

KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

(6 Pages)

Reg. No:

Question Code No : 25001401

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PG Degree - End Semester Examinations, November 2025

First Semester

M.C.A

Discrete Mathematics

(For those who joined in July 2025 onwards)

Time : 3 Hours

Maximum : 75 Marks

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer:

- The number of elements in the power set of $A = \{a, b, c\}$ is _____.
(a) 3 (b) 6
(c) 9 (d) 8
- A set which is not a proper subset of any set is _____.
(a) Empty set (b) Universal set

- (c) Power set (d) Infinite set
3. The relation $R = \{(1,2), (2,2), (3,3)\}$ on $\{1,2,3\}$ is _____.
- (a) One-to-many (b) Many-to-many
(c) Many-to-one (d) One-to-one
4. The matrix representation of the relation $R = \{(1,2), (2,3)\}$ on $\{1,2,3\}$ is of order _____.
- (a) 2×2 (b) 3×3
(c) 3×2 (d) 2×3
5. The inverse of the function $f(x) = 2x + 3$ is _____.
- (a) $(x-3)/2$ (b) $2x-3$
(c) $(x+3)/2$ (d) $x+3$
6. A function $f: A \rightarrow B$ is onto if _____.
- (a) Every element of A has an image in B
(b) Every element of B has a pre-image in A
(c) $A \subseteq B$
(d) Every element of A has a unique image in B
7. The truth value of $p \wedge (\neg p \vee q)$ when $p=1, q=0$ is _____.
- (a) 0 (b) 1
(c) Either 0 or 1 (d) Undefined
8. A statement that is always true is called _____.
- (a) Contradiction (b) Tautology
(c) Contingency (d) Proposition

9. The transpose of a symmetric matrix is _____.
- (a) Skew-symmetric (b) Diagonal
(c) Symmetric (d) Triangular
10. The determinant of the matrix is $\begin{bmatrix} 3 & 2 \\ 3 & 4 \end{bmatrix}$ is _____.
- (a) -6 (b) 5
(c) -5 (d) 6

PART - B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

11. (a) If A, B and C are any three non empty sets then, verify that
 $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

(OR)

- (b) Using Venn diagram, prove $(A \cup B)^c = A^c \cap B^c$ where A and B are non empty sets.

12. (a) Find the transitive closure of the relation $R = \{(1, 2), (2, 3), (3, 1)\}$ on $\{1, 2, 3\}$.

(OR)

- (b) Examine whether the relation $R = \{(a,a), (b,b), (a,b)\}$ on $\{a,b\}$ is reflexive, symmetric and transitive.

13. (a) Determine whether the following functions are onto
(i) $f: A \rightarrow B$ where $A = B = \mathbb{N}$ and $f(a) = a + 2$

(ii) $g: A \rightarrow B$ where $A = B = Z$ and $g(a) = a + 2$

(iii) $h: A \rightarrow B$ where $A = B = R$ and $h(a) = 2a + 3$.

(OR)

(b) If $f(x) = x^2$ and $g(x) = x+1$, find $(f \circ g)(2)$ and $(g \circ f)(2)$.

14. (a) Reduce the statement $(p \wedge q) \vee (p \wedge \neg q)$ to its simplest form using laws of logic.

(OR)

(b) Show that $(p \rightarrow q) \equiv (\neg q \rightarrow \neg p)$.

15. (a) Find AB where $A = \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 & -4 \\ 5 & -2 & 6 \end{bmatrix}$.

(OR)

(b) Prove that $A(BC) = (AB)C$ where A, B and C are matrices in which products and sums are defined.

PART - C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 600 words.

16. (a) Discuss the various ways in which a set can be represented.

(OR)

(b) If $A = \{a, e, i, o, u\}$, $B = \{a, b, c, \dots, m\}$, $C = \{n, o, p, \dots, z\}$ and $D = \{d, i, s, c, r, e, t\}$, then examine the following

(i) $A \cup B$

(ii) $B \cap C$

(iii) $A - B$

(iv) B^c

(v) $(A - B) \Delta (D - A)$

(vi) $\wp(A \cap B)$.

17. (a) Let R be a relation on the set $\{1,2,3,4\}$ defined by $R = \{(a,b) \mid a \leq b\}$. Prove that R is reflexive, antisymmetric and transitive.

(OR)

- (b) If S is a relation in $\{1,3,5,7,9\}$ defined by mSn if $n=3m$, then determine the domain and range of S. Also construct the arrow diagram.

18. (a) Illustrate with examples that there functions from Z to Z which is

(i) Injective but not surjective.

(ii) Surjective but not injective.

(iii) Bijective.

(OR)

- (b) If $f: R \rightarrow R$ is defined by $f(x) = 3x + 5$, prove that f is one-to-one and onto.

19. (a) Find the truth tables for. (i) $p \vee \neg q$; (ii) $\neg p \wedge \neg q$.

(OR)

(b) Test the validity of the following arguments:

(i) If a man is a bachelor, he is unhappy. If a man is unhappy, he dies young.

(ii) If 7 is less than 4, then 7 is not a prime number. 7 is not less than 4.

20. (a) Prove that the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$ satisfies the polynomial $g(x) = x^2 + 3x - 10$ but does not satisfy the polynomial $f(x) = 2x^2 - 3x + 5$.

(OR)

(b) Prove that the product of two symmetric matrices is not necessarily symmetric with an example.