M.C.A. SEM - I (CHOICE BASED CREDIT SYSTEM 2011 & 2012 COURSE) : WINTER - 2017

SUBJECT: DISCRETE STRUCTURES – I

Day: **Thursday** Time: **02.00 PM TO 05.00 PM**
Date: **16/11/2017** **W-2017-1688** Max. Marks: 100

N.B.:

1) Attempt any **FOUR** questions from Section –I and any **TWO** questions from Section –II.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in **SEPARATE** answer book.
4) Use of non programmable **CALCULATOR** is allowed.

SECTION-I

Q.1 **a)** Show that propositions $\sim(p \wedge q)$ and $(\sim p) \vee \sim(q)$ are Logically equivalent. **(07)**

b) Verify that the proposition $p \vee \sim(p \wedge q)$ is a Tautology. **(08)**

Q.2 **a)** Prove by Mathematical Induction method. **(07)**

$$1^2 + 2^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}.$$

b) Use set builder notation and logical equivalences to establish the second De Morgan's Law $\overline{A \cap B} = \overline{A} \cup \overline{B}$. **(08)**

Q.3 **a)** Let f and g be the functions from the set of integers to the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$ find fog and gof. **(07)**

b) What letter replaces the letter M when the function $f(p) = (5p + 3) \bmod 26$ is used for encryption? **(08)**

Q.4 **a)** The English language consists of 21 consonants and 5 vowels. How many 5 letter words, consisting of at least a vowel and two consonant can be formed from them? **(07)**

b) Draw the Hasse diagram representing the partial ordering relation $\{(a,b) / a / b\}$ on the set $\{2,4,5,10,12,20,25\}$. **(08)**

Q.5 **a)** Prove that an equivalence relation induces a partition and a partition induces an equivalence relation. **(07)**

b) Suppose that the relation R on a set is represented by the matrix **(08)**

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

Is R reflexive, symmetric and antisymmetric?

P. T. O.

Q.6 Write short notes on: **(15)**

a) N- ary relations

b) Skolmization

SECTION-II

Q.7 a) State and prove Lame's theorem. **(10)**

b) Let $f:\mathbb{Z}\to\mathbb{Z}$ be such that $f(x)=x+1$. Is f invertible? If yes find its inverse. **(10)**

Q.8 Give an argument which will establish the validity of the following interference. **(20)**
"All integers are rational numbers. Some integer are power of 2. Therefore, some rational number are power of 2".

Q.9 Describe Warshalls algorithm. Use this algorithm to find the transitive closure of the relation: $\{(1,2),(2,1),(2,3),(3,4),(4,1)\}$ on the set $\{1, 2, 3, 4\}$. **(20)**

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