



K16P 0098

Reg. No. :

Name :

I Semester M.C.A. Degree (Reg./Sup./Imp.) Examination, February 2016
(2014 Admn. Onwards)
MCA1C01 : DISCRETE MATHEMATICS

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Answer any ten questions from Section – A.
Each question carries three marks.
2) Answer all questions from Section – B.
Each question carries 10 marks.

SECTION – A

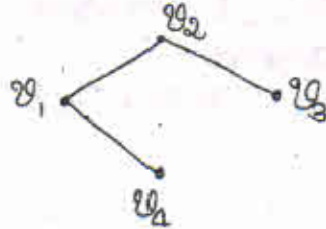
Answer any ten questions. Each question carries three marks.

1. Construct the truth table for $(p \wedge q) \vee \sim r$.
2. Simplify the logical statement $\sim(\sim p \wedge q) \wedge (p \vee q)$.
3. Show that $\sim(p \rightarrow q) \equiv p \wedge \sim q$.
4. Given that ϕ is an empty set, find $P(\phi)$, $P(P(\phi))$, $P(P(P(\phi)))$.
5. Define one-one function and onto function. Give an example each.
6. If $A = \{\alpha, \beta\}$ and $B = \{1, 2, 3\}$, what are $A \times B$, $B \times A$, $A \times A$, $B \times B$ and $(A \times B) \cup (B \times A)$?
7. Let $A = \{a, b\}$, $R = \{(a, a), (b, a), (b, b)\}$ and $S = \{(a, b), (b, a), (b, b)\}$. Then verify that $(S \circ R)^{-1} = R^{-1} \circ S^{-1}$.
8. Define reflexive, irreflexive and antisymmetric relations with an example each.

P.T.O.



9. Find n if $2P(n, 2) + 50 = P(2n, 2)$.
10. Find the sequence represented by the recursive formula
 $a_1 = 5, a_n = 2a_{n-1}, 2 \leq n \leq 7$.
11. Find the complement of the following graph.



12. Define graph, digraph and self-loop with an example each.

SECTION - B

Answer **all** questions. **Each** question carries **ten** marks.

13. a) Give the converse and contrapositive of the implications.

- i) If it is hot; then I take cold drinks.
 ii) If today is Monday, then tomorrow is Tuesday.

- b) Show that $((p \vee \sim q) \wedge (\sim p \vee \sim q)) \vee q$ is a tautology.

- c) Define Tautology and Contradiction.

(4+4+2)

OR

- a) Show that $(p \wedge (\sim p \vee q)) \vee (q \wedge \sim(p \wedge q)) \equiv q$.

- b) Obtain disjunctive normal form of

$$p \vee (\sim p \rightarrow (q \vee (q \rightarrow \sim r)))$$

(6+4)

14. a) State and prove D'Morgan's laws for set theory.

- b) If $f: A \rightarrow B$ and $g: B \rightarrow C$ are bijective mapping, then show that

$$(g \circ f)^{-1} = f^{-1} \circ g^{-1}$$

(5+5)

OR

- a) Use Venn diagram to show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

- b) If $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = ax + b$, where $a, b, x \in \mathbb{R}, a \neq 0$, then show that f is invertible and find the inverse of f .

(5+5)



15. a) Give an example of a non-empty set and a relation on the set that satisfies each of the following combinations of properties.

- Symmetric and reflexive but not transitive.
- Transitive and reflexive but not anti-symmetric.
- Anti-symmetric and reflexive but not transitive.

b) Let R be a relation from the Set A to the Set B and S be a relation from the Set B to the Set C , then show that $(S \circ R)^{-1} = R^{-1} \circ S^{-1}$.

(6+4)

OR

a) Explain Warshall's algorithm with suitable example.

b) Let $A = \{0, 1, 2, 3, 4\}$. Find the equivalence classes of the equivalence relation $R = \{(0, 0), (0, 4), (1, 1), (1, 3), (2, 2), (3, 1), (3, 3), (4, 0), (4, 4)\}$ defined on A .

Draw the digraph of R and write down the partition of A induced by R . (5+5)

16. a) For any finite Sets A, B, C , show that

$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C).$$

b) If $P(n, r) = 5040$ and $C(n, r) = 210$, find n and r .

(5+5)

OR

a) State Pigeonhole principle. Show that among 100 people there are at least $\lceil \frac{100}{12} \rceil = 9$ who were born in the same month.

b) What is the solution of the recurrence relation

$$a_n = a_{n-1} + 2a_{n-2} \text{ with } a_0 = 2, a_1 = 7?$$

(5+5)

17. a) Define Hamiltonian graph and Eulerian graph with examples.

b) Explain Dijkstra's algorithm of finding shortest path.

(4+6)

OR

a) Explain depth-first search. Use it to find a spanning tree for the graph shown below.

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