

Roll No. :

Total No. of Questions : 9] [Total No. of Pages : 7

97663

**B.C.A. 1st Semester (New)
(Full & Reappear)
Examination, March-2021**

**MATHEMATICS
Paper-BCA-103**

Time : Three Hours]

[Maximum Marks : 80

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note :- Attempt five questions in all, selecting one question from each Unit. Question No. 1 is compulsory. All questions carry equal marks.

1. (a) Compute $3A + 4B$ if :

$$A = \begin{bmatrix} 2 & 3 \\ -1 & -1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 1 & -2 \\ -1 & 0 \end{bmatrix}$$

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(1)

RD-561

P.T.O.

(b) Write the power set of $\{2, 5, 10\}$.

(c) Evaluate :

$$\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{x^2}$$

(d) Find the domain of :

$$y = \sqrt{x-5}$$

(e) Find $\frac{dy}{dx}$, when :

$$y = \frac{3x^2 + 1}{x}$$

(f) Find $\frac{dy}{dx}$, when :

$$y = a^{7x+4}$$

(g) Evaluate :

$$\int \sqrt{x}(x^2 + 2x + 3) dx$$

(h) Evaluate :

$$\int \frac{dx}{1 - \cos x}$$

$$2 \times 8 = 16$$

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(2)

RD-561

Unit-I

2. (a) In a group of 400 people, 250 can speak English only and 70 can speak Hindi only.

Find :

(i) How many can speak both English and Hindi ?

(ii) How many can speak English ?

(iii) How many can speak Hindi ? 8

(b) If :

$$A = \begin{bmatrix} 3 & 2 & 0 \\ 1 & 4 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$

show that : $A^2 - 7A + 10I = 0$ where I is a unit matrix. 8

3. (a) Prove that :

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a+b+c)(a-b)(b-c)(c-a)$$

8

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(3)

RD-561

P.T.O.

- (b) Solve the following system of equations using matrices :

$$2x + 8y + 5z = 5$$

$$x + y + z = -2$$

$$x + 2y - z = 2$$

8

Unit-II

4. (a) In the set N of all natural numbers, let a relation R be defined by :

$$R = \{(x, y) : x \in N, y \in N, \\ x - y \text{ is divisible by } 5\}$$

Prove that R is an equivalence relation. 8

- (b) (i) If :

$$f(x) = x^5 - \frac{1}{x^5},$$

find the value of $f(x) + f\left(\frac{1}{x}\right)$. 4

- (ii) If :

$$f(x) = x + \frac{1}{x},$$

prove that :

$$[f(x)]^3 = f(x^3) + 3f\left(\frac{1}{x}\right) \quad 4$$

5. (a) Evaluate :

$$\lim_{x \rightarrow 0} \left(\frac{\operatorname{cosec} x - \cot x}{x} \right) \quad 8$$

- (b) Discuss the continuity of the function $f(x)$

$$\text{at } x = \frac{1}{2} :$$

$$f(x) = \begin{cases} \frac{1}{2} - x, & \text{if } 0 \leq x < \frac{1}{2} \\ 1, & \text{if } x = \frac{1}{2} \\ \frac{3}{2} - x, & \text{if } \frac{1}{2} < x \leq 1 \end{cases} \quad 8$$

Unit-III

6. Differentiate the following functions w.r.t. x :

(i) $y = \frac{x}{\sin x}$

(ii) $y = \sqrt{\frac{1-x}{1+x}}$

$$(iii) \quad y = \tan^{-1} \left(\frac{\sqrt{1 + \sin x}}{\sqrt{1 - \sin x}} \right)$$

$$(iv) \quad y = \tan^{-1} (\sqrt{1 + x^2} + x) \quad 4 \times 4 = 16$$

7. (a) Find $\frac{dy}{dx}$, if :

$$y = x^{\sin x} + (\sin x)^x. \quad 8$$

(b) Find $\frac{dy}{dx}$, when :

$$\dot{x} = a(1 + \cos \theta),$$

$$y = a(\theta + \sin \theta) \quad 8$$

Unit-IV

8. Evaluate the following integral :

$$(a) \quad \int \tan^{-1}(\sec x + \tan x) dx \quad 8$$

$$(b) \quad \int \frac{x^2 \tan^{-1} x}{1 + x^2} dx \quad 8$$

9. Evaluate the following integral :

$$(a) \quad \int \frac{x dx}{(x+2)(3-2x)} \quad 8$$

$$(b) \quad \int_0^\pi \log(1 + \cos x) dx \quad 8$$