

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA– SEMESTER –III EXAMINATION –SUMMER-2019

Subject Code: 4639301

Date: 15-05-2019

Subject Name: Basic Mathematics

Time: 02.30 pm to 5.00 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) Elementary Path
 - (3) Power Set
 - (4) Modus ponens
 - (5) Partially ordered set
 - (6) Skew symmetric matrix
 - (7) Countable set
- (b)** Prove that : $A \cap (B \cup C) \equiv (A \cap B) \cup (A \cap C)$ **07**
- Q.2 (a)** Define Tautology and Contradiction with examples. Prove that $P \rightarrow (P \vee Q)$ is Tautology without constructing truth table. **07**
- (b)** (1) Express the following using predicates, quantifiers and logical connectives. **03**
Also verify the validity of consequence
“Every Computer science student needs to take Java Programming”
- (2) Use a truth table to determine whether the following statement form is valid: **04**
- $x \rightarrow y$
 $x \rightarrow z$
therefore, $x \rightarrow y \vee z$
- 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)** Draw a flow chart to calculate $n!$ using recursive procedure **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)** What is relation? Give the properties of relation .Example of relation which is both symmetric and anti-symmetric. **07**
- (b)** Define Power Set. Find the Power Set of the set $A = \{x, \{y,z\}, p\}$ **07**
- 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 **07**
- $p = \{ \langle 1,2 \rangle, \langle 2,3 \rangle, \langle 3,1 \rangle \}$ $q = \{ \langle 1,2 \rangle, \langle 2,1 \rangle, \langle 3,3 \rangle \}$
 $r = \{ \langle 1,1 \rangle, \langle 2,2 \rangle, \langle 3,1 \rangle \}$ $s = \{ \langle 1,1 \rangle, \langle 2,2 \rangle, \langle 3,3 \rangle \}$
Find qoq , qop , $poroq$, soq , qos , sos
- (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 $\mathbb{Z}$.

OR

- 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. **07**

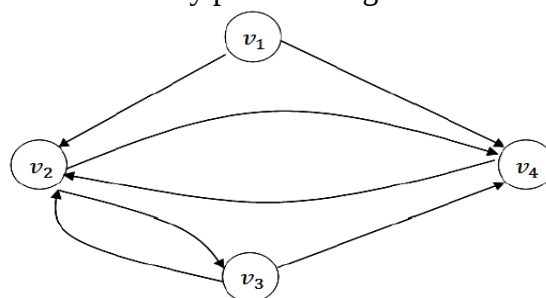
$$f : N \rightarrow N \quad f(j) = j^2 + 2$$

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

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

- Q.5 (a)** Give other three representation of tree expressed by $(v_0(v_1(v_2(v_3)(v_4))(v_5(v_6)(v_7)(v_8)(v_9))(v_{10}(v_{11})(v_{12})))$ obtain binary tree **07**

- (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)** Find all the indegrees and outdegrees of the nodes of the graph given in following figure. **07**

Give all the elementary cycles of this graph. List all the nodes which are reachable from another node of the digraph

