Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – May / June 2026

Date: 21- 05-2026 **Time:** 09:30am – 12:30pm

School: SOCSE	**Program:** B. Tech.	
Course Code: MAT2605	**Course Name:** Discrete Mathematics	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	12	16	16	27	14	15

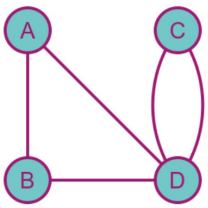
Instructions:

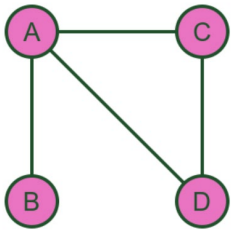
(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2 marks. **10Q x 2M = 20M**

1	Convert the statement to its contrapositive "Price of a product will rise whenever there is a demand".	2 Marks	L2	CO1
2	Expand $(2+x)^6$ using binomial theorem.	2 Marks	L2	CO2
3	How many different strings can be made by reordering the letters of the word DISCRETE?	2 Marks	L2	CO2
4	How many ways can a subset of 3 elements be selected from a set containing 10 distinct elements?	2 Marks	L2	CO2
5	Find the value of $\left\lfloor x^{\frac{2}{3}} \right\rfloor$ *and* $\left\lceil \frac{x^3}{2} \right\rceil$ where x is 4.75.	2 Marks	L2	CO3
6	Draw the Hasse diagram of the poset $(D_{20}, /)$.	2 Marks	L2	CO3
7	Define a distributed lattice.	2 Marks	L1	CO3
8	What is the generating function for the sequence $\{1, 3, 3, 9, \ldots\}$?	2 Marks	L2	CO4
9	Write the adjacency matrix of the graph. 	2 Marks	L2	CO5
10	Draw the complement of the graph.	2 Marks	L2	CO5

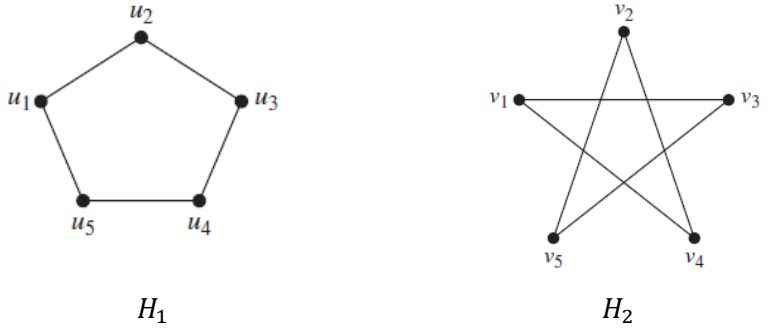
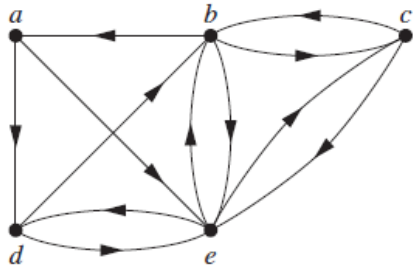
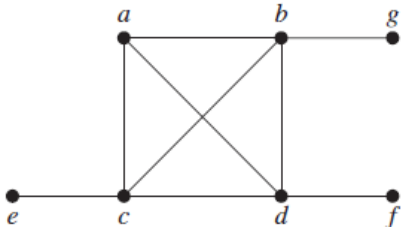
Part B

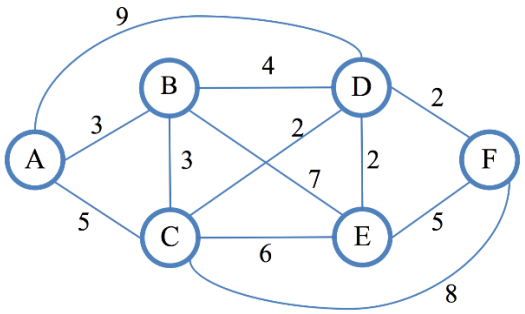
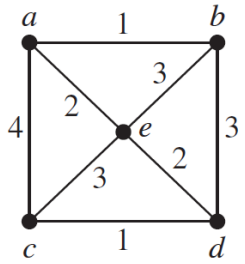
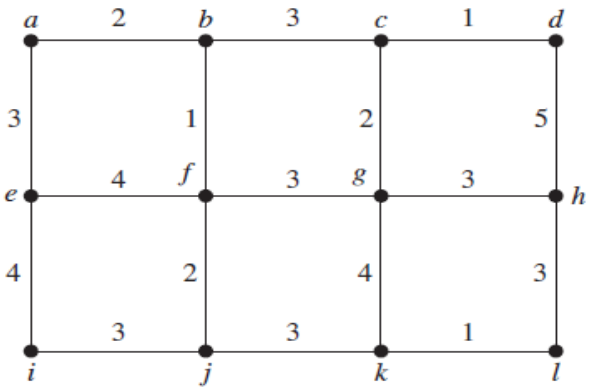
Answer the Questions. **Total Marks 80M**

