

Roll No.

Total Pages : 04

GSE/D-23

1123

MATHEMATICAL FOUNDATIONS-I

BCA-113

Time : Three Hours]

[Maximum Marks : 80

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. 1 is compulsory.

(Compulsory Question)

1. (a) Draw Venn diagram for $A - B$.
- (b) Define bounded lattices.
- (c) Evaluate :

$$\lim_{x \rightarrow -3} \frac{x^3 + 4x^2 + 4x + 3}{x^2 + 2x - 3}.$$

- (d) Find order and degree of the differential equation :

$$\frac{d^2 y}{dx^2} - x \left(\frac{dy}{dx} \right)^{2/3} = e^x$$

- (e) Solve the differential equation :

$$\frac{d^4 y}{dx^4} + 4x = 0.$$

5×4=20

Unit I

2. (a) Prove that :

$$\cap(B \cup C) = (A \cap B) \cup (A \cap C)$$

- (b) Show that the relation 'Divides' defined on N is a partial order relation.

3. (a) A class has 18 girls and 12 boys. In how many ways can a committee of two boys and two girls be chosen ?

- (b) Determine its disjunctive normal form of the following Boolean expression $x \cap (y \cup z)$.

Unit II

4. (a) By using ϵ - δ definition of limit show that :

$$\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 - 1} = \frac{3}{2}.$$

- (b) If $f(x) = \begin{cases} \frac{|x-2|}{2-x}, & x \neq 2 \\ -1 & x = 2 \end{cases}$ find whether or not,

is continuous at $x = 2$.

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

- (b) If $y = \left(x + \sqrt{1+x^2}\right)^n$, show that : 8

$$(1+x^2) \frac{d^2 y}{dx^2} + x \frac{dy}{dx} = n^2 y.$$

Unit III

6. (a) Form the differential equation of the equation $xy = Ae^x + Be^{-x}$ by eliminating the arbitrary constants and B. 7

- (b) Solve the differential equation : 8

$$\frac{dy}{dx} = e^{2x-3y} + 4x^2 e^{-3y}$$

7. (a) Solve the differential equation : 7

$$(y^2 - 2xy) dx = (x^2 - 2xy) dy.$$

- (b) Solve the differential equation : 8

$$(x^2 + y^2 + 2x) dx + 2y dy = 0.$$

Unit IV

8. (a) Solve the differential equation : 7

$$\frac{d^3 y}{dx^3} - 2 \frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 6y = e^{3x}.$$

- (b) Solve the differential equation : 8

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 2y = e^x \sin x.$$

9. (a) Solve the differential equation : 7

$$x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 5y = \sin(\log x)$$

- (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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