Register No: ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

Third Semester

Information Technology

MA3354 – Discrete Mathematics

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

Regulations - 2021

Duration : 3 Hrs *Maximum: 100 Marks*

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

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Construct a truth table $(p \vee q) \rightarrow (p \wedge q)$.	UN	1	2
2.	Symbolize the statement "Every apple is red".	UN	1	2
3.	In how many ways can 6 boys and 4 girls sit in a row?	UN	2	2
4.	Write short notes on Pigeonhole Principle.	UN	2	2
5.	Define a connected digraph and the degree of a vertex.	RE	3	2
6.	Define graph.	RE	3	2
7.	Define semi group homomorphism.	RE	4	2
8.	Consider the group $Z_4 = \{[0],[1],[2],[3]\}$ of integers modulo 4. Let $H = \{[0],[2]\}$ be a subgroup of Z_4 under addition mod 4. Find the left cosets. of H.	UN	4	2
9.	Define poset with an example.	RE	5	2
10.	State and prove the Demorgan's law in Boolean algebra.	RE	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Find the PDNF and PCNF of the following statement $(p \wedge q) \vee (p \wedge r) \vee (q \wedge r)$.	AP	1	8
		ii	Prove that the premises "one student in this class knows how to write program in JAVA" and "Everyone who knows how to write programs in JAVA can get a high-paying job" imply the conclusion "Someone in this class can get a high-paying job",	AP	1	8
			Or			
	b	i	Show that $\forall x (P(x) \vee Q(x)) \Rightarrow \forall x P(x) \vee \exists x Q(x)$ using the indirect method.	AP	1	8
		ii	Show that the following statements are valid argument. If there was a rain, then travelling was difficult. If they had umbrella, then travelling was not difficult. They had umbrella. Therefore, there was no rain.	AP	1	8

12.	a	i	How many different strings can be made from the letters in MISSISSIPPI using all the letters of the word?	AN	2	8
		ii	Prove by mathematical induction that $1^2+3^2+5^2+...+(2n-1)^2=\frac{1}{3}n(2n-1)(2n+1)$	AN	2	8
			Or			
	b		Solve the recurrence relation $a_n=4a_{n-1}-4a_{n-2}+4^n, n\geq 2$ given that $a_0=2\ and\ a_1=8$.by the method of generating function.	AN	2	16
13.	a	i	Prove that a connected graph contains an eulerian circuit if and only if each of its vertices is of even degree.	UN	3	8
		ii	Define Euler and Hamiltonian path with examples.	UN	3	8
			Or			
	b	i	Explain connected graph, strongly connected graph, weakly connected graph and unilaterally connected graph with examples.	UN	3	8
		ii	Prove that a simple graph with n vertices and K components have at most $\frac{(n-k)(n-k+1)}{2}$ edges.	UN	3	8
14.	a	i	Prove that the necessary and sufficient condition is that a non empty subset H of a group G to be a subgroup is $a,b\in H \Rightarrow a*b^{-1}\in H$.	UN	4	8
		ii	Prove that a subgroup H of a group G is normal if $x*h*x^{-1}=H$ for all $x\in G$.	UN	4	8
			Or			
	b		State and prove Lagrange's theorem.	UN	4	16
15.	a		For the poset $(\{3,5,9,15,24,45\},/(\text{divisor of}))$ Find (i) The maximal and minimal elements. (ii) The greatest and least elements. (iii) The upper bounds and LUB of {3,5}. (iv) The lower bounds and GLB of {15,45}.	EV	4	16
			Or			
	b	(i)	Show that the "greater than or equal to" relation on the set of integers.is a partial ordering relation.	EV	5	8
		(ii)	If $\{L,\leq\}$ is a Lattice then prove that for any $a,b,c\in L$ (i). $a\wedge(b\vee c)\geq(a\wedge b)\vee(a\wedge c)$. (ii). $a\vee(b\wedge c)\leq(a\vee b)\wedge(a\vee c)$.	EV	5	8