Printed page: 03 **Subject Code: AMCA0105**

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

MASTER OF COMPUTER APPLICATIONS (MCA)

(SEM: I Theory Examination (2020-2021)

SUBJECT DISCRETE MATHEMATICS

Time: 3 Hours **Max. Marks:100**

General Instructions:

- All questions are compulsory. Answers should be brief and to the point.
- This Question paper consists of 03 pages & 8 questions.
- It comprises of three Sections, A, B, and C. You are to attempt all the sections.
- Section A -Question No- 1 is objective type questions carrying 1 mark each, Question No- 2 is very short answer type carrying 2 mark each. You are expected to answer them as directed.
- Section B - Question No-3 is Long answer type -I question with external choice carrying 6 marks each. You need to attempt any five out of seven questions given.
- Section C -Question No. 4-8 are Long answer type –II (within unit choice) questions carrying 10marks each. You need to attempt any one part *a or b.*
- Students are instructed to cross the blank sheets before handing over the answer sheet to the invigilator.
- No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION – A

1. Attempt all of the following questions. **[10×1=10]** **CO**

a. If $n(A\times B) = 6$ and $A = \{1, 3\}$ then $n(B)$ is **(1)** **CO1**
(i) . 1 (ii). 2 (iii). 3 (iv). 6

b. The smallest set A such that A ∪ {1, 2} = {1, 2, 3, 5, 9} is? **(1)** **CO1**
(i). {2,3,5} (ii). {1, 2, 5, 9} (iii). {3, 5, 9}
(iv). None of the mentioned

c. The relation ≤ is a partial order if it is ___________ **(1)** **CO2**
(i). reflexive, antisymmetric and transitive
(ii). reflexive, symmetric
(iii). asymmetric, transitive
(iv) irreflexive and transitive

d. In preorder traversal of a binary tree the second step is ____________ **(1)** **CO2**
(i). traverse the right subtree
(ii). traverse the left subtree
(iii). traverse right subtree and visit the root
(iv). visit the root

e. A group homomorphism is called isomorphism if the mapping is **(1)** **CO3**
(i). one -one
(ii). onto
(iii). one-one onto
(iv). none of these

f.	A set G along with a binary operation is a group if the operation satisfies (i). Closure property and associative property only (ii). Existence of identity element only (iii). Existence of inverse only (iv). All the three property mentioned above	**(1)**	**CO3**
g.	If p is true and q is false, then $p \leftrightarrow q$ is (i). False (ii). True (iii). Neither true nor false (iv). none of these	**(1)**	**CO4**
h.	$p \wedge q$ is true when (i). p is true, q is false (ii). p is false, q is true (iii). p is true , q is true (iv). p is false, q is false	**(1)**	**CO4**
i.	How many permutations of the letter of the word APPLE are there? (i). 600 (ii). 120 (iii) 240 (iv). 60	**(1)**	**CO5**
j.	How many ways four boys and three girls are seated in a row so that they are alternate. (i). 144 (ii). 288 (iii). 12 (iv). 256	**(1)**	**CO5**

2.	**Attempt <u>all</u> of the following questions.**	**[5×2=10]**	**CO**
a.	Let $F: R \rightarrow R$ be defined by the $F(x) = 2x - 3$. Find $F^{-1}: R \rightarrow R$	**(2)**	**CO1**
b.	What do you mean by simple graph? Give one example.	**(2)**	**CO2**
c.	Define Permutation group with an example.	**(2)**	**CO3**
d.	If p is true and q is false, then find the truth value of the $\neg (p \rightarrow \neg q)$	**(2)**	**CO4**
e.	Out of seven consonants and four vowels. How many words of three consonants and two vowels can be formed?	**(2)**	**CO5**

SECTION – B

			CO
3.	**Answer any <u>five</u> of the following-**	**[5×6=30]**	
a.	For every natural number n prove that the proposition P(n) given by $1^2 + 2^2 + 3^2 + \ldots\ldots\ldots + n^2 = (n(n+1)(2n+1)) / 6$.	**(6)**	**CO1**
b.	Let R be a relation on the set A = {1, 2, 3, 4} defined by R = {(1, 1), (2, 2), (2, 3), (3, 2), (4, 2), (4, 4)} Find (i). Reflexive closure of R (ii). Symmetric closure of R (iii). Transitive closure of R	**(6)**	**CO1**
c.	Draw a Hasse Diagrams of the Poset(S, ≤) where S = {2, 3, 6, 12, 24, 36} and x ≤ y if x/y (x divides y)	**(6)**	**CO2**

	d.	For a Group G, prove that G is abelian if $(ab)^2 = a^2 b^2 \quad \forall \ a, b \in G$	**(6)**	**CO3**
	e.	Using logical equivalent formulas, show that $\neg (P \lor (\neg P \land Q)) \equiv \neg P \land \neg Q$.	**(6)**	**CO4**
	f.	Solve the recurrence relation $2a_r - 5a_{r-1} + 2a_{r-2} = 0$ then find the particular solution $a_o = 0$ and $a_1 = 1$	**(6)**	**CO5**
	g.	Find N if $2P(N, 2) + 50 = P(2N, 2)$	**(6)**	**CO5**

SECTION – C

4		**Answer any one of the following-**	**[5×10=50]**	
	a.	For every natural number n prove that the proposition P(n) given by $1^2 - 2^2 + 3^2 - 4^2 + \ldots\ldots\ldots + (-1)^{n-1} n^2 = (-1)^{n-1} (n(n+1)) / 2$.	**(10)**	**CO1**
	b.	If $f{:}A \rightarrow B$ and $g{:}B \rightarrow C$ be one to one onto functions then show that *gof* is also one-one onto and $(gof)^{-1} = f^{-1} o g^{-1}$	**(10)**	**CO1**
5.		**Answer any one of the following-**		
	a.	Define a Binary Tree. A Binary Tree has 9 Nodes. With its Inorder and Preorder Traversals nodes sequence are as follows: Inorder: E A C K F H D B G Preorder: F A E K C D H D G Draw the tree.	**(10)**	**CO2**
	b.	Define a Poset. Show that "less than or equal to" relation on a set of real number is partial ordering. Draw the Hasse Diagram of the partial ordering relation {(A, B)/A ⊆B) on the power set where S = {a, b, c}	**(10)**	**CO2**
6.		**Answer any one of the following-**		
	a.	Prove that the set of all rational numbers Q along with the operation of addition from a group. Show that (R, +) is also a group.	**(10)**	**CO3**
	b.	Let G be the set of all non-zero real numbers and let $a * b = ab/ 2$ Show that (G , *) is an abelian group.	**(10)**	**CO3**
7.		**Answer any one of the following-**		
	a.	Show that $P \lor \neg (P \land Q)$ is a tautology and $(P \land Q) \land \neg (P \lor Q)$ is a contradiction	**(10)**	**CO4**
	b.	Prove that $(p \leftrightarrow \neg q) \land (p \leftrightarrow \neg r) \equiv \neg [p \land (q \lor r)]$ without constructing truth table	**(10)**	**CO4**
8.		**Answer any one of the following-**		
	a.	Solve the following recurrence relation $a_{n+2} - 5a_{n+1} + 6a_n = 2$ with initial condition $a_o = 1$ and $a_1 = -1$	**(10)**	**CO5**
	b.	Write the short notes on following (i). Polya's Counting Theorem (ii). Pigeonhole Principle	**(10)**	**CO5**