UPES
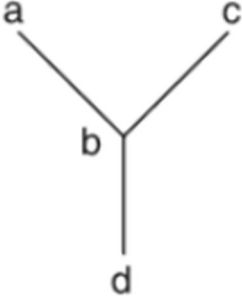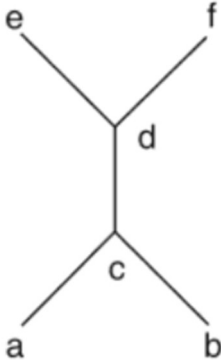**End Semester Examination, December 2023**

Course: Discrete Mathematics   Semester: VII
Program: B.Sc. Mathematics by Research   Time   : 03 hrs.
Course Code: MATH4012   Max. Marks: 100

Instructions: Answer all the questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Consider the following statements. p: This computer is good. q: This computer is cheap. How do you express each of the following statements in their symbolic form? (a) This computer is good and cheap. (b) This computer is not good but cheap. (c) This computer is costly but good. (d) This computer is neither good nor cheap.	4	CO1
Q 2	Find whether the set of all integers Z under divisibility ($\mid$) relation forms a Poset or not.	4	CO2
Q 3	Define the following. (a) Complete Lattice. (b) Bounded Lattice. (c) Complement of an element in a Lattice. (d) Complemented Lattice.	4	CO2
Q 4	What is Generalized Pigeonhole principle? Find the minimum number of teachers in a college to be sure that four of them were born in the same month.	4	CO3
Q 5	Find the greatest number less than 250 and divisible by 4 and 10.	4	CO4

<table>
<tr><td colspan="4" align="center">**SECTION B**
(4Qx10M= 40 Marks)</td></tr>
<tr>
<td>Q 6</td>
<td>Apply Mathematical induction to prove the following statement.

$$1^2 + 3^2 + 5^2 + \cdots + (2n-1)^2 = \frac{n(2n+1)(2n-1)}{3}$$</td>
<td>10</td>
<td>CO1</td>
</tr>
<tr>
<td>Q 7</td>
<td>Identify the Lattices from the Posets given in the Hasse diagrams A and B.

(A)   (B)</td>
<td>10</td>
<td>CO2</td>
</tr>
<tr>
<td>Q 8</td>
<td>Explain the 'congruence modulo m' relation and prove that it is an equivalence relation.</td>
<td>10</td>
<td>CO4</td>
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<tr>
<td>Q 9</td>
<td>Define Permutation. If $n_{P_2} = 72$, obtain the value of n.

(OR)

Define Factorial and prove that $(2n)! = 2^n n! \,(1.3.5 \ldots (2n-1))$</td>
<td>10</td>
<td>CO3</td>
</tr>
<tr><td colspan="4" align="center">**SECTION-C**
(2Qx20M=40 Marks)</td></tr>
<tr>
<td>Q 10</td>
<td>Discuss Linear recurrence relation with constant coefficients and by using the method of undetermined coefficients, solve the equation $y_{n+2} - y_{n+1} - 2y_n = n^2$.
(OR)
Discuss Generating Function and using the Generating function technique, solve the following recurrence relation.

$y_{n+2} - 2y_{n+1} + y_n = 2^n, y_0 = 2, y_1 = 1$.</td>
<td>20</td>
<td>CO3</td>
</tr>
<tr>
<td>Q 11</td>
<td>Explain Linear Diophantine equation and find the general solution of the equation $70x + 112y = 168$.</td>
<td>20</td>
<td>CO4</td>
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