Printed Page:-   **Subject Code:-** AMCA0105

                                            Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

MCA

SEM: I - THEORY EXAMINATION (2022 - 2023)

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.*

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SECTION A   **20**

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1. Attempt all parts:-

1-a.   The cardinality of the set of odd positive integers less than 10 is_____. (CO1)   1

           (a) 10

           (b) 5

           (c) 3

           (d) 20

1-b.   A = {1, 2, 3} which of the following function f: A → A does not have an inverse   1
           function. (CO1)

           (a) {(1, 1), (2, 2), (3, 3)}

           (b) {(1, 2), (2, 1), (3, 1)}

           (c) {(1, 3), (3, 2), (2, 1)}

           (d) {(1, 2), (2, 3), (3, 1)

1-c.   The number of edges present in a complete graph having n vertices are_____.   1
           (CO2)

           (a) (n*(n+1))/2

(b) (n*(n-1))/2

(c) n

(d) Information given is insufficient

1-d.   A non empty set A is termed as an algebraic structure_____.(CO2)   1

(a) with respect to binary operation *

(b) with respect to ternary operation ?

(c) with respect to unary operation +

(d) with respect to unary operation -

1-e.   A cyclic group is always_____.(CO3)   1

(a) abelian group

(b) monoid

(c) semigroup

(d) subgroup

1-f.   A relation (34 × 78) × 57 = 34 × (78 × 57) can have_____.(CO3)   1

(a) distributive

(b) associative

(c) commutative

(d) closure

1-g.   Let P: I am in Delhi.; Q: Delhi is clean.; then q ^ p is_____.(CO4)   1

(a) Delhi is clean and I am in Delhi

(b) Delhi is not clean or I am in Delhi

(c) I am in Delhi and Delhi is not clean

(d) Delhi is clean but I am in Mumbai

1-h.   A compound proposition that is neither a tautology nor a contradiction is called   1
a/an (CO4)

(a) Contingency

(b) Equivalence

(c) Condition

(d) Inference

1-i.   Determine the value of a_2 for the recurrence relation $a_n = 4a_{n-1} + 3$ with a_0 1
=3 (CO5)

(a) 66

(b) 65

(c) 64

(d) 63

1-j.   The number of different six digit can be formed from the digits 4, 5, 2, 1, 8, 9 is   1
_____.(CO5)

(a) 480

(b) 360

(c) 720

(d) 840

2. Attempt all parts:-

2.a.   Write an example of finite and infinite set in set builder form. (CO1)   2

2.b.   Define degree of a vertex. (CO2)   2

2.c.   Define commutative property in abelian group with an example.(CO3)   2

2.d.   Prove the Demorgan`s law by truth table.(CO4)   2

2.e.   In how many ways can the letters be arranged so that all the vowels come   2
together in the word "CRICKET".(CO5)

SECTION B   30

3. Answer any <u>five</u> of the following:-

3-a.   In a class of 50 students, 28 play cricket and 36 play hockey. Use Venn- diagram   6
to find the following. (CO1)
(i) Number of students play both the game.
(ii) Number of students play only Cricket.

3-b.   Define bijective function with an example.(CO1)   6

3-c.   Explain Inorder, Preorder and Postorder traversal operation on Binary tree with   6
example. (CO2)

3-d.   Make a binary search tree for the following sequence of numbers: 45, 36, 76,   6
23, 89,115, 98, 39, 41, 56, 69, 48. Traverse the tree in Preorder, Inorder and
Postorder.(CO2)

3.e.   Show that the set R = {0, 2, 4, 6} is a commutative ring under addition and   6
multiplication modulo 8. (CO3)

3.f.   Show that $p \to (q \to r)$ is logically equivalent to $(p \wedge q) \to r$. (CO4)   6

3.g.   Solve the recurrence relation $2Y_{n+2} - 5Y_{n+1} + 2Y_n = 0$ then find the particular   6
solution $Y_0 = 0$ and $Y_1 = 1$. (CO5)

SECTION C   50

4. Answer any <u>one</u> of the following:-

4-a. Let A = { 1, 2, 3, 5}, F = { (1,5), (2,1), (3,3), (5,2) and G = {(1, 3), (2, 1), (3, 2), (5, 5)} find (I) FoG (II) GoF (III) FoF (IV) GoG. (CO1) 10

4-b. In a class of 50 students, it was found that 30 students read "The Hindu", 35 students read "Hindustan" and 10 read neither. Find the number of students read both: "The Hindu" and "Hindustan" newspapers. (CO1) 10

5. Answer any <u>one</u> of the following:-

5-a. Let X = {1, 2, 3, 4, 5, 6}, then / is a partial order relation on X. Draw the Hasse Diagram of (X, /). (CO2) 10

5-b. Show that a graph is bipartite graph if and only if it can be colured with two colours. (CO2) 10

6. Answer any <u>one</u> of the following:-

6-a. Find all generators of multiplicative group G = {1,-1, i,-i}. (CO3) 10

6-b. Define a Ring and field. Show that the system (E, +, ·) of even integers is a ring under ordinary addition and multiplication. (CO3) 10

7. Answer any <u>one</u> of the following:-

7-a. Compute the truth table for predicate $(F \lor G) \land \neg(F \land G)$. (CO4) 10

7-b. Justify that the statements $P \to (Q \lor R)$ and $(P \to Q) \lor (P \to R)$ are logically equivalent or not. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. In a group of 6 boys and 4 girls, four children are to be selected, find the different numbers of ways for selection such that at least one boy is always there. (CO5) 10

8-b. Solve the recurrence relation $a_n - 5a_{n-1} + 6a_{n-2} = 4$ with initial condition $a_0 = 1$ and $a_1 = -1$. (CO5) 10