

**Subject Code: MC1313/R13**

**M C A - I Semester Regular/Supply Examinations, Dec/Jan – 2015-16**

**DISCRETE MATHEMATICAL STRUCTURES AND GRAPH THEORY**

**Time: 3 hours**

**Max Marks: 60**

Answer any **FIVE** of the following

All questions carry equal marks.

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1. (a) Prove that  $[(p \wedge \sim q) \rightarrow r] \rightarrow [p \rightarrow (q \vee r)]$  is a tautology.  
(b) symbolize the following argument and check for its validity:  
Lions are dangerous animals  
There are lions  
Therefore, there are dangerous animals.
2. (a) Let  $X = \{1,2,3,4\}$  and  $R = \{(x, y) \mid x > y\}$ . Draw the graph of  $R$  and also give its matrix.  
(b) Let  $X = \{1,2,3,4,5,6,7\}$  and  $R = \{(x, y) \mid x-y \text{ is divisible by } 3\}$ . Show that  $R$  is an equivalence relation. Draw the graph of  $R$ .
3. (a) Show that the functions  $f(x) = x^3$  and  $g(x) = x^{1/3}$  for  $x \in \mathbb{R}$  are inverse of one another.  
(b) Let  $X = \{1,2,3\}$  and  $f, g, h$  and  $s$  be functions from  $X$  to  $X$  given by  $f = \{(1,2), (2,3), (3,1)\}$ ,  $g = \{(1,2), (2,1), (3,3)\}$ ,  $h = \{(1,1), (2,2), (3,1)\}$  and  $s = \{(1,1), (2,2), (3,3)\}$ .  
Find  $f \circ g$ ,  $g \circ f$ ,  $f \circ s$ ,  $s \circ f$ ,  $f \circ g \circ s$  and  $g \circ h \circ s$ .
4. (a) Define group and sub group.  
(b) A non empty subset  $S$  of  $G$  is a sub group of  $(G, *)$  iff for any pair of elements  $a, b \in S$ ,
5. (a) How many committees of 5 or more can be chosen from 9 people?  
(b) How many integral solutions are there to  $x_1 + x_2 + x_3 + x_4 + x_5 = 20$  where each  $x_i \geq 2$ ?
6. (a) Solve the recurrence relation  $a_n = a_{n-1} + f(n)$  for  $n \geq 1$  by substitution method.  
(b) Solve the recurrence relation  $a_n - 9a_{n-1} + 26a_{n-2} - 24a_{n-3} = 0$  for  $n \geq 3$  with initial conditions  $a_0 = 0$ ,  $a_1 = 1$  and  $a_2 = 10$ .
7. (a) Define lattice and show that  $(P(\{1,2,3\}), \subseteq)$  is a lattice.  
(b) Prove that every chain is a distributive lattice.
8. (a) A complete graph  $K_n$  is planar iff  $n \leq 4$ .  
(b) Every simple planar graph is 5-colorable.

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