×2=10

(i) Define closure property for group.

(ii) Define the term semi-group.

(iii) Explain the term duality.

(iv) What is modus ponen?

(v) What is the identity element in a monoid?

Unit–I

2. What do you mean by tautology, contradiction and contingency? Show that the following is tautology, contradiction or contingency : 10

$(P \to (Q \to R)) \to ((P \to Q) \to (P \to R))$.

3. Show that $\frac{1^2}{1.3}+\frac{2^2}{3.5}+\ldots+\frac{n^2}{(2n-1)(2n+1)}=\frac{n(n+1)}{2(2n+1)}$ using mathematical induction. 10

Unit–II

4. (a) If (S, *) and (T, o) be a monoids with the identity elements e and e' respectively. Let f: S→T be an isomorphism, then f(e) =e'. 5

(b) In a monoid, show that the set of left invertibles as well as the set of right invertibles forms a submonoid. 5

5. What is Cyclic group? Prove that an infinite cyclic group is isomorphic to the additive group of integers (Z, +). 10

Unit–III

6. (a) Define error in numerical computation. Explain various types of errors with examples. Explain their causes and impact on computations. 5

(b) Explain the bisection method. Derive its algorithm. 5

7. (a) Explain Lagrange's interpolation formula and derive it. 5

(b) Compare Trapezoidal Rule and Simpson's 1/3 rule in terms of accuracy and application. 5

Unit–IV

8. Use the graphical method to solve the following LP problem : *Minimize* $Z = 3x_1 + 2x_2$ subject to the constraints : 10

(i) $5x_1 + x_2 \geq 10$,

(ii) $x_1 + x_2 \geq 6$,

(iii) $x_1 + 4x_2 \geq 12$ and $x_1, x_2 \geq 0$.

9. Explain the simplex method with the help of suitable example. 10

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BCA-NEP-4 years (NEP-AICTE) 2nd Semester NEP

Scheme Examination, May-2026

Data Structures

Paper : 25BCA402DS02

Time allowed : 3 Hours] *[Maximum marks : 50*

Note : *Attempt **five** questions in all. **Question No. 1 is compulsory.** In addition to compulsory question, attempt **four** more questions selecting **one** question from each unit. All questions carry equal marks.*

1. (i) How do you push and pop elements in a stack?

(ii) Define Graph, Multigraph and Complete Graph.

(iii) Define the tree and write the properties of a tree.

(iv) How do you insert an element in an array?

(v) What are the limitations of simple queue?

5×2=10

Unit–I

4×2.5=10

2. Differentiate between :

(i) Linear and non-linear data structure

(ii) Homogenous and non-primitive data structure

(iii) Primitive and non-primitive data structure

(iv) Static and dynamic data structure

3. (i) Explain Big-Oh notation with the help of example. 6

(ii) What is an algorithm? Differentiate between algorithm and program. 4

Unit–II

4. (i) What is hashing? What are the different methods used for calculating hash functions? Explain with suitable examples. 5

(ii) Describe the advantages and disadvantages of circular list. 5

5. (i) What is a circular linked list? What are its advantages over linear linked list? Write a program/algorithm to insert a node at desired position in a circular linked list. 5

(ii) What is linked list? How can you represent a linked list in memory? 5

Unit–III

6. (i) What is recursion? Write the recursion algorithm and iterative algorithm for finding the factorial of a number N. 5

(ii) What is doubly ended queue? Write a program/algorithm to implement a doubly ended queue (deque). 5

7. (i) Differentiate between linear queue and circular queue. Which one is better and why? 5

(ii) Explain overflow and underflow conditions of a stack with examples. 5

Unit–IV

8. (i) What is binary search tree? How can you search, insert and delete an element in a BST? Explain using suitable example. 5

(ii) Explain the various representation of graph with example in detail? 5

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9. (i) Define the following : 5

(a) Strictly binary tree

(b) Completely binary tree

(ii) What is graph? Explain how graphs are represented. 5

BCA-NEP-4 years (NEP-AICTE) 2nd Semester

NEP Scheme Examination, May-2026

Operating Systems

Paper : 25BCA402DS03

Time allowed : 3 Hours] *[Maximum marks : 50*

Note : Question No. 1 is compulsory. *Attempt any* ***four*** *questions from rest eight questions. All questions carry equal marks.*

1. (a) What is an Operating System?

(b) What is a Process Control Block (PCB)?

(c) What is a race condition?

(d) What is paging in memory management?

(e) What is fragmentation?

