GSE/D-21 **1192**

MATHEMATICAL FOUNDATION-I
Paper–BCA-113

Time : Three Hours] [Maximum Marks : 80

Note : Attempt *five* questions in all, selecting at least *one* question from each section. Question No. 1 is compulsory. All questions carry equal marks.

Compulsory Question

1. (a) Find power set of {2,3,4}.

   (b) Define Lattices.

   (c) Evaluate : $\lim\limits_{x \to 5} \dfrac{x^2 - 9x + 20}{x^2 - 6x + 5}$.

   (d) Find order and degree of the differential equation

   $$\frac{d^3y}{dx^3} - \left(\frac{dy}{dx}\right)^{1/3} = xy.$$

   (e) Solve the differential equation:

   $$\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - y = 0.$$

SECTION–I

2. (a) Prove that, $A - (B \cap C) = (A - B) \cup (A - C)$.

(b) Let A = {1, 2, 3, 4} and
R = {(1, 1), (1, 3), (2, 2), (2, 4), (3, 1), (3, 3), (4, 2), (4, 4)}. Show that R is an equivalence relation.

3. (a) In how many ways 5 different microprocessor books and 4 different digital electronics books be arranged in a self so that all the four digital electronics books are together.

(b) If $f\{x, y, z\} = (xvy) \wedge (xvy') \wedge (x'vz)$ be a given Boolean function. Determine its DN form.

SECTION–II

4. (a) By using $\varepsilon - \delta$ definition of limit show that

$$\lim_{x \to 1} \frac{x^2 - 1}{x - 1} = 2, \, x \neq 1.$$

(b) Find the value of a if the function f given by

$$f(x) = \begin{cases} 2x - 1, & 2 < x \\ a, & x = 2 \\ x + 1, & x > 2 \end{cases}$$

is continuous at $x = 2$.

5. (a) Find $\frac{dy}{dx}$ if $y = \frac{\log x}{1 + \log x}$.

(b) If $= x^x$, show that $\frac{d^2y}{dx^2} - \frac{1}{y}\left(\frac{dy}{dx}\right)^2 - \frac{y}{x} = 0.$

SECTION–III

6. (a) Form the differential equation of the equation $y = ax^3 + bx^2$ by eliminating the arbitrary constants a and b.

   (b) Solve the differential equation :
   $$\frac{dy}{dx} = (4x + y + 1)^2, \text{ if } y(0) = 1.$$

7. (a) Solve the differential equation :
   $$x - xdy = \sqrt{x^2 + y^2} \ dx.$$

   (b) Solve the differential equation :
   $$(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0.$$

SECTION–IV

8. (a) Solve the differential equation :
   $$\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{2x} + \sin 2x.$$

   (b) Solve the differential equation :
   $$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x.$$

9. (a) Solve the differential equation :
   $$x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \log x.$$

   (b) Determine the curve whose sub-tangent is twice the abscissa of the point of contact and passes through the point (1, 2).

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