



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (W), Mumbai : 400058, India

(Autonomous College of Affiliated to University of Mumbai)

Special ~~Ex~~ Examination

August 2023

Max Marks: 100

Class: SE

Course code: CS201/DS201/AI201

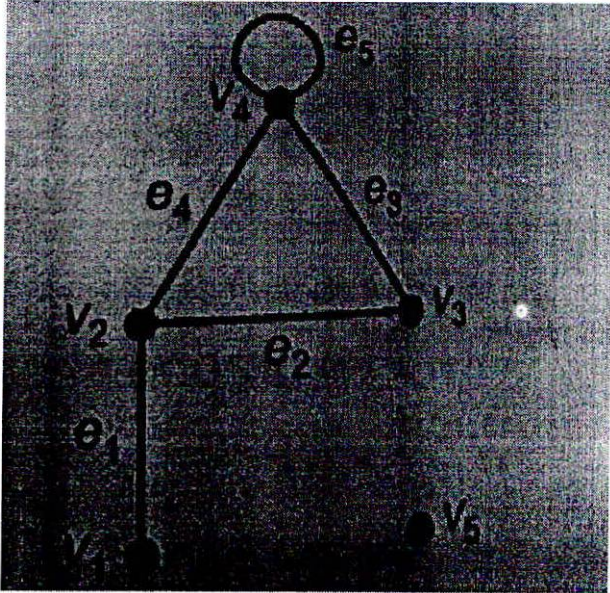
Name of the course: Discrete Structure and Graph Theory

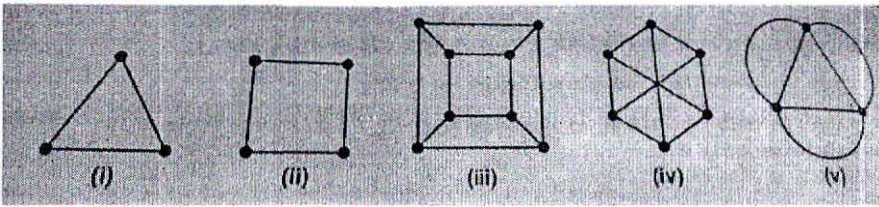
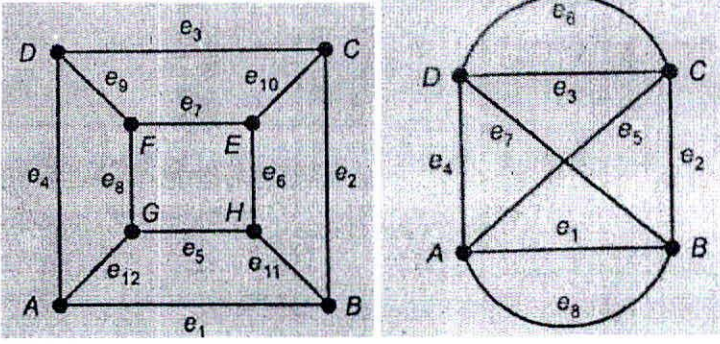
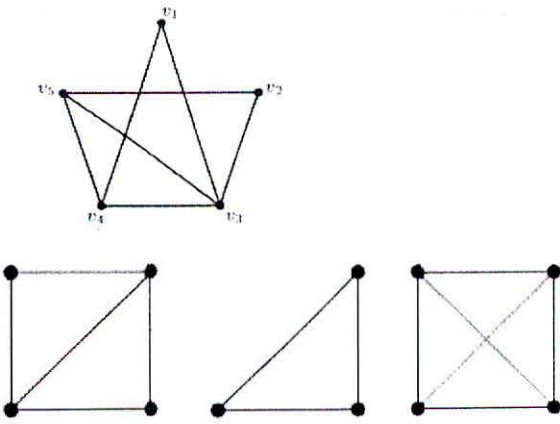
Duration: 3 hours

