Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA - SEMESTER– III• EXAMINATION – WINTER 2020

Subject Code:4639301   **Date:08/01/2021**

Subject Name:Basic Mathematics

**Time:10:30 AM to 12:30 PM**   **Total Marks: 56**

Instructions:
1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define the following terms: **07**
- I)   Subset
- II) Cardinality number of a set
- III) Singleton set
- IV) Reflexive Relation
- V)   Function
- VI) Null Graph
- VII) Binary Tree

(b) Check the validity of the following argument using predicates, quantifiers and logical connectives: **07**

All humans are mortal.

Socrates is a human.

Therefore, Socrates is mortal.

Q.2 **(a)** Give a Direct proof to show that, the sum of two odd integers is an even integer.   **07**

(b) I) Let the two matrices $A = \begin{bmatrix} 1 & 2 & -3 \\ 3 & 7 & 5 \\ 0 & 1 & 12 \end{bmatrix}$ and $B = \begin{bmatrix} 8 & 6 & 3 \\ 2 & 4 & 1 \\ 0 & -1 & 9 \end{bmatrix}$.Compute   **03**

$A + B,\ A - B\ \&\ B^T$.

II) Find the power set of the following sets: **04**
- (i) A = {r, s, t}
- (ii) B = {ϕ, {ϕ}}

Q.3 **(a)** Using Euclidean Algorithm (a = bq + r), find the GCD of the integers, a = 2274   **07**
& b = 174. Also find the LCM of these integers.

(b) I) Prove by Mathematical induction,"5 divides 5n+3 for all positive integers n".   **03**

II) Prove that the statement formula $[p \wedge (p \to q)] \to q$ is tautology, using the   **04**
truth table.

**Q.4** **(a)** Convert $(3FB09)_{16}$ from hexadecimal to decimal representation.   **07**

(b) I) Prove by Mathematical induction: "$7^n + 5$ is divisible by 3 for all **03** integers $n \geq 0$".

II) Give the converse, inverse and contrapositive of the implication: **04**
  "If it is raining, then I get wet".

Q.5 **(a)** The relation R from the set A = {2,5,7,18} into the set B = {2,3,4,5,10} is **07** defined by aRb if and only if $a \leq b$. Write the relations R and R^{-1} as a set of ordered pairs. Write the matrix of R. Also find the domain and range of the relation R.

(b) Define one-one and onto function. Let $f : A \to B$ be the function from the set **07** A = {3,4,5,6,7,8} into the set B = {0,1,2,3,4}, given by f = {(3,4), (4,1), (5,3), (6,0), (7,2), (8,4)}. Check whether the function f is one-one (injective) or onto (surjective) or both.

Q.6 **(a)** Give the definition of an equivalence relation. Prove that the given relation R on **07** the set A = {1,2,3,4} is an equivalence relation. Here, R= {(1,1), (1,2), (2,1), (2,2), (3,3), (3,4), (4,3), (4,4)}.

(b) Define composition of functions. Let the functions $f : R \to R$ & $g : R \to R$ be **07** defined by $f(x) = 4x - 3$ and $g(x) = x^2 + 2$, $\forall x \in R$. Find gof, fof & gog.

Q.7 **(a)** Define a directed graph (digraph). Write the adjacency matrix of the below **07** directed graph. Also discuss the in degree and out degree of each node (vertex) from the matrix. Is there any isolated node in the graph?
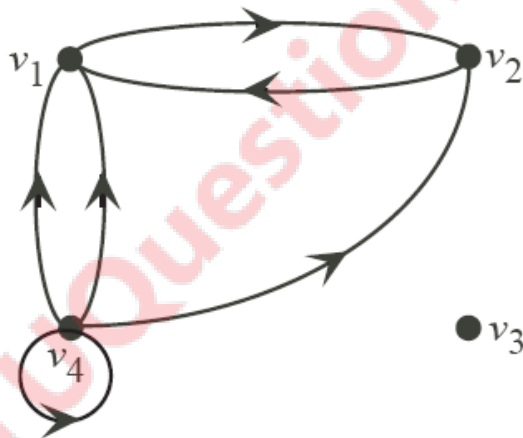
(b) Is the given tree a Binary tree? Also determine the order in which the nodes will be **07** visited if the tree is traversed in Inorder , Postorder and Preorder.
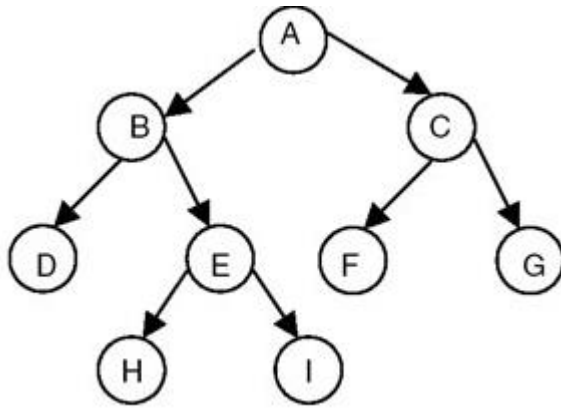
Q.8 **(a)** Check whether the below graph is weakly, unilaterally or strongly connected. If it is not **07** fall any of the above categories then find its components.
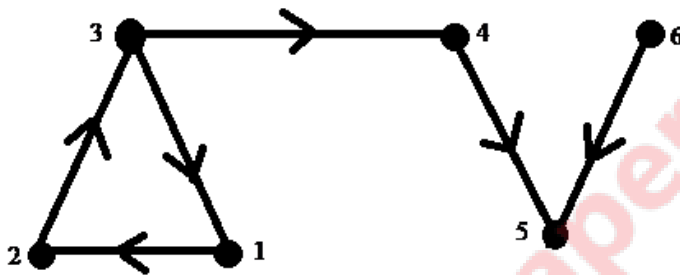
(b) Represent the below tree in Parenthesized expression and in List of content of a book **07** expression (Index)

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