

**B.C.A. SEM-III (2014 COURSE) CBCS : SUMMER - 2018**

**SUBJECT : MATHEMATICS**

Day : **Saturday**  
Date : **05/05/2018**

**S-2018-1705**

Time : **02.00 PM TO 05.00 PM**  
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.

**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  $S = \{\text{red, blue, green, yellow}\}$ . Determine which of the following is a partition of  $S$  and why? [08]
- i)  $P_1 = [\{\text{red}\}, \{\text{blue, green}\}]$   
ii)  $P_2 = [\emptyset, \{\text{red, blue}\}, \{\text{green, yellow}\}]$   
iii)  $P_3 = [\{\text{red, blue, green, yellow}\}]$   
iv)  $P_4 = [\{\text{blue}\}, \{\text{red, yellow, green}\}]$
- b) Define Cartesian product. For sets  $A = \{a, b, c\}, B = \{1, 2, 3, 4\}$ . Define  $A \times B$  and prove  $A \times B \neq B \times A$ . [07]
- Q.3** a) By mathematical Induction prove  $1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n - 1)}{2}$ . [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  $0 \leq r < |b|$ : i)  $a = 258$  and  $b = 12$       ii)  $a = 573$  and  $b = -16$ . [07]
- Q.5** For sets  $U =$  positive integers  $< 30, A = \{a \mid \text{sub set of divisible by } 3\}, B = \{b \mid \text{subset of divisible by } 4\}, C = \{\text{set of even integers and subset of } U\}$ . 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  $R = \{(a, b) \mid a \% b = 0\}$ . Check if the given relation is equivalence relation. [08]
- b) Express the given expressions as a sum-of-products and then 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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