

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 $(a+b)(a'+c) = a'b + ac + bc'$
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) $(fogoh)(x)$ (ii) $(gog)(x)$ (iii) $(go)(x)$ (iv) $(hogof)(x)$

10. Describe the Boolean duality principle. Write the dual of each Boolean equations:

(i) $x+x'y=x+y$ (ii) $(x.l)(0+x')=0$

11. Let R be a binary relation on the set of all strings of 0 and 1 such that $R = \{(a, b) : a$ and b 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

C. Attempt all the parts.

(5 X 7 = 35)

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

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

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