Code No.: DS402PC	R20	H.T.No.			8	R					

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–II–Semester End Examinations (Supply) - December- 2025
DISCRETE MATHEMATICS
(Common to CSC, CSD & AI&DS)

[Time: 3 Hours] **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(20 Marks)**

1. a) Define Tautology, Contradiction. [2M]
   b) Construct the truth table for the compound proposition for $(P \to Q) \wedge (Q \to P)$ [2M]
   c) What is the Cartesian product of $A = \{1,2\}$ and $B = \{a, b, c\}$. [2M]
   d) What is the value of $\sum_{S \in \{0,2,4\}} S$? [2M]
   e) Define Algorithm. [2M]
   f) State induction Principle. [2M]
   g) Define conditional probability. [2M]
   h) Let the recurrence relation be $a_n = a_{n-1} - a_{n-2}$ for $n = 2,3$ and $a_0 = 3$, $a_1 = 5$ then find a_2, a_3. [2M]
   i) Draw the graph with adjacency matrix $\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ [2M]
   j) Define a planar graph. [2M]

PART-B **(50 Marks)**

2.a) Prove $P \vee Q \Leftrightarrow \neg(\neg P \neg Q)$. [5M]
   b) Show that $(\exists x)(P(x) \wedge Q(x)) \Longrightarrow (\exists x)P(x) \wedge (\exists x)Q(x)$. Is the converse true? [5M]

OR

3. Show that $(p \to (q \to r)) \to ((p \to q) \to (p \to r))$ is a tautology. [10M]

4.a) Define composition of a function. Let f and g functions from the set of integers to the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 6$. What is the composition of f and g ? What is the composition of g and f ? Justify your answer. [5M] [5M]
   b) Show that the relation *equal* on set of integers is equivalence relation.

OR

5.a) Explain the properties of binary relations with examples. [5M]
   b) Draw the Hasse diagram for the partial ordering $\{(A, B) : A \leq B\}$ on a power set S where $S = \{a, b, c\}$ and $\leq$ is subset relation. [5M]

6.a) Write the properties of algorithm. [5M]

b) Write the algorithm for Linear search. [5M]

OR

7. Using induction principles prove that $1^2 + 2^2 + 3^2 \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$. [10M]

8. State and prove Baye's theorem. [10M]

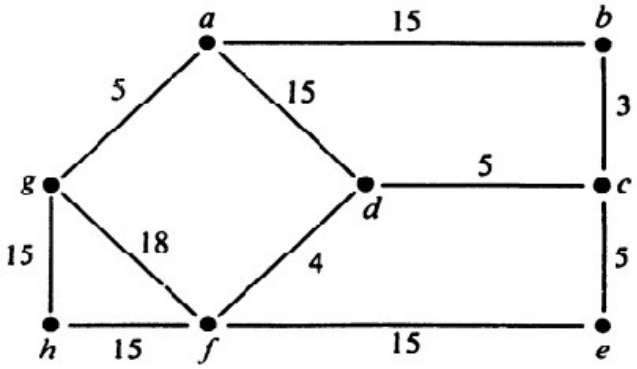
OR

9. Solve the recurrence relation $a_k = 3a_{k-1}$ for $k = 1,2,3,\ldots$ and the initial condition $a_0 = 2$ by using generating functions. [10M]

10. Let G be a connected planar simple graph with e edges, vertices v , and r be the number of regions then prove that $r = e - v + 2$. [10M]

OR

11. Explain Krushkal's algorithm. . Find Minimal spanning tree for the following graph using Krushkal's algorithm. [10M]



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