Reg. No. | | | | | | | | |

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

UG DEGREE END SEMESTER EXAMINATIONS - APRIL 2025.
(For those admitted in June 2023 and later)

PROGRAMME AND BRANCH: B.Sc., INFORMATION TECHNOLOGY

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
III	PART - III	CORE - 3	U23IT3A3	DISCRETE MATHEMATICS

Date & Session:07.05.2025/FN **Time : 3 Hours** **Maximum 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	SECTION – A (10 X 1 = 10 Marks) Answer ALL Questions.
CO1	K1	1.	Which logical connective represents "if and only if"? a) ∧ b) ∨ c) → d) ↔
CO1	K2	2.	A compound proposition that is always true is called: a) Contradiction b) Tautology c) Contingency d) Implication
CO2	K1	3.	The power set of a set with n elements has: a) n elements b) 2^n elements c) n^2 elements d) n! elements
CO2	K2	4.	A relation R on set A is antisymmetric if: a) ∀a,b ∈ A, aRb ∧ bRa ⇒ a = b b) ∀a ∈ A, aRa c) ∀a,b,c ∈ A, aRb ∧ bRc ⇒ aRc d) None of the above
CO3	K1	5.	The rank of a matrix is defined as: a) Number of rows b) Maximum number of linearly independent rows/columns c) Number of non-zero elements d) Sum of diagonal elements
CO3	K2	6.	Using Cayley-Hamilton theorem, if A is a square matrix, then: a) A = I b) A satisfies its own characteristic equation c) A is invertible d) A is symmetric
CO4	K1	7.	In a graph, the degree of a vertex is: a) Number of edges in the graph b) Number of edges incident to the vertex c) Number of vertices d) Length of the longest path
CO4	K2	8.	A connected graph with no cycles is called: a) Complete graph b) Tree c) Eulerian graph d) Bipartite graph
CO5	K1	9.	An Eulerian graph must have: a) All vertices of even degree b) All vertices of odd degree c) Exactly two vertices of odd degree d) A Hamiltonian cycle
CO5	K2	10.	The center of a tree is: a) A single vertex or two adjacent vertices b) The root node c) The longest path d) A cycle

Course Outcome	Bloom's K-level	Q. No.	**SECTION – B (5 X 5 = 25 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	11a.	Construct a truth table for the proposition: $((p \rightarrow q) \leftrightarrow (\neg p \vee q))$ and verify if it is a tautology. **(OR)**
CO1	K3	11b.	Prove using a truth table that the implication: **$(\neg p \rightarrow \neg q)$** is logically equivalent to: **$(q \rightarrow p)$**
CO2	K3	12a.	Determine whether the relation: **R={(a,b)|a divides b}** on the set of integers is a partial order. **(OR)**
CO2	K3	12b.	Show that the set of integers under addition forms a group.
CO3	K4	13a.	Find the inverse of the matrix using elementary row operations: $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ **(OR)**
CO3	K4	13b.	Solve the system of linear equations using matrix methods: $\begin{cases} 2x+3y=5 \\ 4x+6y=10 \end{cases}$
CO4	K4	14a.	Draw all non-isomorphic graphs with 3 vertices and classify them as connected or disconnected. **(OR)**
CO4	K4	14b.	Prove that in any graph, the sum of the degrees of all vertices is equal to twice the number of edges.
CO5	K5	15a.	Determine whether the given graph is Eulerian or Hamiltonian and justify your answer.  **(OR)**
CO5	K5	15b.	Find the center of the given tree and explain the method used. **Tree Diagram**: A / \ B C / \ D E

Course Outcome	Bloom's K-level	Q. No.	**SECTION – C (5 X 8 = 40 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K3	16a.	Develop a logical circuit for the Boolean expression: $((p \wedge q) \vee (\neg p \wedge \neg q))$ and simplify it using logical equivalences. **(OR)**
CO1	K3	16b.	Critically evaluate the role of tautologies and contradictions in the design of digital circuits.

CO2	K4	17a.	Prove that every equivalence relation partitions the set into disjoint equivalence classes. **(OR)**
CO2	K4	17b.	Investigate the properties of subgroups in the context of group theory, including Lagrange's theorem.
CO3	K4	18a.	Using the Cayley-Hamilton theorem, find the inverse of the matrix: $A = \begin{pmatrix} 2 & 1 \\ 1 & 2 \end{pmatrix}$ **(OR)**
CO3	K4	18b.	Solve the system of equations using matrix rank and discuss its consistency: $\begin{cases} x+2y=3 \\ 2x+4y=6 \end{cases}$
CO4	K5	19a.	Prove that a connected graph with n vertices has at least n−1 edges. **(OR)**
CO4	K5	19b.	Design an algorithm to find the shortest path in an unweighted graph using Breadth-First Search (BFS) and apply it to a sample graph.
CO5	K5	20a.	Prove that every tree with n vertices has exactly n−1 edges and no cycles. **(OR)**
CO5	K5	20b.	Determine the center(s) of a tree using the concept of eccentricity and illustrate with an example.