Printed Page:-05 **Subject Code:- BCSBS0106**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: I - THEORY EXAMINATION (2024 - 2025)

Subject: Discrete Mathematics

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. When designing a circuit to emulate a truth table, both Product-of-Sums (POS) expressions and Sum-of-Products (SOP) expressions can be derived from? (CO1, K2) 1

(a) k-map
(b) NAND gate
(c) NOR gate
(d) X-NOR gate

1-b. K-map is used for _____ ? (CO1, K1) 1

(a) logic minimization
(b) expression maximization
(c) summing of parity bits
(d) logic gate creation

1-c. If set A has 4 elements and B has 3 elements then set n(A X B) is? (CO2, K2) 1

(a) 10
(b) 12
(c) 4
(d) 8

1-d. For two sets C and D the set (C – D) ∩ D will be _____? (CO2, K3) 1

(a) C

(b) D

(c) Φ

(d) None of the mentioned

1-e. Find the number of ways in which 4 people E, F, G, H, A, C can be seated at a round table, such that E and F must always sit together. (CO3, K2) 1

(a) 48

(b) 62

(c) 120

(d) 50

1-f. How many different choices can be made from 5 roses, 4 marigold and 8 sunflowers if at least one flower is to be chosen for making of garland? (CO3,K3) 1

(a) 269

(b) 270

(c) 271

(d) 268

1-g. For a connected planar simple graph G=(V, E) with e=E=16 and v=V=9, then find the number of regions that are created when drawing a planar representation of the graph? (CO4,K2) 1

(a) 9

(b) 102

(c) 525

(d) 1024

1-h. Describe degree of a vertex in a graph? (CO4,K1) 1

(a) total edges incident on vertex

(b) total weights incident on vertex

(c) total loops on a vertex

(d) total multiple edges

1-i. Describe the converse of the conditional statement “When Raj stay up late, it is necessary that Raj sleep until noon.” (CO5,K1) 1

(a) If Raj stay up late, then Raj sleep until noon.

(b) If Raj does not stay up late, then Raj does not sleep until noon.

(c) If Raj does not sleep until noon, then Raj does not stay up late.

(d) If Raj sleep until noon, then Raj stay up late

1-j. Describe the contrapositive of the conditional statement “I come to class whenever there is going to be a test.” (CO5,K1) 1

(a) “If I come to class, then there will be a test.”

(b) “If I do not come to class, then there will not be a test.”

(c) “If there is not going to be a test, then I don’t come to class.”

(d) "If there is going to be a test, then I don't come to class."

2. Attempt all parts:-

2.a. Use a Venn diagram to verify 2
(a) A + AB = A + B
(b) AB + AC + BC = AB + AC (CO1,K3)

2.b. Write the dual of each equation: 2
(a) A = (BC ∩ A) ∪ (A ∩ B)
(b) (A ∩ B) ∪ (AC ∩ B) ∪ (A ∩ BC) ∪ (AC ∩ BC) = U (CO2, K1)

2.c. From a group of 6 men and 5 women, four persons are to be selected to form a committee so that at least 2 men are there in the committee. In how many ways can it be done? (CO3, K4) 2

2.d. Define various ways of graph representation? Explain with example. (CO4,K1) 2

2.e. Classify which rule of inference is used in each of these arguments, "If it hails today, the local office will be closed. The local office is not closed today. Thus, it did not hailed today." (CO5,K1) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Plot the following Boolean expression on Karnaugh maps (K-maps): $x\bar{y} + \bar{x}y + xy$ (CO1, K5) 6

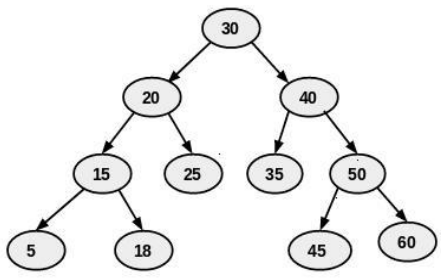
3-b. Write the duals of the following Boolean equations: 6
(1) (a + b) + c(1 + d) + 1 = 1
(2) A.B+B.C+A.(B+C).1 (CO1,K6)

3-c. Determine if each function is one-to-one. 6
(a) f: R→ R defined as $f(a) = 3a^3 - 4$.
(b) f: R→ R defined as $f(x) = 3x+1$.
(c) f: R→ R defined as $f(x) = x^3$.
(d) f: R→ R defined as $f(x) = x/3$ (CO2,K1)

3-d. Show that the set R = {0, 2, 4, 6} is a commutative ring under addition and multiplication modulo 8. (CO3,K3) 6

3.e. Identify the unique solution with initial conditions given: $a_n = 9a_{n-1} - 27a_{n-2} + 27a_{n-3}$ with $a_0 = 5$, $a_1 = 24$, $a_2 = 117$. (CO3,K1) 6

3.f. Find the post-order traversal of the given graph. (CO4,K3) 6



3.g. Show that the biconditional statement $(a \rightarrow b) \leftrightarrow (\sim b \rightarrow \sim a)$ is a tautology. (CO5,K2) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Given the function f(x,y,z) below, write f(x,y,z) as a sum of minterms. 10
f(x,y,z) = $x\bar{z} + y\bar{z} + xyz$ (CO1,K6)

4-b. Minimize F(A,B,C,D)=$\pi(3,5,7,8,10,13)$ using K-map. (CO1,K3) 10

5. Answer any one of the following:-

5-a. Let R be the relation on N defined by x + 3y = 12, i.e. R = {(x, y) x + 3y = 12}. 10
(a) Write R as a set of ordered pairs. (c) Find R^{-1}.
(b) Find the domain and range of R. (d) Find the composition relation $R \circ R$.
(CO2, K2,K6)

5-b. Show that G = {1, w, w^2} is an abelian group under multiplication, where 1, w, w^2 are cube roots of unity (CO2,K1) 10

6. Answer any one of the following:-

6-a. Suppose 32 students are in an art class A and 24 students are in a biology class B, and suppose 10 students are in both classes. Find the number of students who are: (a) in class A or in class B; (b) only in class A; (c) only in class B. (CO3,K2) 10

6-b. A class contains 10 students with 6 men and 4 women. Find the number n of ways to: 10
(a) Select a 4-member committee from the students.
(b) Select a 4-member committee with 2 men and 2 women.
(c) Elect a president, vice president, and treasurer. (CO3,K3)

7. Answer any one of the following:-

7-a. Define five color theorem. Illustrate with example. (CO4,K1) 10

7-b. Explain chromatic number of a graph. What should be the chromatic number of a complete graph with 4 vertex. (CO4, K1) 10

8. Answer any one of the following:-

8-a. Construct truth tables for the following statements. 10
(1) $(a \rightarrow b) \wedge (\sim b \rightarrow \sim a)$ (2) $\sim (a \vee b) \vee \sim (a \wedge b)$ (CO5,K6)

8-b. Write this English sentence in symbolic form-Either today is Sunday or Monday. 10
What do you mean by contingency and validity of a proposition? Explain with suitable examples. (CO5,K6)