Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–III • EXAMINATION – SUMMER - 2017

Subject Code: 3630001 **Date: 02/06/2017**

Subject Name: Basic Mathematics

Time:02:30 pm - 05:00 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)** Show the following equivalences without constructing the truth table

(i) $(\neg P \wedge (\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ **04**

(ii) $\neg (P \wedge Q) \rightarrow (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$ **03**

(b) (i) State Peano's axioms. **02**

(ii) Prove that $1+2+3+...+n = n(n+1)/2$ **03**

(iii) Show that $n^3 + 2n$ is divisible by 3 **02**

Q.2 **(a)** Define: Maximal Compatibility Block. Let the compatibility relations on the sets {1, 2, 3, 4, 5, 6} and $\{x_1, x_2, \ldots, x_6\}$ be given by following two matrices respectively. Construct the graph and find the maximum compatibility blocks. **07**

(i)

2	1				
3	1	1			
4	1	1	1		
5	0	1	0	0	
6	0	0	1	0	1
	1	2	3	4	5

(ii)

x_2	1				
x_3	1	1			
x_4	0	0	1		
x_5	0	0	1	1	
x_6	1	0	1	0	1
	x_1	x_2	x_3	x_4	x_5

(b) Construct the truth tables for the following formulas

(i) $((P \rightarrow (Q \rightarrow R)) \rightarrow ((P \rightarrow Q) \rightarrow (P \rightarrow R)))$ **04**

(ii) $(P \wedge Q) \vee (\neg P \wedge Q) \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ **03**

OR

(b) Define Relation. Let X = {1, 2, 3, 4} and R = {<x,y> | x > y}. Draw the graph of R and also give its matrix. **07**

Q.3 **(a)** 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}

(b) (i) For A = {2, 3, 4, 5, 6}, B = {3, 4, 5, 6, 7}, C = {4, 5, 6, 7, 8} find **04**

a) $(A \cup B) \cap (A \cup C)$ b) $(A \cap B) \cup (A \cap C)$

(ii) Define Power Set. Find the Power Set of the set Q = {1, {2, 3}, 4 } **03**

OR

Q.3 **(a)** Define Composition of a function. Let X={1,2,3} and *f,g,h* and *s* be functions from X to X given by **07**

f = {<1,2>,<2,3>, <3,1>} g = {<1,2>,<2,1>, <3,3>}

h = {<1,1>,<2,2>, <3,1>} s = {<1,1>, <2,2>, <3,3>}

Find $f \circ g$, *gof, fohog, sog, gos, sos*

(b) What is Recursive Function? Write a Recursive algorithm to find out Fibonacci series. **07**

Q.4 **(a)** Define equivalence relation. Let X = { 1,2,…,7} and R = {<x,y> | x-y is divisible by 3}. Show that R is an equivalence relation. Draw the graph of R. **07**

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

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

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**

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

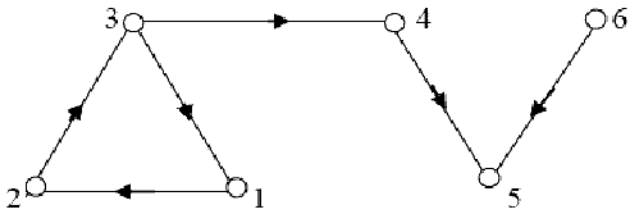
(b) (i) If $A = \begin{pmatrix} 0 & -1 \\ 1 & -1 \end{pmatrix}$ Show that $A^3 = I$ and so find A^{-1} **04**

(ii) Show that $\begin{pmatrix} 3 & 4 \\ 2 & 3 \end{pmatrix}$ is the inverse of $\begin{pmatrix} 3 & -4 \\ -2 & 3 \end{pmatrix}$ **03**

Q.5 **(a)** (i) Define Cyclic graph, Null graph, and Strongly connected graph. **03**

(ii) Define Adjacency matrix and path matrix of a graph. Explain each with example. **04**

(b) Define a unilateral component and strong component. Write unilateral and strong and weak components of the Graph given in following figure. **07**

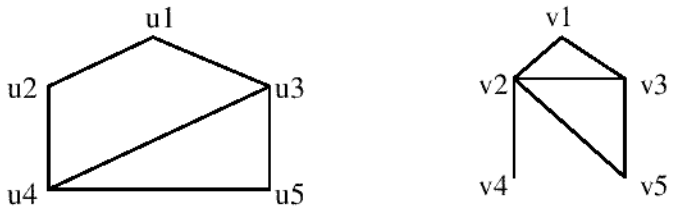


OR

Q.5 **(a)** Define a directed tree. Draw the graph of the tree represented by (A(B(E(H)(I))(F(J)(K))(G(L)))(C(M(O))(N(P)(Q)))(D(R(S(V))(T)(U))) Obtain the binary tree corresponding to it. **07**

(b) (i) Define a path in graph. Define length of the path. What is difference between a simple path and an elementary path? **03**

(ii) Define isomorphic graphs. State whether the following graphs are isomorphic or not. **04**



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