Reg.No.:												

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

Question Paper Code: 20003

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025
Third Semester
Computer Science and Engineering
U23MA304 – DISCRETE MATHEMATICS
(Common to IT, CST and AI&DS)
(Regulation 2023)

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.	Outline the truth value of "If tigers have wings then the earth travels round the sun".	2	K2	CO1
2.	List the two rules P and T of inference .	2	KI	CO1
3.	Symbolize the statement "All men are giants".	2	K2	CO2
4.	Let $Q(x)$ denote the statement "x = x+1". What is the truth value of the quantification $\exists x \quad Q(x)$, where the universe of disclosure consist of all real numbers?	2	K1	CO2
5.	How many relations are there on a set with n elements?	2	K1	CO3
6.	Define equivalence relations.	2	K1	CO3
7.	Do the following set $\{(1,(2,3)),(2,(3,4)),(3,(3,2))\}$ define functions? If so, give their domain.	2	K1	CO4
8.	Define characteristic function of the set A with an example.	2	K1	CO4
9.	Define a monoid.	2	K1	CO5
10.	Define the ring and give an example of an ring with zero-divisors.	2	K1	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Show that $Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ is a tautology.	8	K2	CO1
		ii.	Label and construct the truth table for $(P \rightarrow Q) \wedge (Q \rightarrow P)$.	8	K1	CO1
			(OR)			
	b)	i.	Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$.	8	K2	CO1
		ii.	Find the principal disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge \neg (\neg Q \vee \neg P))$.	8	K1	CO1
12.	a)	i.	Consider the statement "Given any positive integer, there is a greater positive integer". Explain and symbolize this statement with and without using the set of positive integers as the universe of discourse.	8	K5	CO2
		ii.	Outline and express " $\sqrt{2}$ is an irrational number " using quantifiers.	8	K2	CO2
			(OR)			
	b)	i.	Prove that $(\forall x)(P(x)) \vee (\forall x)(Q(x)) \rightarrow (\forall x)(P(x) \vee Q(x))$ is logically valid.	8	K5	CO2
		ii.	Show that $(\exists x)(P(x) \wedge Q(x)) \Rightarrow (\exists x)\ P(x) \wedge (\exists x)\ Q(x)$.	8	K2	CO2
13.	a)	i.	Show by means of an example that $A \times B \neq B \times A$ and $(A \times B) \times C \neq A \times (B \times C)$.	8	K2	CO3
		ii.	Given $S = \{1,2,3, \ldots, 10\}$ and a relation R on S where $R = \{(x, y) \mid x + y = 10\}$, what are the properties of the relation R?	8	K1	CO3
			(OR)			
	b)	i.	Show that the operation of meet are join on a lattice are associative.	8	K2	CO3
		ii.	Let R be a binary relation on the set of all positive integers such that $R = \{(a, b)/a = b^2\}$. Is R reflexive? Symmetric? Anti symmetric? Transitive? An equivalence relation? A partial ordering relation?	8	K1	CO3

14.	a)	i.	Prove that any function from $A = \{1,2,\ldots,n\}$ to A which is one-to-one must also be onto and conversely.	8	K5	CO4
		ii.	Show that the functions $f(x) = x^3$ and $g(x) = x^{\frac{1}{3}}$ for $x \in R$, are inverse of one another.	8	K2	CO4
			(OR)			
	b)	i.	Let $f: X \to Y$ and $Y \to X$. Prove that the function g is equal to f^{-1} only if $g \circ f = I_x$ and $f \circ g = I_y$ in the usual notation.	8	K5	CO4
		ii.	Show that $\overline{(A \cup B)} = \overline{A} \cap \overline{B}$ b using characteristic function.	8	K2	CO4
15.	a)	i.	Show that monoid homorphism preserves invertibility and monoid epimorphism preserves zero element (if it exits).	8	K2	CO5
		ii.	Show that the order of a subgroup of a finite group divides the order of the group.	8	K2	CO5
			(OR)			
	b)	i.	Show that every subgroup of a cyclic group is cyclic.	8	K2	CO5
		ii.	Show that the intersection of two normal subgroups is a normal subgroup.	8	K2	CO5