

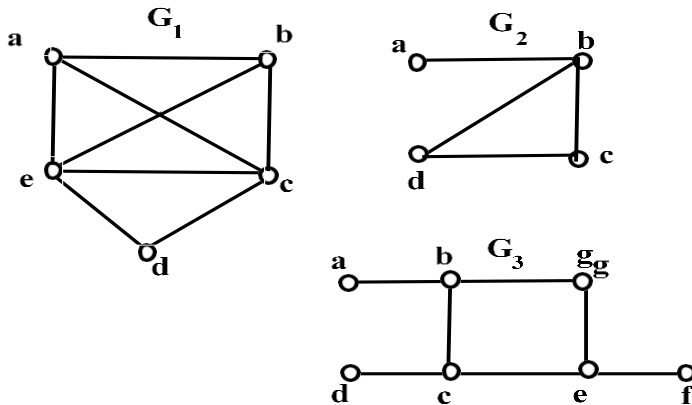
THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2026****Third Semester****Artificial Intelligence & Data Science****MA3354/UMAT24302 - DISCRETE MATHEMATICS****Regulations – 2021 / 2024****Duration : 3 Hrs****Maximum : 100 Marks****PART – A(ANSWER ALL QUESTIONS) (Marks 10*2=20)**

Q.No	Questions	BLT	CO	Marks
1.	Show that $(p \vee q) \wedge \neg(\neg p \wedge q) \Leftrightarrow p$ using truth table.	L2	1	2
2.	Define Universal Quantifier with an example.	L1	1	2
3.	How many permutations are there in the word <i>MISSISSIPPI</i> .	L2	2	2
4.	State the Pigeonhole principle.	L1	2	2
5.	Draw the graph represented by the given adjacency matrix $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$.	L2	3	2
6.	Define a connected graph & a disconnected graph with an example.	L1	3	2
7.	Show that every cyclic group is abelian.	L2	4	2
8.	State any two properties of a group.	L1	4	2
9.	Define Modular lattice.	L1	5	2
10.	Show that in a Boolean algebra $a\bar{b} + \bar{a}b = 0$ iff $a = b$.	L2	5	2

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

Q.No	Questions	BLT	CO	Marks
11. a	i Prove that $A \rightarrow \neg D$ is a conclusion from the premises $A \rightarrow B \vee C, B \rightarrow \neg A$ and $D \rightarrow \neg C$ by using conditional proof.	L3	1	8
	ii Verify the validity of the following argument. Every living thing is a plant or an animal. John's gold fish is alive and it is not a plant. All animals have hearts. Therefore John's gold fish has a heart.	L3	1	8
	Or			
b	i Prove that $\sqrt{2}$ is irrational by giving a proof by contradiction.	L3	1	8
	ii Obtain PDNF of $(P \wedge Q) \vee R \rightarrow \neg P$ & hence find its PCNF.	L3	1	8
12. a	i Find the number of integers between 1 and 250 both inclusive that are not divisible by any of the integers 2, 3, 5 and 7.	L3	2	8
	ii Using mathematical induction, Prove that $1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{1}{3}n(2n-1)(2n+1)$.	L3	2	8
	Or			
b	i Use the method of generating function, solve the recurrence relation $s_n + 3s_{n-1} - 4s_{n-2} = 0, n \geq 2$ given $s_0 = 3$ and $s_1 = -2$.	L3	2	8
	ii Find the generating function of Fibonacci sequence.	L3	2	8

13. a i Prove that a connected graph G is Euler graph if and only if every vertex of G is of even degree. L2 3 8
- ii Determine which of the following graphs are bipartite and which are not if a graph is bipartite. State if it is completely bipartite L3 3 8



Or

- b i Prove that the maximum number of edges in a simple disconnected graph with n vertices and k components is $\frac{(n-k)(n-k+1)}{2}$. L3 3 8
- ii Prove that a connected graph G is Euler graph if and only if every vertex of G is of even degree. L3 3 8
14. a i State and prove the Lagrange's theorem. L2 4 8
- ii Show that the intersection of two normal subgroups of a group G is also a normal subgroup. L3 4 8

Or

- b i State and prove fundamental theorem of group homomorphism. L2 4 8
- ii Show that the group G is abelian iff $(a * b)^2 = a^2 * b^2$. L3 4 8
15. a i State and prove De Morgan's law in a complemented distributive lattice. L2 5 8
- ii Let $D_{30} = \{1, 2, 3, 5, 6, 10, 15, 30\}$ and let the relation R be divisor on D_{30} . L3 5 8
- Find (i) All the lower bounds of 10 & 15 .
- (ii) The glb of 10 & 15.
- (iii) All upper bound of 10 & 15 .
- (iv) The lub of 10 & 15.
- (v) Draw Hasse diagram.

Or

- b i Let $S = Q \times Q$ be the set of all ordered pairs of rational numbers and given by $(a, b) * (x, y) = (ax, ay + b)$ (i) check $(S, *)$ is a semigroup. Is it commutative? (ii) Also find the identity element of S . L3 5 8
- ii Show that in a distributive and complemented lattice $a \leq b \Leftrightarrow a * b' = 0 \Leftrightarrow a' \oplus b = 1 \Leftrightarrow b' \leq a$. L3 5 8
