RV University

School of Computer Science and Engineering

B.Tech (H) Degree Examination -January 2025

Semester : I

Course Code : CS1803

Course Title : Discrete Mathematics and Graph Theory

Duration : 2 Hours **Max. Marks: 30 Marks**

Instructions to students:

Part-A (10 Marks): Consists of 2 Questions. All questions are of 5 marks each. All questions are compulsory.

Part-B (20 Marks): Consists of 2 Questions. Both questions are of 10 marks each. All questions are compulsory.

Sl. No.	PART A – Max Marks (10)	Marks	L1-L6	CO
1.	a. In a school art competition, 28 students participated. Out of these, 23 students painted using blue, and some students painted using green. If 15 students used both colors, calculate the number of students who used green. **[03 marks]** b. If $f(x) = 2x + 5$ and $g(x) = (x - 5)/2$, find $(f \circ g)(x)$and $(g \circ f)(x)$. Verify if $f(x)$ and $g(x)$ are inverses of each other. **[02 marks]**	5	L3	CO1
2.	a. Examine the number of solutions of equation $x + y + z = 11$, where x, y, and z are non-negative integers. **[03 marks]** b. Consider the following graph, which G has 5 vertices $V = \{A, B, C, D, E\}$ and edges $E = \{(A, B), (A, C), (B, D), (C, D), (C, E)\}$. Calculate the chromatic number of a graph G? **[02 marks]**	5	L3 L3	CO2 CO4

	c) P(T) = {⌀} d) P(T) = {⌀, {Math}, {Science}, {History}, {English}}			
4.	A school attendance record shows "Present" for Math and Science classes for John, but "Absent" for History class. Interpret the scenario: a. John attended the History class only. b. John attended the Math and Science classes but not the History class. c. John attended all three classes. d. John did not attend any classes.	1	L2	CO1
5.	If there are 30 students in a classroom and each student has one of 6 favorite sports, calculate the minimum number of students who must share the same favorite sport. a) 3 b) 4 c) 5 d) 6	1	L3	CO2

Sl. No.	PART B – Max Marks (20)	Marks	L1-L6	CO
6.	a. Identify, if the expression $Q \vee \neg Q$ is a tautology, and explains your reasoning. **[2 Marks]** b. Consider the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, and let $A = \{1, 3, 5, 7, 9\}, B = \{2, 4, 5, 6, 8, 10\}$, express and verify the truth value of the statement: "There exists an element in A is also in B". **[1 Mark]** c. In a distributed database system, two servers store data as multisets of key-value: **Server** A: $\{3x, 2y, 4z\}$ **Server** B: $\{4x, y, 3z, w\}$ Compute the **maximum number of replicas** and the **minimum number of replicas** for each key present on both servers. **[2 Marks]**	5	L3	CO1
7.	a. Identify the relation S on the set R of real numbers, $S = \{(a, b): a, b \in N \text{ and } a \leq b^2\}$ is reflexive, symmetric and transitive. **[3 Marks]** b. If $f, g: R \to R$ is defined b $f(x) = sin(x)$, $g(x) = \frac{1}{x}$, Calculate $fog(x)$. Is $fog(x)$ defined for all x ? **[2 Marks]**	5	L3	CO1

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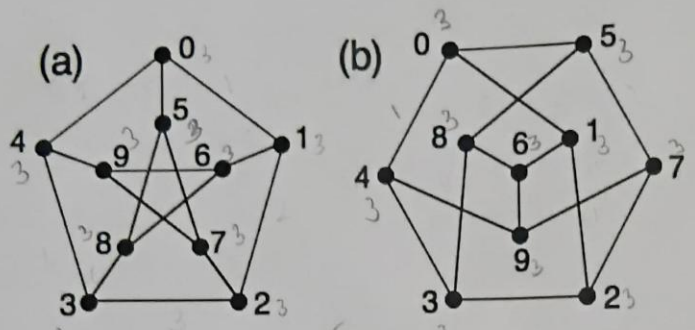
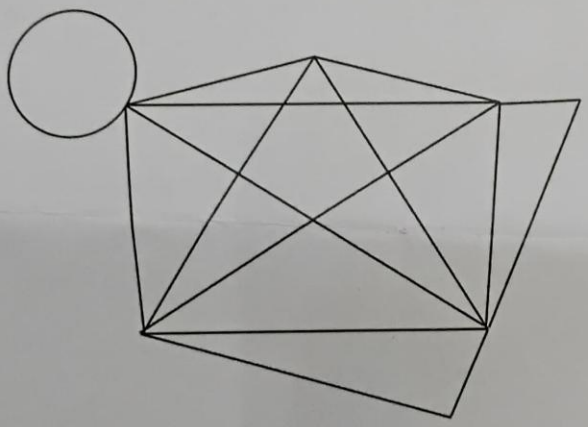
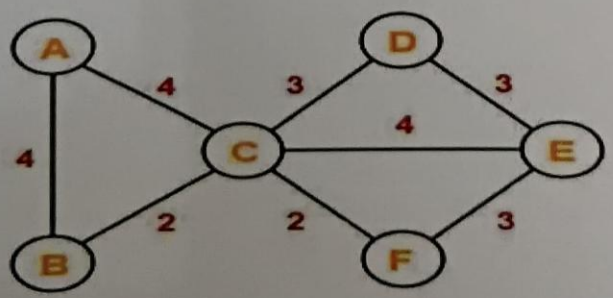
Sl. No.	PART B – Max Marks (20)	Marks	L1-L6	CO
3.	a. Identify whether the following graphs are isomorphic or not **[05 marks]**  b. Apply an elementary reduction method to find whether the following graph is planar or not. **[05 marks]** 	**10**	**L3**	**CO4**
4.	**a.** Apply Kruskal's algorithm and determine the minimal spanning tree for the following graph **[05 marks]** 	**10**	**L3**	**CO4**

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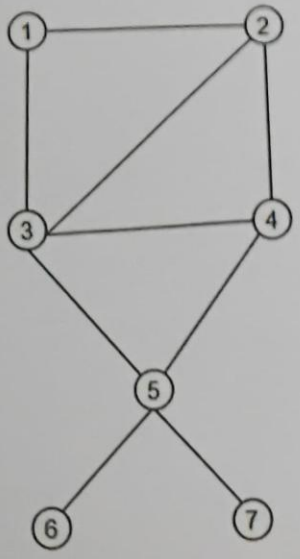
b. Apply the Breadth First Search Algorithm for the following graph and compute the spanning tree. **[05 marks]**



Course Outcomes:

1. Apply the principles of discrete mathematical structures for efficient computation and problem-solving in computer science.
2. Solve problems in game theory, decision making and cryptography using the concepts of combinatorics.
3. Implement discrete mathematical concepts through Computer Programming using open source tools.
4. Apply Graph Theory concepts to solve real-life problems.

Marks Distribution										
L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
		30				05	03		22	