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 - CARRY OVER THEORY EXAMINATION - AUGUST 2022

Subject: Discrete Mathematics

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 marks each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. 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

(a) One

(b) Two

(c) Zero

(d) Three

1-b. What type of a relation is R = {(1, 3), (4, 2), (2, 4), (2, 3), (3, 1)} on the set A = {1, 2, 3, 4} ? (CO1) 1

(a) Reflexive

(b) Transitive

(c) Symmetric

(d) None of these

1-c. What is the number of edges present in a complete graph having n vertices? (CO2) 1

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

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

(c) n

(d) Information given is insufficient

1-d. Total number of degrees of an isolated node is (CO2) 1

(a) 0

(b) 1

(c) 2

(d) 3

1-e. An algebraic structure is called a semigroup. (CO3) 1

(a) (P, *)

(b) (Q, +, *)

(c) (P, +)

(d) (+, *)

1-f. A function f(x) is defined from A to B then f^{-1} is defined __________ (CO3) 1

(a) from A to B

(b) from B to A

(c) depends on the inverse of function

(d) none of the mentioned

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

(a) Contingency

(b) Equivalence

(c) Condition

(d) Inference

1-h. Which of the proposition is $p \wedge (\sim p \vee q)$ (CO4) 1

(a) tautulogy

(b) A contradiction

(c) Logically equivalent to $p \wedge q$

(d) All of the above

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

(a) 66

(b) 65

(c) 64

(d) 63

1-j.	In how many ways can be letters of the word LEADER be arranged? (CO5) (a) 72 (b) 144 (c) 360 (d) 720	1

2. Attempt all parts:-

2.a.	Write an example of finite and infinite set in set builder form. (CO1)	2
2.b.	Define Least Upper Bound with an example. (CO2)	2
2.c.	State any two properties of a group. (CO3)	2
2.d.	Define Tautology with an example. (CO4)	2
2.e.	In how many ways can the letters be arranged so that all the vowels come together? Word is "HOCKEY." (CO5)	2

SECTION B 30

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

3	If X, Y and Z are Three sets then Prove that $X - (Y \cap Z) = (X - Y) \cup (X - Z)$ (CO1)	6
3	R and S are relation on A = { 1, 2, 3}, R = { (1,1), (1,2), (2,3), (3,1), (3,3) and S = {(1, 2), (1, 3), (2, 1), (3, 3)} then find RoS and SoR (CO1)	6
3	Draw the binary search tree for the following input list 60, 25,75,15,50,66,33,44. Trace an algorithm to delete the nodes 25, 75, 44 from the tree. (CO2)	6
3	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.	Prove that intersection of two normal subgroups of a group G is a normal subgroup of G. (CO3)	6
3.f.	Prove that $(A \vee B) \wedge [(\neg A) \wedge (\neg B)]$ is a contradiction (CO4)	6
3.g.	Solve the recurrence relation $2a_r - 5a_{r-1} + 2a_{r-2} = 0$ then find the particular solution $a_0 = 0$ and $a_1 = 1$. (CO5)	6

SECTION C 50

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

4	Prove using mathematical induction that for all $n \geq 1$, $1 + 4 + 7 + \cdot\cdot\cdot + (3n - 2) = n(3n - 1)/2$. (CO1)	10
4	Show that the relation "is proper subset of" with respects to sets is not an equivalence	10

relation. (CO1)

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

5	Show that a complemented distributive lattice is a boolean algebra. (CO2)	10
5	Prove that any connected graph G with N vertices and N -1 Edges in a tree. (CO2)	10

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

6	Show that the set G = {1, 2, 3, 4} is a finite abelian group under multiplication modulo 5. (CO3)	10
6	Define order of an element of a group, find the order of every element in the multiplicative group G = { a , a^2 , a^3 ,a^4 ,a^5 , a^6 = e }. (CO3)	10

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

7	Use the truth tables method to determine whether $(\neg p \vee q) \wedge (q \rightarrow \neg r \wedge \neg p) \wedge (p \vee r)$ (denoted with ϕ) is satisfiable. (CO4)	10
7	Are the statements $P \rightarrow (Q \vee R)$ and $(P \rightarrow Q) \vee (P \rightarrow R)$ logically equivalent or not ? (CO4)	10

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

8	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	Solve the recurrence relation $U^{r+2} - U^{r+1} + 6U^r = 2^r + r$ (CO5)	10