5×2=10

Unit–I

2. (a) What are the main components and services of an Operating System? How do they support user programs? Illustrate. 5

(b) What are different types of Operating Systems? How do batch and time-sharing systems differ? Explain. 5

3. (a) What is System call? How do system calls act as an interface between user and OS? Illustrate. 5

(b) What is Operating System Structure? How do layered and monolithic structures differ? Explain. 5

Unit–II

4. (a) What is a process? How do process states change during execution? Illustrate. 5

(b) What is CPU scheduling? How do FCFS and SJF scheduling algorithms work? Explain. 5

5. (a) What are threads? How do multithreading and single-threading differ in execution? Illustrate. 5

(b) What is Round Robin Scheduling? How does it ensure fairness among processes? Explain. 5

Unit–III

6. (a) What is critical section problem? How does mutual exclusion solve this issue? Illustrate. 5

(b) What are Semaphores? How are they used in process synchronization? Explain. 5

7. (a) What is Deadlock? How do necessary conditions lead to deadlock situations? Illustrate. 5

(b) What is Banker's algorithm? How does it help in deadlock avoidance? Explain. 5

Unit–IV

8. (a) What is Memory Allocation? How do MFT and MVT techniques differ? Illustrate. 5

(b) What is Virtual Memory? How does demand paging work in managing memory? Explain. 5

9. (a) What are page replacement algorithms? How does FIFO differ from LRU? Explain. 5

(b) What is disk scheduling? How do algorithms like SSTF improve disk performance? Illustrate. 5

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BCA 4 years (NEP) 2nd Semester

Examination, May-2026

DIGITAL LOGIC DESIGN

PAPER–23BCA402DS01

Time allowed : 3 hours] *[Maximum marks : 70*

Note : ***Question No. 1 is compulsory.*** *Attempt any* ***four*** *questions from rest eight questions. All questions carry equal marks.*

1. (a) What is meant by a digital system ? 7×2=14

(b) What is signed binary number ?

(c) What is an XOR gate ?

(d) What is meant by a Prime Implicant ?

(e) What is a binary multiplier ?

(f) What is a latch in sequential circuits ?

(g) What is a Modulo-N counter ?

Unit–I

2. (a) What are binary codes ? How are complements used in digital systems ? Illustrate with examples. 7

(b) What are error detection and correction codes ? Discuss their significance. 7

3. (a) What are the fundamental theorems and properties of Boolean Algebra used in logic simplification ? Illustrate. 7

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(b) How do logic gates such as NOT, OR, AND, XOR, and XNOR function ? Explain with truth tables. 7

Unit–II

4. (a) What are canonical forms ? How are Boolean expressions simplified using algebraic methods ? Illustrate. 7

(b) How are K-Maps constructed and used for minimizing Boolean functions with four variables? Illustrate. 7

5. (a) What are Don't Care conditions ? How do they help in logic minimization ? Explain with a suitable example. 7

(b) How can complex Boolean functions be implemented using only NAND gates or only NOR gates ? Illustrate. 7

Unit–III

6. (a) What are the functions of Full-Subtractor circuits in binary arithmetic ? Explain with logic diagrams. 7

(b) How does a parallel binary adder perform arithmetic operations ? Illustrate. 7

7. (a) What are the applications of binary multipliers and comparators in digital systems ? Explain. 7

(b) How do encoders and decoders convert information from one form to another in digital circuits ? Illustrate. 7

Unit–IV

8. (a) What are the operating principles of latches and flip-flops in sequential logic circuits ? Explain. 7

(b) How does a Master-Slave-Flip-Flop eliminate timing problems in sequential circuits ? Illustrate. 7

BCA-NEP-4 years 2nd Semester NEP Scheme

Examination, May-2026

Data and File Structures

Paper : 23BCA402DS02

Time allowed : 3 Hours] *[Maximum marks : 50*

Note : *Attempt **five** questions in all. **Question No. 1 is compulsory.** In addition to compulsory question, attempt **four** more questions selecting **one** question from each unit. All questions carry equal marks.*

1. Compulsory Question : 5×2=10

(i) Write any two applications of stack.

(ii) Define the term parallel array.

(iii) Write the worst and average complexity of bubble sort.

(iv) Define the term record.

(v) Write the formula to calculate the length of linear array.

Unit–I

2. Explain the term linear array and its representation in memory. Explain how an element is deleted from array with the help of diagram and an algorithm. 10

3. What is Searching? Explain binary search with the help of algorithm and its prerequisite. Also, differentiate it with sequential search.

Unit–II

4. What is Sorting? Write an algorithm for insertion sort and explain it with the help of example. What are the minimum number of passes required to sort the list with insertion sort. 10

5. Discuss the following in detail : 2×5

   (a) Stack vs Queue

   (b) Polish notation & Recursion

Unit–III

6. Explain the following in detail : 4, 3, 3

   (a) Garbage Collection

   (b) Header Linked List

   (c) Threaded List

7. (a) How insertion is performed in a tree? Write an algorithm and draw a suitable diagram. 6

(b) What do you mean by graph? Explain pendant vertex, isolated vertex and degree of a graph with the help of diagram. 4

Unit–IV

8. Define the term file and its importance. Discuss various types of files and different operations that can be performed on a file. 10

9. Explain the following : 2×5

(a) Access methods in file

(b) Hashed file organization