

AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD

Department of CSE

Pre-University Test

Course: B. Tech.
Session: 2025-26
Subject: DSTL
Max Marks: 70

Semester: 3rd

Section: CSE, CSE-DS, CSE-AIML, CS, AIML

Sub. Code: BCS303

Time: 3 hrs.

OBE Remarks:

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO No.	1	1	2	2	3	4	5	1	2	2	1	3	3	4	4	5	5
Bloom's Level	L1	L6	L2	L3	L6	L1	L2	L5	L3	L3	L3	L5	L5	L3	L3	L3	L2
Weightage CO3: 16						Weightage CO4: 16						Weightage CO5: 16					

Note: Answer all the sections.

Section-A

A. Attempt all the parts.

(7 X 2 = 14)

1. State De Morgan's law and Absorption Law
2. Draw the Hasse diagram representing the positive divisors of 18.
3. In any Boolean algebra, show that $(a + b) \cdot (a' + c) = a' \cdot b + ac + bc$
4. Solve the following Boolean function using K-map: $F(A, B, C) = (1, 2, 5, 7)$ and $D(0, 4, 6)$ using Sum of product (SOP) form.
5. Construct inverse of the following statement "If I wake up early in the morning, then I will be healthy."
6. Show that set $\{1, 2, 3, 4, 5\}$ is not a group under addition modulo 6.
7. Compare Euler circuit and Hamiltonian circuit

Section-B

B. Attempt Any three. (Q. No. 12 is Compulsory)

(3X 7=21)

8. Prove / disprove the following identities.

(i) $(A \cup B) \cup (A \cap B^c) = A$	(ii) $A - B \subseteq A$
(iii) $(A - C) \cap (C - B) = \emptyset$	(iv) $(A - B) \cup (A \cap B) = A$
9. If $f: R \rightarrow R$, $g: R \rightarrow R$ and $h: R \rightarrow R$ defined by $f(x) = 3x^2 + 2$, $g(x) = 7x - 5$ and $h(x) = 1/x$. Compute the following composition functions

(i) $(f \circ g)(x)$	(ii) $(g \circ g)(x)$	(iii) $(g \circ h)(x)$	(iv) $(h \circ g \circ f)(x)$
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10. Describe the Boolean duality principle. Write the dual of each Boolean equations:

(i) $x + x'y = x + y$	(ii) $(x \cdot 1) \cdot (0 + x') = 0$
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11. Let R be a binary relation on the set of all strings of 0 and 1 such that $R = \{(a, b): a \text{ and } b \text{ have same number of 0's}\}$. Show that whether R is reflexive, symmetric, transitive or a partial order relation
12. Define tautology, contradiction and contingency? Check whether $(p \vee q) \wedge (\neg p \vee r) \rightarrow (q \vee r)$ is tautology, contradiction and contingency.

Section-C

(5 X 7 = 35)

C. Attempt all the parts.

13. Attempt any one.

- (a) Show the validity of the following argument: hypotheses: "It is not sunny this afternoon and it is colder than yesterday. We will go swimming only if it is sunny. If we do not go swimming, then we will take a canoe trip. If we take a canoe trip, then we will be home by sunset.
conclusion: "We will be home by sunset."

- (b) Construct the truth table for the following statements: (i) $(P \rightarrow Q') \rightarrow P'$ (ii) $P \leftrightarrow (P' \vee Q')$.

14. Attempt any one.

- (a) Describe Algebraic structure, semigroup, monoid and group. Also explain the relationship among them.

Determine whether the set $H = \{0, 1, 5\}$ is a subgroup of Z_6 under addition modulo 6.

- (b) In a group $(G, *)$ prove that

(i) $(a^{-1})^{-1} = a$

(ii) $(ab)^{-1} = b^{-1}a^{-1}$

15. Attempt any one.

- (a) Let $G = \{1, -1, i, -i\}$ with the binary operation multiplication be an algebraic structure, where $i = \sqrt{-1}$ then determines whether G is an Abelian group. Also if G is cyclic Group, then determine the generator of G .

- (b) Explain Cyclic group. Let H be a subgroup of a finite group G . Justify the statement "the order of H is a divisor of the order of G "

16. Attempt any one.

- (a) Explain Pigeon hole principle. Describe generalized form of Pigeon hole principle. If 6 colors are to paint 37 homes. Show that at least 7 of them will be of same color.

- (b) Define planar graph. Prove that for any connected planar graph, $v - e + r = 2$ Where v , e , r is the number of vertices, edges, and regions of the graph respectively.

17. Attempt any one.

- (a) Compare bipartite and complete graph with example. Draw $K_{3,4}$ and K_5 . Explain why these two graphs are not planar

- (b) Show that $K_{3,3}$ satisfies in equality $|E| \leq 3|V| - 6$, but it is nonplanar. (V =No. of Vertices, E =No. of Edges, R =No. of Regions)


Faculty Sign


HoD Sign