H-92-21 **Roll No. .....**

ANNUAL EXAMINATION, 2020-21

B.C.A. II

B.C.A. 201

Paper I

(Calculus and Differential Equations)

Time : 3 Hours] [Maximum Marks : 80

Note : *Attempt any two parts from each unit. All questions carry equal marks.*

Unit-I

1. (a) Test for continuity of the function :

$$f(x) = \begin{cases} 1 & , \text{ if } x = 0 \\ 3x - 1 & , \text{ if } x < 0 \\ 0 & , \text{ if } x > 0 \end{cases}$$

at $x = 0$.

(b) Show that the $\lim_{x \to 0} f(x)$ does not exist, where

$$f(x) = \begin{cases} \dfrac{|x|}{x} & , \quad x \neq 0 \\ 0 & , \quad x = 0. \end{cases}$$

(c) Show that the function :

$$f(x) = \begin{cases} x^2 \sin\left(\dfrac{1}{x}\right) & , \text{ when } x \neq 0 \\ 0 & , \text{ when } x = 0 \end{cases}$$

is continuous and differentiable at $x = 0$.

Unit-II

(a) Differentiable $\dfrac{x}{1 + \tan x}$ w.r.t. x.

(b) Find $\dfrac{dy}{dx}$, when $x = a\,(t + \sin t)$

$$y = a\,(1 - \cos t).$$

(c) Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius a is $2a\sqrt{3}$.

Unit-III

3. (a) If $\int_1^a (3x^2 + 2x + 1)\, dx = 11$, then find the real value of a.

(b) Evaluate $\int_1^2 \frac{5x^2}{(x^2 + 4x + 3)}\, dx$.

(c) Evaluate $\int_{\pi/4}^{\pi/2} \cos zx \cdot \log \sin x\, dx$.

Unit-IV

4. (a) Integrate :

$$\int \frac{\sec^2 x\, dx}{\sqrt{\tan x}}.$$

(b) Evaluate :

$$\int \frac{x^2}{16 + 25x^6}\, dx.$$

(c) Evaluate :

$$\int \frac{dx}{1 + 3x - x^2}.$$

Unit-V

5. (a) Evaluate the following integral :

$$(x + 2)\, \frac{dy}{dx} = x^2 + 4x - 9,\ x \neq -2.$$

(b) Solve $\frac{dy}{dx} + y = 1$.

(c) Differentiate the following :

$$xy\, \frac{dy}{dx} = (x + 2)\, (y + 3).$$

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