Register No: ____________________

# THE KAVERY ENGINEERING COLLEGE

*(An Autonomous Institution)*

**B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025**

**Third Semester**

**Artificial Intelligence and Data Science**

**MA3354-Discrete Mathematics**
**(Common to Computer Science and Engineering & Information Technology)**

**Regulations - 2021**

***Duration : 3 Hrs*** ***Maximum: 100 Marks***

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

| *Q.No* | *Questions* | *BLT* | *CO* | *Marks* |
|---|---|---|---|---|
| 1. | Define Tautology and give an example. | L1 | 1 | 2 |
| 2. | Using truth table show that $P \vee (P \wedge Q) \equiv P$. | L3 | 1 | 2 |
| 3. | How many different words are there in the word ENGINEERING? | L1 | 2 | 2 |
| 4. | State pigeon hole principle. | L1 | 2 | 2 |
| 5. | Define Eulerian graph and give an example. | L1 | 3 | 2 |
| 6. | Write the adjacency matrix and incidence matrix of $K_{2,2}$. | L1 | 3 | 2 |
| 7. | Define monoid. | L1 | 4 | 2 |
| 8. | Define abelian group with example. | L1 | 4 | 2 |
| 9. | Define Lattice. | L1 | 5 | 2 |
| 10. | State De Morgan’s law in any Boolean Algebra. | L1 | 5 | 2 |

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

| *Q.No* | | | *Questions* | *BLT* | *CO* | *Marks* |
|---|---|---|---|---|---|---|
| 11. | a | i | Prove $((p \vee q) \wedge \neg(\neg p \wedge (\neg q \vee \neg r))) \vee (\neg p \wedge \neg q) \vee (\neg p \wedge \neg r)$ is a tautology. | L3 | 1 | 8 |
| | | ii | Find a principal disjunctive normal form and a principal conjunctive normal form of $p \vee (\sim p \rightarrow (q \vee (\sim q \rightarrow r)))$. | L3 | 1 | 8 |
| | | | **Or** | | | |
| | b | i | Use indirect method of proof to prove that $(x)(P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x)$. | L3 | 1 | 8 |
| | | ii | Prove that $P \rightarrow Q$, $Q \rightarrow \neg R$, $R$, $P \vee (J \wedge S)$ => $J \wedge S$ | L3 | 1 | 8 |
| 12. | a | i | How many bit strings of length 10 contains (i) exactly four 1’s (ii) atmost four 1’s (iii) at least four 1’s (iv) an equal number of 0’s and 1’s. | L3 | 2 | 8 |
| | | ii | Solve the recurrence relation $a_{n+2} - 6a_{n+1} + 9a_n = 0$ with $a_0 = 1$ & $a_1 = 4$. | L3 | 2 | 8 |
| | | | **Or** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | b | i | Find the number of distinct permutations that can be formed from all the letters of each word (1) RADAR (2) UNUSUAL | L2 | 2 | 8 |
| | | ii | Prove by mathematical induction that $6^{n+2} + 7^{2n+1}$ is divisible by 43 for each positive integer. | L3 | 2 | 8 |
| 13. | a | i | Prove that an undirected graph, the number of odd degree vertices is even. | L2 | 3 | 8 |
| | | ii | Prove that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$. | L2 | 3 | 8 |
| | | | **Or** | | | |
| | b | i | Draw the complete bipartite graphs for $K_{2,3}$ & $K_{3,3}$. | L2 | 3 | 8 |
| | | ii | Show that isomorphism of simple graphs is an equivalence relation. | L2 | 3 | 8 |
| 14. | a | i | State and Prove Lagrange's theorem. | L6 | 4 | 8 |
| | | ii | Show that the intersection of two normal subgroups of a group (G, *) is a normal subgroup of (G, *). | L2 | 4 | 8 |
| | | | **Or** | | | |
| | b | i | In any group $\langle G,*\rangle$show that $(a * b)^{-1} = b^{-1} * a^{-1}$, for all $a, b \in G$. | L2 | 4 | 8 |
| | | ii | Prove that the subgroup of a cyclic group must be cyclic subgroup. | L2 | 4 | 8 |
| 15. | a | i | Show that the De Morgan's laws are valid in a Boolean Algebra. | L2 | 5 | 8 |
| | | ii | In a Boolean algebra, prove that $(a \wedge b)' = a' \vee b'$. | L2 | 5 | 8 |
| | | | **Or** | | | |
| | b | i | Show that every chain is a distributive lattice. | L2 | 5 | 8 |
| | | ii | Let (L, ≤) be a lattice and a,b,c,d ϵ L. If a ≤ c and b ≤ d, then prove that 1) a ∨ b ≤ c ∨ d 2) a ∧ b ≤ c ∧ d. | L2 | 5 | 8 |