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MCS-013

10011

MCA (Revised)

Term-End Examination

December, 2011

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

Note : *Question number **1** is **compulsory**. Attempt **any three** questions from the rest.*

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1. (a) If there are 12 persons in a party, and if each two of them shake hands with each other how many hand shakes happen in the party ? **3**

(b) Prove that $A-B=A \Leftrightarrow A \cap B = Q$ **4**

(c) Let R be the binary relation defined as **4**

$R=\{(a,\ b) \in R^2 \mid a-b \leq 3\}$

Determine whether R is reflexive, symmetric antisymmetric or transitive.

(d) What is a propositional function ? Write propositional function for following statement. **3**

Always there are some students in a class who are hardworking.

(e) Represent the following argument symbolically and determine whether the argument is valid ? "If today is Children's day then today is Pt.Jawaharlal Nehru's birthday". "If today is Pt.Jawaharlal Nehru's birthday then today is 14^{th} Nov".
Hence "If today is Children's day then today is 14^{th} Nov. **3**

(f) Simplify the Boolean function **3**

$$B(x_1, x_2, x_3) = [(x_1 \wedge x_2) \vee ((x_1 \wedge x_2) \wedge x_3)] \vee (x_2 \wedge x_3)$$

2. (a) Using mathematical induction method, show that : **4**

$$1^3 + 2^3 + 3^3 + ... + n^3 = \left[\frac{n(n+1)}{2}\right]^2$$

(b) Find the number of different messages that can be represented by sequences of 4 dashes and 3 dots. **2**

(c) If I be the set of integers, find whether $f: I \to I$ defined by $f(x) = x^3$ is one-one onto or both. **4**

3. (a) Construct a logic circuit represented by the Boolean expression. **4**

$$(x_1' \wedge x_2) \vee (x_1 \vee x_3') \wedge (x_2 \vee x_3)$$

where $x_i (1 \leq i \leq 3)$ are assumed to be inputs to that circuitry.

(b) Verify that the proposition $p \vee \sim(P \wedge Q)$ is a tautology. 2

(c) A valid Computer password consists of nine characters, the first of which is the digit 1, 5 or 7 the third character is either a # or a $ and the remaining a english alphabet or a digit. Find how many different passwords are possible ? 4

4. (a) Let I be the set of all integers. Let R be a relation on I, defined by 3

$R = \{(x, y) : x - y \text{ is divisible by } 6 \ \forall \, x, y \in I\}$

Show that R is an equivalence relation.

(b) Give the geometric representation of $\{3\} \times \mathbb{R}$. 3

(c) There are 15 points in a plane, no three of which are collinear. Find the number of straight lines formed by joining them. 4

5. (a) If 100 bulbs are placed in 15 boxes. Show that two of the boxes must have the same number of bulbs. 3

(b) If $f(x) = x^2$ and $g(x) = x + 1$, then find $(fog)x$ and $(gof)x$. 4

(c) Explain with reason, whether or not 3

(i) the collection of all good teachers is a set.

(ii) the set of points on a line is finite.