Semester: III

Branch: SE Comp/CSE-AIML, DS

Q No		Max Marks	CO	BL
Q1	<p>Show that the set of all divisions of 70 form a lattice. Find LUB and GLB of every pair.</p> <p style="text-align: center;">OR</p> <p>Let $L = \{1, 2, 3, 5, 30\}$ and R be the relation 'is divisible by'. Prove that L is a lattice.</p>	10M 10M	CO2	3
Q2A	Let every pair of vertices of a hexagon be joined by a line which is either red or yellow. Prove that at least one of the triangles so formed has sides having the same color.	5M	CO2	3
Q2B	A box contains 5 red, 7 blue, and 10 black balls. Find the minimum number of balls that must be drawn blind folded to get 4 balls of the same color.	5M	CO2	3
Q3A	<p>Using a warshall algorithm, find transitive closure of the following graph.</p>	10M	CO2	3
Q3B	<p>Give an example of a relation which is</p> <p>(i) Reflexive, Symmetric but not transitive</p> <p>(ii) Symmetric, transitive but not reflexive</p>	10M	CO2	3
Q3C	<p>Find the solution of recurrence relation $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with the conditions $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$</p> <p style="text-align: center;">OR</p> <p>Solve the Fibonacci sequence relation $a_n = a_{n-1} + a_{n-2}$ for $n \geq 2$, $a_0 = 0$, $a_2 = 1$</p>	10M	CO2	3
Q4	<p>a. Prove that this statement is true for all integers n: n is odd if and only if $5n + 3$ is even.</p> <p>b. Write the following statement in English, using the predicates $F(x)$: "x is a Freshman" $M(y)$: "y is a math course"</p>	4 4	CO1 CO1	3 3

	<p>$T(x, y)$: "x is taking y" where x represents students and y represents courses: $\neg \exists x [F(x) \wedge \forall y (M(y) \rightarrow T(x, y))]$</p> <p>c. Explain Diffie - Hellman algorithm with mathematical principle behind it. and solve the following problem using it. Alice and Bob decide to form a key for encryption. Alice decides prime no $n = 11$ and Bob decides prime number $g = 7$ Alice chooses private number $x = 3$ and Bob decides private number $y = 6$. Determine the Key both agree upon using Diffie-hellman algorithm</p> <p>d. Prove the following statement for all non-negative integers n: $\sum_{i=0}^n 2^i = 2^{n+1} - 1$</p> <p>e. State principle of inclusion and exclusion. and Solve the problem using it. A total of 1232 students have taken a course in Spanish, 879 have taken a course in French, and 114 have taken a course in Russian. Further, 103 have taken courses in both Spanish and French, 23 have taken courses in both Spanish and Russian, and 14 have taken courses in both French and Russian. If 2092 students have taken a course in at least one of Spanish, French and Russian, how many students have taken a course in all 3 languages.</p> <p style="text-align: center;">OR</p> <p>Explain principle of inclusion and exclusion. and solve the following problem. How many positive integers not exceeding 1000 are divisible by 7 or 11.</p>	8	CO4	4
		4	CO1	4
		5	CO1	4
		5	CO1	4
Q5A	<p>Define following terms with neat diagram I-Adjacent vertices, II-Incident edge III- Degree of a vertex IV -Pendant vertex, V-Pendant edge VI-Loop State the hand shaking lemma and verify it for the following graph.</p> 	10		

Q5.B	<p>State following graphs are regular or not. Also state these graphs are complete or not.</p> 	10		
Q.5 C	<p>Define Hamiltonian graph. State following graphs are Eulerian and Hamiltonian or not. Justify your answer.</p>  <p>OR</p> <p>What is a chromatic number ? What is the chromatic number for the given number?</p> 	5		

For official use only (not for students)

CO Number	CO statement	Marks allotted
CO1	Solve problems using set theory, logic and its various proof techniques.	20

CO2	Apply the concepts of relations, functions, lattices and recurrence relations to solve problems	55
CO3	Apply the concepts of graph, trees and their various types with their traversing techniques to solve problems.	20
CO4	Apply the basics of coding theory and cryptography to solve real world problems.	05

PI chart for percentage CO marks