**Printed Page:-04** Subject Code:- BMCA0105 Roll. No: NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA (An Autonomous Institute Affiliated to AKTU, Lucknow) MCA SEM: I - THEORY EXAMINATION (2024-2025) **Subject: Discrete Mathematics Time: 3 Hours** Max. Marks: 100 **General Instructions: IMP:** *Verify that you have received the question paper with the correct course, code, branch etc.* 1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice *Questions (MCQ's) & Subjective type questions.* 2. Maximum marks for each question are indicated on right -hand side of each question. 3. Illustrate your answers with neat sketches wherever necessary. 4. Assume suitable data if necessary. 5. Preferably, write the answers in sequential order. 6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked. **SECTION-A** 20 1. Attempt all parts:-1-a. If  $A = \{1, 2, 3\}$  and  $B = \{2, 3, 4\}$ , what is  $A \cap B$ ? (CO1, KB 1  $\{1, 2, 3, 4\}$ (a) (b)  $\{2, 3\}$ (c)  $\{1, 4\}$ { } (d) Identity the cardinality of the set {2, 4, 6, 8}? (CO1, K3) 1-b. 1 2 (a) 4 (b) (c) 6 8 (d)

1-c. If an edge connects two vertices, they are considered \_\_\_\_? (CO2, K2)

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- (a) class
- (b) adjecent
- (c) normal
- (d) incident
- 1-d. Graph is a collection of \_\_\_\_\_. (CO2, K2)
  - (a) vertices
  - (b) edges

(d) None of the above An algebraic structure is \_\_\_\_\_. (CO3, K2) 1 1-e. A set with two binary operations (a) (b) A set with one binary operation A set with three binary operations (c) A set with four binary operations (d) The order of a finite field is . (CO3, K2) 1 1-f. The number of elements in the field (a) The smallest positive integer n such that n times any element in the field equals the (b) additive identity The largest positive integer n such that n times any element in the field equals the (c) additive identity The number of distinct elements generated by a specific element in the field (d) Implication of "P(x) implies Q(x)" in predicate logic is \_\_\_\_\_. (CO4, K2) 1 1-g.  $P(x) \rightarrow Q(x)$ (a)  $P(x) \Leftrightarrow Q(x)$ (b) (c)  $P(x) \leftrightarrow Q(x)$  $P(x) \oplus Q(x)$ (d) There are types of quantifier in predicate logic. (CO4, K2) 1-h. 1 (a) 2 3 (b) (c) 4 (d) 5 Pigeonhole principle is based on 1-i. . (CO5. K2) 1 Counting principle (a) generating series (b) recurrence series (c) fibonacii series (d) Series Fn = Fn-1 + Fn-2 is known as \_\_\_\_\_. (CO5, K2) 1-j. 1 generating series (a) (b) recurrence series (c) fibonacii series none of these (d) 2. Attempt all parts:-2.a. If  $A = \{2, 4, 6\}$  and  $B = \{3, 6, 9\}$ , Draw venn diagram for AUB. (CO1, K2) 2 Define Hasse diagram in POSET. (CO2, K3) 2 2.b.

(c)

2.c.

Define a group. (CO3, K3)

Both A and B

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2.d.	Explain the following terms with suitable example: (i) Conjunction (ii) Disjunction (CO4, K3)	2
2.e.	Discuss types of linear recurrence relation. (CO5, K2)	2
<b>SECT</b>	<u>ION-B</u>	30
3. Ansv	wer any <u>five</u> of the following:-	
3-а.	Define different types of relation on a set with example. (CO1, K3)	6
3-b.	Check a relation R on set A = $\{1, 2, 3\}$ as follows: R = $\{(x, y)   x + y = 0\}$ is equivalence relation or not? (CO1, K3)	6
3-с.	Explain Poset. Define a Poset on the set $K = \{2, 4, 6\}$ with the relation "divides." Check if it is a partial order and draw its Hasse diagram. (CO2, K3)	6
3-d.	Define Binary tree. Discuss different types of binary tree traversal with example. (CO2, K3)	6
3.e.	Prove that the set $O = \{0,1,2,3\}$ is a group with respect to addition modulo 4. (CO3, K3)	6
3.f.	Show that $(P \rightarrow Q) \land (\neg Q \rightarrow \neg P)$ a tautology using truth table. (CO4, K3)	6
3.g.	Solve the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ . (CO5, K3)	6
<b>SECT</b>	ION-C	50
4. Ansv	wer any <u>one</u> of the following:-	
4-a.	Let A={1,4,3,6,2} and B={1,9,3,6,4,2,8,7}.Find (i)AUB (ii)AOB (iii)A-B (iv)B-A (v) Cardinality of A and B. (CO1, K3)	10
4-b.	In a survey of 60 people, it was found that 25 read Magazine A, 26 read B & 26 read C. 9 read both A & C, 11 read both A & B, 8 read both B & C and 8 read no magazine at all. Find the number of people: a) Who read all three magazines b) Who read exactly one magazine. (CO1, K3)	10
5. Ansv	wer any <u>one</u> of the following:-	
5-a.	Discuss graph and types of graph. Differentiate between isomorphic and homeomorphic graph. Create a simple undirected graph G with vertices $V = \{A, B, C, D\}$ and edges $E = \{(A, B), (B, C), (C, A), (C, D)\}$ . (CO2, K3)	10
5-b.	Define lattices and properties of lattices. Differentiate between modular and complete lattice.Draw the Hasse diagram of $P = \{1, 2, 3, 4, 5, 6\}$ ordered by divisibility. (CO2, K3)	10
6. Ans	wer any <u>one</u> of the following:-	
6-a.	Describe Abelian Group. Show that $G = \{1, w, w2\}$ is an abelian group under multiplication, Where 1, w, w2 are cube roots of unity. (CO3, K3)	10
6-b.	Define Subgroup of a group. (CO3, K3) (i) Show that the union of two sub groups of a group G need not be a sub group of G.	10
	(ii) Show that the intersection of two sub groups of a group G again is a sub group of G.	

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- 7. Answer any one of the following:-
- 7-a. Explain proposition and proposition function with an example. (CO4, K3)
  10 Write the truth table of following propositional statement:
  P: Amit is poor
  Q: Ram is rich
  "Amit or Ram is rich"
- 7-b. (i) Prove that:  $[(p \rightarrow q) \land (q \rightarrow r)] \rightarrow [p \rightarrow r]$  is a tautology. 10 (ii) Show  $[p \land (p \rightarrow q)] \rightarrow q$  is a tautology or contradiction. (CO4, K3)

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- 8. Answer any one of the following:-
- 8-a. Discuss the following: (CO5, K3)
  - (i) Generating Function
  - (ii) Counting Principle
- 8-b. Define Recurrence relation. Solve the recurrence relation  $2a_r-5a_{r-1}+2a_{r-2}=0$  where  $a_0=0$  and  $a_1=1$ . (CO5, K3)

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