

22201

11920

3 Hours / 70 Marks

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following :

10

- a) If $f(x) = 16^x - \log_2 x$ find $f\left(\frac{1}{4}\right)$
- b) If $f(x) = ax^2 - bx - 1$, $f(2) = 5$, $f(-2) = 10$ find a and b .
- c) Find $\frac{dy}{dx}$, if $y = x \sin^{-1} x$
- d) Evaluate : $\int \frac{dx}{3x^2 + 4}$
- e) Evaluate : $\int \sin^3 x \, dx$
- f) Find the volume obtained by revolving the area under the curve $9x^2 - 4y^2 = 36$ in the interval from $x = 2$ to $x = 4$ about x -axis.
- g) Find order and degree of the differential equation $\frac{d^2 y}{dx^2} = \left(y + \frac{dy}{dx}\right)^{3/2}$

P.T.O.

2. Attempt any THREE of the following: 12

- a) If $x^p y^q = (x + y)^{p+q}$ show that $\frac{dy}{dx} = \frac{y}{x}$
- b) If $y = 3 \sin \theta - 2 \sin^3 \theta$ and $x = 3 \cos \theta - 2 \cos^3 \theta$ find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$
- c) Find the radius of curvature of the curve $xy = c$ at point (c, c)
- d) Discuss maxima and minima of the function “ $\tan x - 2x$ ”.

3. Attempt any THREE of the following: 12

- a) Find the equation of tangent and normal to the curve $y = x(2 - x)$ at point $(2, 0)$.
- b) Find $\frac{dy}{dx}$, $y = (\sin^{-1} x)^x + (\cos x)^{\sin x}$
- c) If $y = \tan^{-1} \left[\frac{5x - 4}{5 + 4x} \right]$ find $\frac{dy}{dx}$
- d) Evaluate $\int \frac{\sec^2 x}{(1 + \tan x)(2 + \tan x)} dx$

4. Attempt any THREE of the following: 12

- a) Evaluate : $\int \frac{dx}{2x^2 + 3x + 1}$
- b) Evaluate : $\int \frac{dx}{1 + \sin x + \cos x}$
- c) Evaluate : $\int \frac{x \sin^{-1} x}{\sqrt{1 - x^2}} dx$
- d) Evaluate : $\int_0^{\pi/2} \frac{\tan x}{1 + \tan x} dx$
- e) Evaluate : $\int \frac{x}{(x^2 + 4)(x^2 + 9)} dx$

5. Attempt any TWO of the following:

12

- a) Find the area between the curves $y^2 - 2x = 0$ and $y^2 + 4x - 12 = 0$
- b) Attempt the following:
- (i) Form the differential equation if

$$y = A \cos(\log x) + B \sin(\log x)$$
- (ii) Solve

$$x \log x \frac{dy}{dx} + y = 2 \log x$$
- c) A circular column of radius 'x' and having depth y support a load. The equation of equilibrium is $2 \frac{dy}{dx} - kx = 0$ where 'k' is constant. Find the relation between x and y.

6. Attempt any TWO of the following:

12

- a) Using Simpson's $\frac{1}{3}$ rd rule, evaluate $\int_0^2 \frac{1}{1+x^3} dx$ with $n = 4$.
- b) Using Simpson's $\frac{3}{8}$ th rule, evaluate $\int_0^{\pi/2} \cos x dx$ with $n = 8$
- c) Attempt the following:
- (i) Using Trapezoidal rule, evaluate $\int_{-1}^1 (1+x+x^2+x^3) dx$ by taking $n = 2$.
- (ii) Using Simpson's $\frac{1}{3}$ rd rule evaluate $\int_1^3 \frac{dx}{x}$, taking $h = 0.5$.
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