

Reg.No.:

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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 20004

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025

Third Semester

Computer Science and Engineering

U19MA304 – DISCRETE MATHEMATICS

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Show that $\neg p \vee q$ and $p \rightarrow q$ are logically equivalent.	2	K2	CO1
2.	Using truth table, show that the proposition $p \vee \neg(p \wedge q)$ is a tautology.	2	K2	CO1
3.	Define Universal Quantifier.	2	K1	CO2
4.	Give the symbolic form of the statement “Some of the crop will be destroyed if there is a flood”.	2	K2	CO2
5.	Given $A = \{2,5,6\}$, $B = \{3,4,2\}$ and $C = \{1,3,4\}$ find $A - B$ and $A - C$.	2	K1	CO3
6.	Let $A = \{1,2,3\}$ and $B = \{1,4\}$. If the relation R is such that “ $<$ ” then, find R, R^c, R^{-1} .	2	K1	CO3
7.	$f(x) = ax + b$ and $g(x) = cx + d$, where a, b, c and d are constants. For which constants a, b, c and d, it is true that $f \circ g, g \circ f$.	2	K1	CO4
8.	Let A be a subset of E. Then show that $(A^c)^c = A$.	2	K2	CO4
9.	Define semigroup.	2	K1	CO5
10.	Give an example of a monoid which is not a group.	2	K1	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Construct a truth table to prove the statement $(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)$.	8	K2	CO1
	ii. Find the PDNF and PCNF of $P \rightarrow (P \wedge (Q \rightarrow P))$.	8	K2	CO1
	(OR)			
b)	i. Prove that $(P \vee Q) \wedge (7P \wedge (7P \wedge Q)) \leftrightarrow (7P \wedge Q)$.	8	K2	CO1
	ii. Using indirect method of proof, prove that $P \rightarrow R, Q \rightarrow S, P \vee Q \Rightarrow S \vee R$.	8	K2	CO1
12. a)	i. Write rules of inference and implications.	8	K2	CO2
	ii. Prove that $(\exists x(P(x) \wedge Q(x)) \Rightarrow (\exists x)P(x) \wedge (\exists x)Q(x))$.	8	K2	CO2
	(OR)			
b)	i. Explain Universal and Existential quantifiers with an example.	8	K3	CO2
	ii. Show that $\exists xM(x)$ follows logically from the premises $(x)(H(x) \rightarrow M(x), \exists xH(x))$.	8	K3	CO2
13. a)	Given below are the relation matrices M_R and M_S . Find $M_{R \circ S}, M_{\overline{R \circ S}}, M_{R \circ \overline{S}}, M_{\overline{R}}$ and $M_{\overline{S}}$. And show that $M_{\overline{R \circ S}} = M_{\overline{S \circ R}}$.	16	K3	CO3
	$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}; M_S = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$			
	(OR)			
b)	i. For any 3 sets A, B and C prove that a. $A \times (B \cup C) = (A \times B) \cup (A \times C)$ b. $A \times (B \cap C) = (A \times B) \cap (A \times C)$	8	K3	CO3
	ii. Show that the relation "Congruence modulo 3" defined by $R = \{(x, y) / x - y \text{ is divisible by } 3\}$ is an equivalence over the set of integers. What are the equivalence classes of R?	8	K3	CO3

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| 14. a) | i. | Let $f : R \rightarrow R$ and $g : R \rightarrow R$ where R is the set of real numbers be given by $f(x) = x^2 - 2, g(x) = x + 4$.
Find $f \circ g, g \circ f$. | 8 | K4 | CO4 |
| | ii. | Show that $A \oplus (B \oplus C) = (A \oplus B) \oplus C$.
(OR) | 8 | K4 | CO4 |
| | b) i. | Prove Demorgan's law using characteristic function. | 8 | K2 | CO4 |
| | ii. | Using generating function solve
$a_n - 3a_{n-1} = n, n \geq 1, a_0 = 1$. | 8 | K2 | CO4 |
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| 15. a) | State and prove Lagrange's theorem for any finite group G .
(OR) | 16 | K3 | CO5 |
| b) | Prove that a group $(G, *)$ is abelian iff
$(a * b)^2 = a^2 * b^2, \forall a, b \in G$. | 16 | K3 | CO5 |