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**Time: 3 hours**

**Max. Marks: 60**

**Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer FIVE Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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<u><b>PART-A ( 10 Marks)</b></u>		BCLL	CO(s)	Marks
<u><b>(Write all answers of this part at one place)</b></u>				
1	A Define statement in the context of logic and give any two examples.	L1	CO-I	[1M]
	B What is valid argument in statement calculus ?	L1	CO-I	[1M]
	C What is a relation between sets? Give an example.	L1	CO-II	[1M]
	D Define POSET in the context of relations.	L1	CO-II	[1M]
	E Give an example of a non-abelian group under addition.	L3	CO-III	[1M]
	F Define an isomorphism between two groups.	L1	CO-III	[1M]
	G How many integers between 1 and 100 are divisible by either 2, 3, or 5?	L2	CO-IV	[1M]
	H In an examination, a candidate is required to pass all five different subjects. The number of ways he can fail is ?	L3	CO-IV	[1M]
	I Draw a directed graph with 4 vertices and 5 edges where each vertex has outdegree 1 and indegree 1.	L6	CO-V	[1M]
	J Define and draw the complete graph with 4 vertices.	L1,L6	CO-V	[1M]

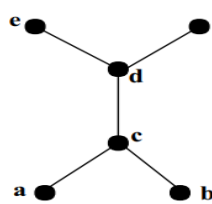
**PART-B ( 50 Marks)**

**SECTION-I**

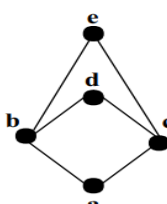
2	Verify whether the compound proposition $\sim (p \wedge q) \rightarrow (\sim p \vee (\sim p \vee q)) \wedge (\sim p \vee q)$ is a tautology, contradiction, or contingency using a (a) truth table and (b) logical equivalence. OR	L3,L4	CO-I	[10M]
3	A Establish the validity of the following argument using rules of inference. If the band could not play rock music or the refreshments were not served on time, then the new year party could have been cancelled and Alica would have been angry. If the party were cancelled, then refunds would have to be made. No refunds were made, therefore the band could play rock music. B Find the negation of the following quantified statement $\forall x, \exists y, [(p(x,y) \wedge q(x,y)) \rightarrow r(x,y)]$	L2,L3	CO-I	[5M]
		L3,L4	CO-I	[5M]

**SECTION-II**

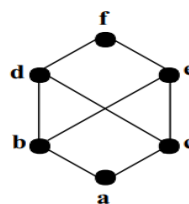
4	Draw a Hasse diagram for the divisibility relation ( $/$ ) on the set $A = \{2, 3, 6, 12, 24, 36\}$	L2	CO-II	[10M]
OR				
5	Explain which of the following Hasse diagram of partially ordered sets are lattices.	L4,L5	CO-II	[10M]



(i)



(ii)



(iii)

<u><b>SECTION-III</b></u>				
6	Prove that $G = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}, \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \right\}$ forms an abelian group under matrix multiplication.	L2,L3	CO-III	[10M]

OR

- 7 Let  $G = (\mathbb{Z}, +)$  and  $H = (2\mathbb{Z}, +)$  be two groups (for a fixed integer  $n$ ). Verify the mapping  $f: G \rightarrow H$  defined by  $f(m) = 2m$  for  $m \in \mathbb{Z}$  is an isomorphism from  $G$  to  $H$ . L2,L3 CO-III [10M]

**SECTION-IV**

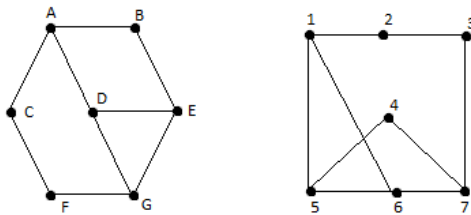
- 8 A Suppose repetitions are not permitted. (i) How many three-digit numbers can be formed from the six digits 2, 3, 5, 6, 7, and 9? (ii) How many of these numbers are less than 400? (iii) How many are even? L2,L3 CO-IV [5M]
- B A large software development company employs 100 computer programmers. Of them, 45 are proficient in Java, 30 in C#, 20 in Python, six in C# and Java, one in Java and Python, five in C# and Python, and just one programmer is proficient in all three languages above. Determine the number of computer programmers that are not proficient in any of these three languages. L3,L4 CO-IV [5M]

OR

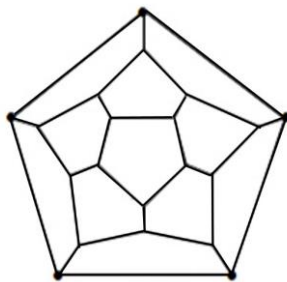
- 9 Solve the recurrence relation  $a_n - 5a_{n-1} - 6a_{n-2} = 0$ ,  $a_0 = 1$ ,  $a_1 = 3$  for  $n \geq 2$ . L3,L4 CO-IV [10M]

**SECTION-V**

- 10 A Verify the two graphs given below are isomorphic or not. L4,L5 CO-V [5M]



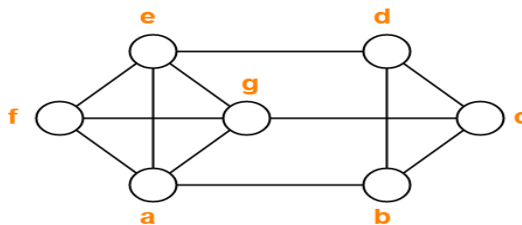
- B Does the following graph has a Hamiltonian circuit and verify is it Euler graph or not. L4,L5 CO-V [5M]



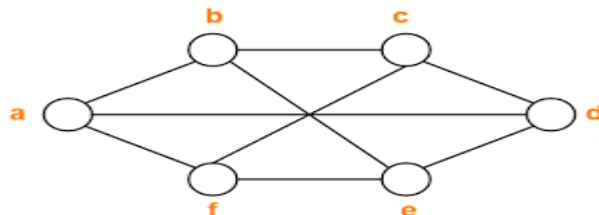
OR

- 11 A Find the Chromatic Number of the following graphs. L2,L3 CO-V [5M]

(i)



(ii)



- B Given a switch board with 6 ports, determine how many different ways there are to connect the ports such that all devices are connected and there are no loops (i.e., it forms a spanning tree). L4,L5 CO-V [5M]

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