QP Code: P25DR001

Reg. No : ....
Name : ....

ST MARY'S COLLEGE (AUTONOMOUS), THRISSUR-20

I SEMESTER (CBCSS-PG) DEGREE EXAMINATIONS, OCTOBER 2025
M. Sc Computer Science
CSS1C01 : DISCRETE MATHEMATICAL STRUCTURES
2024 Admission Onwards
(Credits: 3)

Time: 3 Hours **Maximum Marks: 30**

Section A

Short answer type questions. Answer **any four**. Weightage **2** for each.
(4x2 = 8 Weightage)

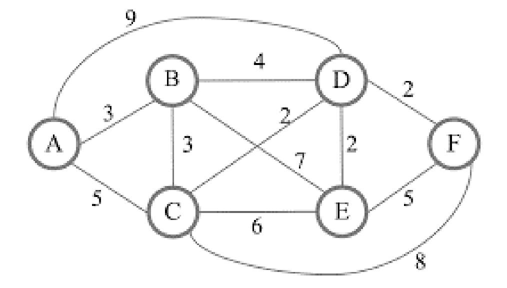
1. State and explain the conditions under which a biconditional statement $P \leftrightarrow Q$ is true.
2. For $f(x)=(5x+1)/2$ find $f^{-1}(x)$ and verify $f(f^{-1}(x))=x$.
3. Differentiate between SOP (Sum of Products) and POS (Product of Sums) form.
4. Differentiate between isomorphism and homeomorphism.
5. Differentiate between a tree, a spanning tree, and a forest.
6. Analyze the relationship between disjoint sets and the principle of inclusion and exclusion.
7. Compare cyclic and non-cyclic groups with examples.

Section B

Short essay-type questions. Answer **any four**. Weightage **3** for each.
(4x3 = 12 Weightage)

8. Convert $(p \vee q) \rightarrow r$ to CNF and DNF.
9. If $f: A \rightarrow B$ is a function, prove that the relation $R=\{(x,y) \in A \times A \mid f(x)=f(y)\}$ is an equivalence relation.
10. Illustrate the Principle of Duality by giving the dual of the absorption law.
11. Describe the significance of Lagrange's Theorem in determining possible subgroup orders.
12. Draw a graph and show multiple paths exists between two vertices. Explain how paths differ from trails and circuits.
13. Apply Dijkstra's algorithm to the following weighted graph to find the shortest path from vertex A to F.

Turn Over



14. State the Pigeonhole Principle and the Generalized Pigeonhole Principle.

Section C

Essay-type questions. Answer **any two**. Weightage **5** for each.

(2x5 = 10 Weightage)

15. Given relations R and S on A={1,2,3,4} where R={(1,1),(2,2),(3,3),(4,4),(1,2),(2,1)} S={(1,1),(2,2),(3,3),(4,4),(3,4),(4,3)} Critically evaluate whether R∘S is an equivalence relation.

16. In a Boolean lattice of subsets of {a,b},
a) Find joins and meets of all element pairs.
b) Verify De Morgan's laws.
c)Show how principle of duality applies.

17. Write notes on:
a) Additive identity and multiplicative identity.
b) Units in a ring.
c) Example of a ring with zero divisors.

18. Analyze the differences between a connected graph and a strongly connected directed graph. Illustrate with examples.

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