# I.M.C.A. SEM–III (2014 COURSE) CBCS : SUMMER - 2018

## SUBJECT : MATHEMATICS

Day : **Saturday** | **S-2018-1759** | Time : **02.00 PM TO 05.00 PM**
Date : **05/05/2018** | Max. Marks : 100

**N.B.:**

1) Attempt **ANY FOUR** questions from Section – I and attempt **ANY TWO** questions from Section – II.
2) Answers to both the sections should be written in **SEPARATE** answer books.
3) Figures to the right indicate **FULL** marks.

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## SECTION – I

**Q.1** **a)** Function f defined from A = {1, 2, 3, 4} to set B = {1, 4, 9, 16} where f(x) = $x^2$ check if it is invertible. If yes find its inverse. **[08]**

**b)** Using Venn diagram for 3 sets A, B and C sub sets of set U. Represent following sets with shaded area: **[07]**
**i)** $A - (B \cap A)$ **ii)** $A' \cap B' \cap C'$ **iii)** $(B \cap C) - A$.

**Q.2** **a)** Let S = {red, blue, green, yellow}. Determine which of the following is a partition of S and why? **[08]**
**i)** $P_1 = [\{red\}, \{blue, green\}]$
**ii)** $P_2 = [\phi, \{red, blue\}, \{green, yellow\}]$
**iii)** $P_3 = [\{red, blue, green\ yellow\}]$
**iv)** $P_4 = [\{\ blue\}, \{red, yellow, green\}]$

**b)** Define Cartesian product. For sets A = {a, b, c}, B = {1, 2, 3, 4}. Define A × B and prove A × B ≠ B × A. **[07]**

**Q.3** **a)** By mathematical Induction prove $1+4+7+.....+(3n-2) = \frac{n(3n-1)}{2}$. **[07]**

**b)** Verify that following propositions are tautology or contradiction: **[08]**
**i)** $p \vee \neg (p \wedge q)$ **ii)** $(p \wedge q) \wedge \neg (p \vee q)$

**Q.4** **a)** R is defined over sets A = {2, 4, 6, 8} B = {3, 6, 9, 12, 15, 18, 21} R = {(2, 6), (4, 12), (6, 6), (6, 12), (2, 12), (2, 18), (2, 24), (4, 24), (6, 24), (8, 24)}. Represent relations using set notation, diagraph and matrix. **[08]**

**b)** For each pair of integers a and b find integers q and r such that a = bq + r where $0 \le r \le |b|$: **i)** a = 258 and b = 12 **ii)** a = 573 and b = – 16. **[07]**

**Q.5** For sets U = positive integers < 30, A = {a | sub set of divisible by 3}, B = {b | subset of divisible by 4}, C = {set of even integers and subset of U}. Perform: **[15]**
**a)** $A \cup B$ **b)** $A \cap B \cap C$ **c)** $A \cap B$ **d)** $A' \cup B' \cup C'$ **e)** $A - (A \cap B)$.

**Q.6** **a)** Relation R is defined on set A = {2, 4, 6, 8} where R = {(a, b) | a % b = 0}. Check if the given relation is equivalence relation. **[08]**

**b)** Express the given expressions as a sum-of-products and them complete sum of products form: **[07]**
E = x (x y ′ + x′ y + y′ z) E = z (x′ + y′) + y′.

**P.T.O.**

**Q.7** **a)** Define the term composition of function if f(x) : A $\rightarrow$ B and g : B $\rightarrow$ C as f(x) = 2x + 1 and g(x) = 3x. Define fog and gof. **[07]**

**b)** For the following matrices find: **[08]**

**i)** A + 4B – C **ii)** A – 3C + 2B.

where $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 5 & 9 \end{bmatrix}$ $B = \begin{bmatrix} 7 & -3 & 5 \\ 7 & 2 & -1 \end{bmatrix}$ $C = \begin{bmatrix} 5 & 7 & 8 \\ 0 & 3 & 2 \end{bmatrix}$.

## SECTION – II

**Q.8** **a)** Draw logic circuit L with inputs A, B, C and output Y which corresponds to each Boolean expression. **[10]**

**i)** Y = ABC + A′ C′ + B′ C′

**ii)** Y = AB′C + ABC′ + AB′C′

**b)** Determine if the following relation R defined on set A is an equivalent relation,if not find its required closures: **[10]**
A = {1, 2, 3, 4, 5}, R = {(1, 3), (1, 4), (2, 1), (2, 3), (2, 5), (4, 3), (3, 5), (5, 1)}.

**Q.9** A survey on a sample of 25 new cars being sold at a local auto dealer was conducted to see which of three popular options, air-conditioning (A), radio (R) and power windows (W), were already installed. The survey found: **[20]**

**a)** 15 had air-conditioning.
**b)** 12 had radio.
**c)** 11 had power windows.
**d)** 5 had air-conditioning and power windows.
**e)** 9 had air-conditioning and radio.
**f)** 4 had radio and power windows.
**g)** 3 had all three options.

Find the number of cars that had :

**i)** Only power windows.
**ii)** Only air-conditioning.
**iii)** Only radio.
**iv)** Radio and power windows but not air-conditioning.
**v)** Air-conditioning and radio, but not power windows.
**vi)** Only one of the options.
**vii)** Atleast one option.
**viii)** None of the options.

**Q.10** **a)** Prove proposition, if a $\leq$ b and b $\leq$ c, then a $\leq$ c. **[10]**

**b)** Prove proposition, if a $\leq$ b and c is any integer. Then a + c $\leq$ b + c. **[10]**

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