

**B.Tech. IN COMPUTER SCIENCE AND  
ENGINEERING (BTCSVI)**

**Term-End Examination**

**December, 2012**

**BICS-008 : DISCRETE MATHS STRUCTURE**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt any seven questions. All questions carry equal marks. All the questions are to be answered in English only.*

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1. (a) If R be a relation on the set of integers  $z$  defined by  $R = \{(x, y) : x \in z, y \in z, (x - y) \text{ is divisible by } 6\}$  5

Prove that R is an equivalence relation.

- (b) Let  $A = \{1, 2, 3\}$  and  $B = \{a, b, c, d\}$ . Let R be 5  
the relation from A to B with Boolean  
Matrices.

$$M_R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

Find Boolean Matrices of  $R^{-1}$  and  $R \circ R^{-1}$ .

2. Define Big O Notation. 10  
 Show that  $f(x) = 3x^2 + 5x + 2$  is  $O(x^2)$ .
3. Define a group. Describe the properties of a group. 10  
 Show that the set  $\{1, 2, 3, 4, 5\}$  is not a group under addition modulo 6.
4. (a) Find the product of the following two permutations and show that it is not commutative 5
- $$f = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{bmatrix} \text{ and } g = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 1 & 4 \end{bmatrix}$$
- (b) State and prove Lagrange's Theorem. 5
5. (a) Show that the relation ' $\geq$ ' is a partial ordering on the set of integers,  $z$ . 5
- (b) Show with an example that the union of two sublattices may not be a sub lattice. 5
6. (a) Prove that the set  $\{\text{AND}, \text{NOT}\}$  is a functionally complete set. 5
- (b) Using Karnaugh map. Simplify the expression  $A'B' + A'B$ . 5
7. (a) State the converse, inverse and contra positive of the statement "If you will work hard then you will pass in exam". 6
- (b) Verify that the proposition  $p \wedge (q \wedge \sim p)$  is a contradiction. 4

8. Prove that validity of the following argument "If I get the job and work hard, than I will get promoted. If I, get promoted, then I will be happy. I will not be happy. Therefore either I will not get job or I will not work hard. 10
9. Solve the recurrence relation 10  
 $a_r - 9a_{r-1} + 20a_{r-2} = 0$  where  $a_0 = -3$ ,  $a_1 = -10$ .
10. Write short note on *any two* of the following : 5+5=10
- (a) Pigeon hole Principle.
  - (b) Graph Colouring.
  - (c) Hass diagram.
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