

B.Sc. (I. T.) Sem. - I (2011 Course) : WINTER - 2018

SUBJECT: DISCRETE MATHEMETICS

Day: Thursday
Date: 22/11/2018

W-2018-1093

Time: 02.30 pm to 05.30 pm
Max. Marks: 80

N.B.:

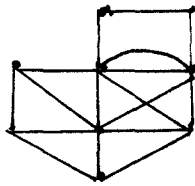
- 1) Attempt **ANY FIVE** full questions.
- 2) Figures to the right indicate **FULL** marks.

- Q.1**
- a) Define power set. Determine the power set of $A = \{a, b, c, d\}$. (06)
 - b) Out of 140 student, 60 have taken math, 45 science and 20 both. Find the number of students who have taken
i) At least one object; ii) Neither math nor science. (10)

- Q.2**
- a) Prove that $(A \cup B) \cap C = A \cap (B \cup C)$. (06)
 - b) Find the number of ways in which 5 IT students and 6 AG students can be seated at a round table so that no two IT students are seated together. (10)

- Q.3**
- a) Let $A = \{1, 2, 3\}$, $B = \{a, b, c\}$ and $C = \{x, y, z\}$ Consider the following relations R and S from A to B and B to C respectively: $R = \{1, b\}, \{2, a\}, \{2, c\}$ and $S = \{(a, y), (b, x), (c, y)\}$. Find
i) $R \circ S$; ii) M_R ; iii) M_S ; iv) $M_{R \circ S}$. Draw the Arrow Diagram of R and S. (08)
 - b) Let $A = \{1, 2, 3, 4, 5\}$. Determine the truth value of each of the following statements:- (08)
i) $(\exists x \in A)(x + 3 = 10)$; ii) $(\forall x \in A)(x + 3 < 10)$
ii) $(\exists x \in A)(x + 3 < 5)$; iv) $(\forall x \in A)(x + 3 \leq 7)$

- Q.4** a) State the "Handshaking Lemma". Verify the Lemma for the following graph: (08)



- b) Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function given by $f(x) = 3x^2 + 5, \forall x \in \mathbb{R}$. Show that f is bijective.
- Q.5** a) Consider the following relation on $A = \{1,2,3\}$:- (08)
 $R = \{(1,1), (1,2), (1,3), (3,3)\}$
 $S = \{(1,1), (1,2), (2,1), (2,2), (2,3)\}$
Determine whether or not each is
i) Reflexive; ii) Symmetric; iii) Transitive
- b) Construct a binary search tree for the following eleven data elements:- (08)
19, 37, 07, 10, 40, 39, 21, 04, 01, 69, 03.

- Q.6** a) Prove by mathematical induction that the sum of the first n natural numbers is $n(n+1)/2$. (06)
- b) The pre-order and in-order traversals of a binary tree T yielded the following sequences of nodes: (10)
Pre Order: G, B, Q, A, C, K, F, P, D, E, R, H.
Lw Order: Q, B, K, C, F, A, G, P, E, D, H, R.
i) Draw the diagram of T.
ii) Find the depth of T.
iii) List the terminal nodes of T.