



Roll no.....

End Semester Examination, December 2024

**Program – B.Tech CSE (AI & ML, UI-UX, FSD, Data Science, Cyber Security), BCA 3rd Semester
DISCRETE MATHEMATICS (ENCS203)**

Time: 2.5 hrs.

Max Marks: **50**

Note: **All Questions are compulsory.** Marks are indicated against each question.

PART-A

Q.1 *Attempt any five questions:*

(a) If $A = \{1,4\}$, $B = \{2,3,6\}$ and $C = \{2,3,6\}$, then verify that $A \times (B-C) = (A \times B) - (A \times C)$
[CO-1] [L-1] **2**

(b) Let $f: R \rightarrow R$, $g: R \rightarrow R$, where R is the set of real numbers be given by $f(x) = x^2 - 2$ and $g(x) = x+4$ find $f \circ g$ and $g \circ f$.
[CO-1] [L-3] **2**

(c) A total of 1500 students have taken a course in Mathematics, 1200 have taken a course in Physics, and 800 have taken a course in Chemistry. Furthermore, 500 students have taken both Mathematics and Physics, 300 have taken both Mathematics and Chemistry, and 200 have taken both Physics and Chemistry. If 2400 students have taken at least one of the subjects, how many students have taken all three subjects?
[CO-1] [L-2] **2**

(d) Show that the function $f: R \rightarrow R$, defined by $f(x) = \frac{x}{1+x^2}$, $x \in R$ is one-one and onto function.
[CO-1] [L-3] **2**

(e) Give difference between proper set and subset with help of example
[CO-1] [L-1] **2**

(f) Find out which of the following sets are null, singleton:

(i) $A = \{x : x + 6 = 6\}$

(ii) $B = \{x : x^2 = 7, 3x = 5\}$

[CO-1] [L-1] **2**

(g) Consider the statements p : You are guilty, q : You are punished
Write the converse and contrapositive statements combining p and q .

[CO-1] [L-1] **2**
2x5

PART-B

Q.2 Check whether the given propositions are tautology, contradiction or contra-positive:

(a) $(Q \vee P) \wedge (Q \vee R) \wedge (\sim (P \vee R) \vee \sim Q)$

(b) $((P \rightarrow Q) \wedge \sim Q) \rightarrow \sim P$

[CO-2] [L-2] **10**

OR

(a) Determine if the relation $R = \{(x,y) \mid x - y \text{ is even, } x \in N\}$ on the set of integers is an equivalence relation.

(b) Simplify the given expression using Boolean algebra properties:

$$F(A, B, C, D) = (A'B + C)(A + B'C')(A'C + BD)$$

Q.3 Find the solution of following recurrence relation:

$$a_{n+3} - 5a_{n+2} + 8a_{n+1} - 4a_n = n \cdot 2^n$$

[CO-3] [L-2] 10

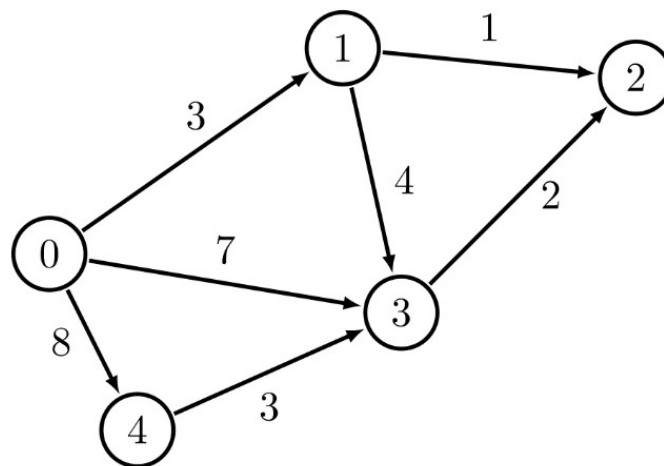
OR

Find the solution of following recurrence relation:

$$a_{n+2} - 5a_{n+1} + 6a_n = n^2$$

[CO-3] [L-4] 10

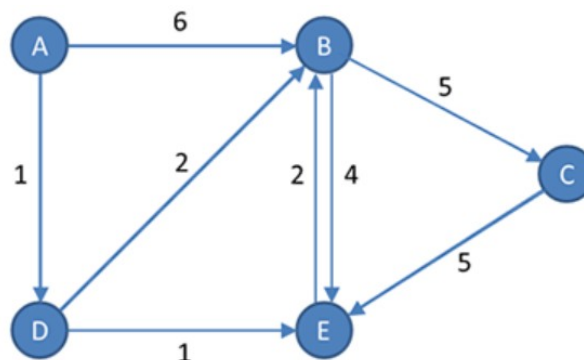
- Q.4 Describe the given graph G in form of:
- Incidence Matrix
 - indegree and outdegree of vertices
 - finding minimum spanning tree using Prim's Algorithm when 0 is the source vertex(consider it as undirected graph)
 - Adjacency Matrix



[CO-4] [L-2] 10

OR

Consider the following directed weighted graph, where the values represent the distances between the vertices:



Use the Floyd-Warshall algorithm to compute the shortest path between all pairs of vertices in the graph. Show the intermediate steps of the algorithm and the final shortest path distance matrix.

[CO- 4] [L-4] 10

Q.5 Write the logical statements into quantified statements:

- For every natural number n , there exists a real number m such that for all integers k , $n \cdot k \leq m$.
- Some snowflakes are same.
- For all circles x , there is a square y such that x and y have the same color
- Some positive integer equals its own square.
- All acute angles are less than 90° in measure.

OR

Use mathematical Induction to show that $\sqrt{1} + \sqrt{2} + \sqrt{3} + \dots + \sqrt{n} \leq n\sqrt{n}$ for all $n \geq 1$.

[CO- 1] [L-3] **10**