

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER- III EXAMINATION – WINTER 2018

Subject Code: 3630001

Date: 04-01-2019

Subject Name: Basic Mathematics

Time: 10.30 am to 1.00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Define the following **07**
- (1) Intersection of two sets
 - (2) Transpose of a matrix
 - (3) Power Set
 - (4) Modus ponens
 - (5) Posets
 - (6) Binary Tree
- (b)** Let $U = \{a, b, c, d, e, f, g, h, p, q, r\}$ **07**
 $A = \{a, b, c, d, e\}$
 $B = \{c, d, e, f, g, h\}$
 $C = \{h, p, q, r\}$
Compute, $A \cup B$, $B \cap C \cap A$, $A - (B \cup C)$, $(A \cup B)'$, A' , $A' \cap B'$, $A \Delta B$, using Venn Diagram. (Note: $A \Delta B = (A - B) \cup (B - A)$)
- Q.2 (a)** Show the following implication without constructing truth table and thereafter show it through the truth tables **07**
 $(P \rightarrow Q) \rightarrow Q \Leftrightarrow (P \vee Q)$
- (b)** (1) Express the following using predicates, quantifiers and logical connectives. **03**
Also verify the validity of consequence
All birds can fly
A sparrow is a bird
Therefore, a sparrow can fly.
(2) Prove by contradiction that $\sqrt{2}$ is an irrational number **04**
- OR**
- (b)** Define Relation . Let $X = \{1, 2, 3, 4\}$ and $R = \{ \langle x, y \rangle \mid x > y \}$. Draw the graph of R and also give its matrix. **07**
- Q.3 (a)** What is Recursive Function? Write a Recursive algorithm to find out Fibonacci series. **07**
- (b)** Draw the Hasse diagrams of the following sets under the partial ordering relation “divides” and indicate those which are totally ordered. **07**
(i) $\{1, 2, 3, 4\}$ (ii) $\{3, 5, 15\}$ (iii) $\{2, 4, 8, 16\}$ (iv) $\{1, 2, 3, 6, 12\}$ (v) $\{2, 3, 6, 12, 24, 36\}$
- OR**
- Q.3 (a)** Let $X = \{2, 3, 6, 12, 24, 36\}$ and the relation $\leq$ be such that $x \leq y$ if x divides y . draw the Hasse Diagram of $\langle X, \leq \rangle$. **07**
- (b)** Let $X = \{\text{bat, bed, dog, let, egg}\}$ and let the relation R be given as: $R = \{ \langle x, y \rangle \mid x, y \in X \wedge xRy, \text{ if } x \text{ and } y \text{ contain some common letters.} \}$ **07**
Identify a relation. Draw a graph for R and find maximal compatibility block for the same.

- Q.4 (a)** Explain with example injective (onto), surjective(one-to-one) and bijective(one-to-one onto) function. Let N be set of Natural numbers including zero. Determine whether the function given below is injective, surjective or bijective.
 $f : N \rightarrow N$ $f(j) = j^2 + 2$ **07**

- (b)** Define equivalence relation. **07**
 Let Z be the set of integers and R be the relation called “Congruence modulo 5” defined by $R = \{ \langle x, y \rangle \mid (x - y) \text{ is divisible by } 5 \}$ Show that R is an equivalence relation. Determine the equivalence classes generated by the elements of Z .

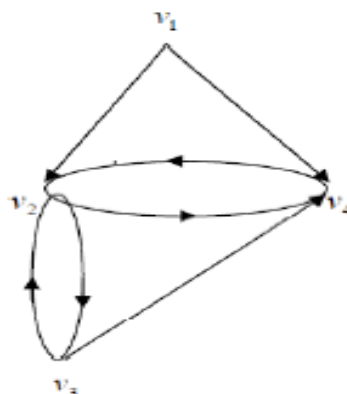
OR

- Q.4 (a)** Define Composition of a function. Let $X = \{1, 2, 3\}$ and p, q, r and s be functions from X to X given by
 $p = \{ \langle 1, 2 \rangle, \langle 2, 3 \rangle, \langle 3, 1 \rangle \}$ $q = \{ \langle 1, 2 \rangle, \langle 2, 1 \rangle, \langle 3, 3 \rangle \}$
 $r = \{ \langle 1, 1 \rangle, \langle 2, 2 \rangle, \langle 3, 1 \rangle \}$ $s = \{ \langle 1, 1 \rangle, \langle 2, 2 \rangle, \langle 3, 3 \rangle \}$ **07**
 Find oq , qop , $poroq$, soq , qos , sos

- (b)** Find the inverse of the matrix **07**

$$A = \begin{pmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{pmatrix}$$

- Q.5 (a)** Define Tree. Draw a graph of tree represented by : **07**
 $(A(B(C(D(E))(F(G(H(J))))(K(L)(M(N)(P(Q)(R))))))$
 Obtain a binary tree corresponding to it.
- (b)** Define adjacency matrix of a digraph. Obtain the adjacency matrix A of the given digraph. Find the elementary paths of lengths 1 and 2 from v_1 to v_4 . **07**



OR

- Q.5 (a)** Give an abstract definition of graph. When are two simple graphs said to be isomorphic? Give an example of two simple digraphs having 4 nodes and 4 edges which are not isomorphic **07**
- (b)** Define a unilateral component and strong component. Write unilateral and strong and weak components of the Graph given in following figure. **07**

