Printed Page:- Subject Code:- AMCA0105

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

Affiliated to Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow

MCA

SEM: I - THEORY EXAMINATION (2021 - 2022)

Subject: Discrete Mathematics

Time: 03:00 Hours Max. Marks: 100

General Instructions:

1. All questions are compulsory. It comprises of three Sections A, B and C.

- Section A - Question No- 1 is objective type question carrying 1 mark each & Question No- 2 is very short type questions carrying 2 marks each.
- Section B - Question No- 3 is Long answer type - I questions carrying 6 marks each.
- Section C - Question No- 4 to 8 are Long answer type - II questions carrying 10 marks each.
- 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. Power set of empty set has exactly _____ subset. (CO1) 1

1. One
2. Two
3. Zero
4. Three

1-b. If A, B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$. then (CO1) 1

1. A = B
2. A = C
3. B = C
4. $A \cap B = d$

1-c. A directed graph or digraph can have directed cycle in which (CO2) 1

1. starting node and ending node are different
2. starting node and ending node are same
3. minimum four vertices can be there
4. ending node does not exist

1-d. Which of the following is not the algorithm to find the minimum spanning tree of the given graph? (CO2) 1

1. Bellman–Ford algorithm
2. Prim’s algorithm
3. Kruskal’s algorithm
4. None of These

1-e. Condition for monoid is (CO3) 1

1. (a+e)=a
2. (a*e)=(a+e)
3. a=(a*(a+e)
4. (a*e)=(e*a)=a

1-f. Which of the following satisfies commutative law? (CO3) 1

1. ∧
2. v
3. ↔
4. All of the mentioned

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

1. Contingency
2. Equivalence
3. Condition
4. Inference

1-h. The frequency Distribution of a nurerical data can be graphically represented by a (CO4) 1

1. Histogram
2. Telegram
3. Monogram
4. Anagram

1-i. If $^{16}P_{r-1} : {}^{15}P_{r-1} = 16 : 7$ then find r. (CO5) 1

1. 10
2. 12
3. 7
4. 8

1-j. In how many ways can six different rings be worn on four fingers of one hand? (CO5) 1

1. 10
2. 12
3. 15
4. 16

2. Attempt all parts:-

2.a. If A = { 1, 2, 3, 4, 5, 6, 7}, B = { 2, 4, 6, 8, 9}. Find A – B and B – A. (CO1) 2

2.b. Show that in any graph the number of odd vertices is always even. (CO2) 2

2.c. Define Used of Identity property in group. (CO3) 2

2.d. Prove the distributive law by truth table. (CO4) 2

2.e. Find the first four terms of the following recurrence relation. 2
$U_n = 2U_{n-1} + 5U_{n-2}$ for all integers $n \geq 2$, $U_0 = 2$, $U_1 = 3$. (CO5)

SECTION B 30

3. Answer any five of the following:-

3-a. All functions are relations, but not all relations are functions. Justify. (CO1) 6

3-b. Prove that for any integer n, the number $(n^3 - n)$ is even. (CO1) 6

3-c. How do you insert an element in a binary search tree? (CO2) 6

3-d. Draw the Hasse diagram of the poset$(S, \leq)$ where $S = \{1, 3, 5, 7, 9, 14, 18\}$ and $X \leq Y$ if X divides Y. (CO2) 6

3.e. Let R be a commutative ring and a , b $\in$ R. Show that $(a - b)^2 = a^2 - 2ab + b^2$. (CO3) 6

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

3.g. Solve the recurrence relation $2a_r - 5a_{r-1} + 2a_{r-2} = 0$ then find the particular solution 6
$a_0 = 0$ and $a_1 = 1$. (CO5)

SECTION C 50

4. Answer any one of the following:-

4-a. Prove using mathematical induction that for all $n \geq 1$, 10

$1 + 4 + 7 + \cdots + (3n - 2) = n(3n - 1)/2$. (CO1)

4-b. In a group of 100 persons, 72 people can speak English and 43 can speak French. How many can speak English only? How many can speak French only and how many can speak both English and French? (CO1) 10

5. Answer any one of the following:-

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

5-b. Show that vertices of every planner graph can be properly coloured with five colours. (CO2) 10

6. Answer any one of the following:-

6-a. Define a cyclic group. Prove that every cyclic group is an abelian group, but the converse is not true. (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 one of the following:-

7-a. Verify by truth table method to determine whether $p \rightarrow (q \wedge \neg q)$ and $\neg p$ are logically equivalent or not. (CO4) 10

7-b. Construct the truth table for the compound proposition (CO4) 10
$(P \rightarrow Q) \leftrightarrow (\neg P \rightarrow \neg R \neg S)$.

8. Answer any one of the following:-

8-a. How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated? (CO5) 10

8-b. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together? (CO5) 10