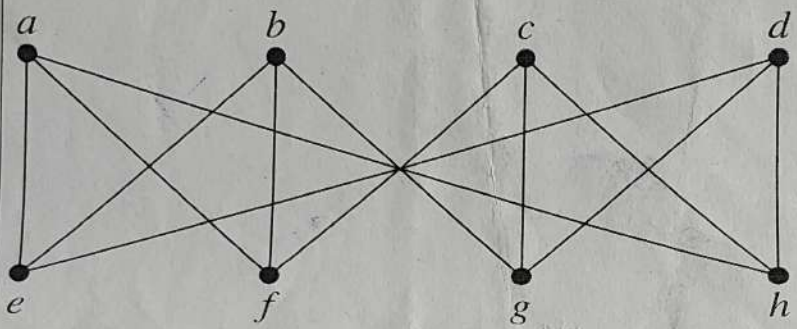
6	Solve the following system of congruences using the Chinese Remainder Theorem: $x \equiv 3 (\mathrm{mod} 4)$ $x \equiv 5 (\mathrm{mod} 7)$ $x \equiv 2 (\mathrm{mod} 9)$	04	CO3
7	How many different spanning trees does each of these simple graphs have? a) K_3 b) K_4 c) $K_{2,2}$ d) C_5	04	CO4
8	Use Kuratowski's theorem to determine whether the given graph is planar. 	04	CO4
9	Let $A = \{1,2,3,4,5,6\}$. Given three permutations in S_6 $f = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 1 & 4 & 5 & 6 & 2 \end{pmatrix}$, $g = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 4 & 1 & 3 & 6 & 5 \end{pmatrix}$, $h = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 5 & 2 & 4 & 3 & 1 & 6 \end{pmatrix}$ Find $f^{-1}g^{-1}h^2$.	04	CO5
10	Given the parity-check matrix $H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ Determine the group code.	04	CO5

**********END**********

Name of the Student.....Nikhil Jodhi Scholar Number.....241120111029

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY BHOPAL

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

EXAMINATION: End Term **MONTH and YEAR: Nov 2025**

Course: B. Tech.	**Semester: 3rd**	**Branch: CSE**	**Subject Code: CSE 24231**
Subject Name: Discrete Mathematics			**Maximum Marks: 40**
Duration: 02-hour		**Date: 17 Nov 2025**	**Time: 09:30 AM to 11:30 AM**

Note: *All questions are compulsory.*
Assume suitable data if needed.
Answer all parts of question at one place

Q. No.	Questions	Marks	COs
1	Prove using mathematical induction, that if n is a positive integer, then 133 divides $11^{n+1} + 12^{2n-1}$.	04	CO1
2	Express the negations of each of these statements so that all negation symbols immediately precede predicates. a) $\forall x \exists y \forall z\, T(x, y, z)$ b) $\forall x \exists y P(x, y) \vee \forall x \exists y Q(x, y)$ c) $\forall x \exists y (P(x, y) \wedge \exists z R(x, y, z))$ d) $\forall x \exists y (P(x, y) \rightarrow Q(x, y))$	04	CO1
3	Determine whether each of these functions is a bijection from R to R. a) $f(x) = 2x + 1$ b) $f(x) = x^2 + 1$ c) $f(x) = x^3$ d) $f(x) = (x^2 + 1)/(x^2 + 2)$	04	CO2
4	Poset: $P = \{3,6,9,12,18\}$ with the relation "$a \leq b$ if a divides b". Find the width and height of the poset.	04	CO2
5	A departmental library has 280 books distributed across 12 shelves. Using the Generalized Pigeonhole Principle, determine: 1. The minimum possible number of books on the shelf that must contain the highest number of books. 2. If no shelf contains more than 30 books, show whether this distribution is possible. Show all steps clearly.	04	CO3