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. 2024
Third Semester
Computer Science and Engineering
U19MA304 – DISCRETE MATHEMATICS
(Common to IT)
(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 $\neg p \rightarrow (p \rightarrow q)$ is a tautology.	2	K2	CO1
2.	Find the contrapositive of the inverse of $p \rightarrow q$.	2	K2	CO1
3.	Define Universal Quantifier.	2	K1	CO2
4.	Give the symbolic form of the statement "every book with a blue cover is a mathematics book".	2	K2	CO2
5.	When will you say that a relation is an equivalence relation.	2	K1	CO3
6.	Define be the Cartesian product of two sets A & B.	2	K1	CO3
7.	What is meant by range of a function? Give an example.	2	K1	CO4
8.	Check whether the function $f(x) = 5x^2 + 7$ is injective.	2	K2	CO4
9.	Show that in a group G, $x^2 = x$ iff $x = e$.	2	K2	CO5
10.	Describe homomorphism.	2	K1	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.		Questions	Marks	KL	CO
11. a)	i.	Check whether the following proposition is a tautology $((P \rightarrow Q) \rightarrow R) \vee \neg P$.	8	K3	CO1
	ii.	Show that $(P \vee Q) \wedge \neg(\neg P \wedge Q) \Leftrightarrow P$.	8	K3	CO1
		(OR)			
b)	i.	Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q, Q \rightarrow R, P \rightarrow M$ and $\neg M$.	8	K3	CO1
	ii.	Obtain PCNF of the formula given by $(\neg p \rightarrow r) \wedge (q \leftrightarrow p)$.	8	K3	CO1
12. a)	i.	Write rules of inference and implications.	8	K3	CO2
	ii.	Verify the validity of the following argument. Lions are dangerous animals. There are lions. Therefore, there are dangerous animals.	8	K3	CO2
		(OR)			
b)	i.	Show that $\exists x M(x)$ follows logically from the premises $(x)(H(x) \rightarrow M(x))$ and $\exists x H(x)$.	8	K3	CO2
	ii.	Prove that $(x)(P(x) \rightarrow Q(x)) \wedge (x)(Q(x) \rightarrow R(x)) \Rightarrow (x)(P(x) \rightarrow R(x))$.	8	K3	CO2
13. a)		Given the relation matrices M_R and M_S, $M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}; M_S = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$. Find $M_{R \circ S}, M_{\overline{R \circ S}}, M_{R \circ S}, M_{\bar{R}}$ and $M_{\bar{S}}$.	16	K5	CO3
		(OR)			
b)	i.	Let R denote a relation on the set of all ordered pairs of positive integers by $(x, y)R\ (u, v)$ iff $xv = yu$. Show that R is an equivalence relation.	8	K4	CO3
	ii.	State and prove Associative law for any three sets.	8	K4	CO3

14. a)	i.	Let $f: R \to R$ and $g: R \to R$ be two functions where R is the set of real numbers is given by $f(x) = x^2 - 2$ and $g(x) = x + 4$. Find f o g, g o f.	8	K4	CO4
	ii.	Prove that inverse of a bijective function is again bijective function.	8	K4	CO4
		(OR)			
b)	i.	Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ using characteristic function.	8	K3	CO4
	ii.	Solve the recurrence relation $a_n = 5a_{n-1} - 6a_{n-2}$ for $n \geq 2$ given that $a_0 = 1, a_1 = 0$.	8	K3	CO4
15. a)		State and prove Lagrange's theorem.	16	K4	CO4
		(OR)			
b)	i.	Prove that every subgroup of an abelian group is normal subgroup.	8	K4	CO4
	ii.	Prove that a group (G, *) is abelian iff $(a*b)^2 = a^2 * b^2, \forall a, b \in G$.	8	K4	CO4