11	a	Using truth table, show that compound statements $(\boldsymbol{p} \rightarrow \boldsymbol{q}) \vee (\boldsymbol{p} \rightarrow \boldsymbol{r})$ and $\boldsymbol{p} \rightarrow (\boldsymbol{q} \vee \boldsymbol{r})$ are logically equivalent.	6 Marks	L3	CO1
	b	Apply the laws of propositional logical to demonstrate that the expression $\neg((p \wedge q) \rightarrow (p \vee q))$ reduces to contradiction.	4 Marks	L3	
Or					
12		Show that following statements constitute a valid argument: "If A works hard, then either B or C will enjoy. If B enjoys, then A will not work hard. If D enjoys, then C will not. Therefore, if A works hard, D will not enjoy.	10 Marks	L3	CO1

13		Calculate how many solutions are there to the equation $\boldsymbol{x_1 + x_2 + x_3 + x_4 + x_5 = 24}$ where $\boldsymbol{x_i}$ $(\boldsymbol{i = 1, 2, 3, 4, 5})$ are nonnegative integers, such that: (i) $\boldsymbol{x_1 \geq 2}$ (ii) $\boldsymbol{x_i \geq 3}$ for $\boldsymbol{i = 1, 2, 3, 4, 5}$ (iii) $\boldsymbol{0 \leq x_1 \leq 7}$	10 Marks	L3	CO2
Or					
14	a	Use mathematical induction to prove that $7^{n+2} + 8^{2n+1}$ is divisible by 57 for every nonnegative integer n.	7 Marks	L3	CO2
	b	In a discrete mathematics class, every student is a major in computer science or mathematics, or both. The number of students having computer science as a major (possibly along with mathematics) is 46; the number of students having mathematics as a major (possibly along with computer science) is 34; and the number of students majoring in both computer science and mathematics is 22. Find how many students are in this class?	3 Marks	L3	

15		Prove that the partially ordered set $(\boldsymbol{D_{30}}, /)$ is distributive lattice.	10 Marks	L3	CO3
Or					
16	a	Let $X = \{1, 2, 3, \ldots, 10\}$ and $R = \{(x, y) \mid x - y$ is divisible by $3\}$. Show that R is an equivalence relation.	6 Marks	L3	CO3
	b	If $f(x) = x^2$, $g(x) = \operatorname{cosec} x$ and $h(x) = \cot x$ then prove that $(f \circ g) = 1 + (f \circ h)$.	4 Marks	L3	

17		Find the solution of the recurrence relation, $\boldsymbol{a_n - 3a_{n-1} + 3a_{n-2} - a_{n-3} = 0}$ for $\boldsymbol{n \geq 3}$ with initial condition $\boldsymbol{a_0 = 1, a_1 = -2}$ and $\boldsymbol{a_2 = -1}$.	10 Marks	L3	CO4
Or					
18		Given the recurrence relation $a_n = 2a_{n-1} + 1$ for $n \geq 1$ and the initial condition $a_0 = 1$. Find the solution using generating function.	10 Marks	L3	CO4
19	a	Prove or disprove the isomorphism of two given graphs $\boldsymbol{H_1}$ and $\boldsymbol{H_2}$.  H_1 H_2	6 Marks	L3	CO5
	b	Determine if a connected graph with vertices of degrees $\{2, 4, 4, 2, 4\}$ contains a Euler circuit. Justify your answer.	4 Marks	L2	
Or					
20	a	Determine whether the given directed graph has a Euler circuit, a Euler path, or neither. Justify your answer.  	6 Marks	L3	CO5
	b	Construct a Hamilton circuit for the given graph and identify an edge that can be removed such that the resulting subgraph still contains a Hamilton circuit. Provide the new circuit for the modified subgraph and justify your choice of edge.  	4 Marks	L3	
21	a	Solve the recurrence relation $\boldsymbol{a_n = a_{n-1} + 2a_{n-2} + 2n^2}$ for $\boldsymbol{n \geq 2}$ with initial conditions $\boldsymbol{a_0 = 2}$ and $\boldsymbol{a_1 = 7}$.	10 Marks	L3	CO4
	b	Obtain a recurrence relation with suitable initial conditions for the number of bit strings of length n that start with 1 and contain two consecutive zeros. Hence, determine the number of such bit strings of length 5.	5 Marks	L2	
Or					

22	a	Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 7^n$ for $n \geq 2$ with $a_0 = 1\,, a_1 = 9$.	10 Marks	L3	CO4
	b	Write the general solution of the recurrence relation for following roots: (i) $6, 6$ (ii) $2, -2$ (iii) $\sqrt{3} \pm i$	5 Marks	L2	
23	a	Apply Dijkstra's algorithm to find the shortest distance from vertex '***A***' to vertex '***F***' in the given network. Demonstrate the labelling process for each node during the algorithm execution. 	8 Marks	L3	CO6
	b	Calculate the weight of the minimum spanning tree for the graph using Kruskal's algorithm. 	7 Marks	L2	
		Or			
24	a	Apply Dijkstra's algorithm to find the shortest path from vertex A to F by considering the following weighted graph with source vertex A. Edge: A–B, A–C, B–C, B–D, C–D, C–E, D–E, D–F, E–F Weight: 4, 2, 1, 5, 8, 10, 2, 6, 3	7 Marks	L3	CO6
	b	Apply Prim's algorithm to the graph to find the minimum spanning tree. Start the process from vertex '*a*' and show the growth of the tree at each step. 	8 Marks	L3	