Register No : ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Third Semester

Information Technology

MA3354 / UMAT24302 - Discrete Mathematics

(Common to Artificial Intelligence and Data Science & Computer Science and Engineering)

Regulations – 2021 & 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Express the following statement in symbolic form: "You can access the internet from campus only if you are a computer science major or you are not a freshman".	L2	1	2
2.	Give the scope of the quantifier, free variables and bound variables of the following formula: $(\exists x)P(x) \wedge Q(x)$.	L2	1	2
3.	A committee consisting of a president, vice-president and secretary is to be formed out of 18 members. In how many ways this can be done.	L2	2	2
4.	State the principle of inclusion and exclusion.	L1	2	2
5.	Define a complete graph.	L1	3	2
6.	Give an example of a graph which is Eulerian but not Hamiltonian.	L1	3	2
7.	Define semi groups and Monoids.	L1	4	2
8.	Obtain all the left cosets of {[0],[3]} in the addition modular group $(z_6, +_6)$.	L3	4	2
9.	State any two properties of Lattices.	L1	5	2
10.	Is Boolean Algebra contains six elements? Justify your answer.	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No				*BLT*	*CO*	*Marks*
11.	a	i	Construct the truth table of $(\sim P \wedge (\sim q \wedge r)) \vee (q \wedge r) \vee (p \wedge r)$.	L3	1	8
		ii	Show that the premises "All men are mortal", "Socrates is a man" imply the conclusion Socrates is a mortal.	L3	1	8
			Or			
	b	i	Obtain the principal conjunctive normal form and principal disjunctive normal form of $P \vee (\sim P \rightarrow (Q \vee (\sim Q \rightarrow R)))$.	L3	1	8
		ii	Using Indirect method of proof, show that $(\forall x)(P(x) \rightarrow Q(x)) \Rightarrow (\forall x) P(x) \rightarrow (\forall x) Q(x)$.	L3	1	8
12.	a	i	Prove by the principle of mathematical induction, that $1^2 + 3^2 + 5^2 + \cdots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$.	L3	2	8

		ii	A survey among 100 students shows that of three ice cream flavours Vanilla, Chocolate ansd Strawberry, 50 students like vanilla, 43 like Chocolate, 28 like Strawberry, 13 like Vanilla and Chocolate, 11 like Chocolate and Strawberry, 12 like Strawberry and Vanilla, and 5 like all of them. Find the number of students surveyed who like each of the following flavours. (i) Chocolate but not Strawberry (ii) Chocolate and Strawberry, but not vanilla (iii) Vanilla (or) Chocolate, but not Strawberry.	L3	2	8
			Or			
	b	i	Define the order of a recurrence relation. Solve the recurrence relation $U_n = 3U_{n-1} + 2,$ where, $n \geq 1, U_0 = 1$.	L3	2	8
		ii	Construct the generating function of $n.a^n$ (a is a constant).	L3	2	8
13.	a	i	Prove that number of vertices of odd degree in a graph is always even.	L2	3	6
		ii	Define isomorphism between two graphs. Are the simple graphs with the following adjacency matrices are isomorphic? $\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$	L2	3	10
			Or			
	b	i	If G is self-complementary graph, then prove that G has $n \equiv 0 \; or \; 1 (mod \; 4)$ vertices.	L2	3	6
		ii	If G is a complete simple graph with n vertices with $n \geq 3$, such that the degree of every vertex in G is atleast $\frac{n}{2}$, then prove that G has Hamilton cycle.	L2	3	10
14.	a	i	Prove that intersection a normal subgroup is also a normal subgroup.	L2	4	8
		ii	Explain Ring and Field with suitable examples.	L2	4	8
			Or			
	b		State and prove Lagrange's theorem.	L2	4	16
15.	a	i	Draw the Hasse diagram for the poset = [{3,5,9,15,24,45}; divisor of]. Compute: a) The maximal and minimal elements b) The greatest and least elements c) The upper bounds and LUB of {3,5} d) The lower bounds and GLB of {15,45}	L3	5	8
		ii	Obtain the values of Boolean function $f(x, y, z) = xy + z'$.	L3	5	8
			Or			
	b		Let (L, $\wedge$, $\vee$) be a lattice in which $\wedge$ and $\vee$ denote meet and join respectively, then prove that $a \leq b \Leftrightarrow a \vee b = b \Leftrightarrow a \wedge b = a$ for any $a, b \in L$.	L3	5	16