

22201

12425

03 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 answer with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Solve any FIVE of the following:

10

- a) If $f(x) = \sin x$, show that
$$f(3x) = 3f(x) - 4f^3(x)$$
- b) If $f(x) = \frac{x^2 + 1}{x^3 - 1}$, find $f\left(\frac{1}{2}\right)$
- c) Find $\frac{dy}{dx}$, if $y = \log(x^2 - 2x + 7)$
- d) Evaluate $\int \frac{dx}{3x^2 + 4}$
- e) Evaluate $\int xe^x dx$.
- f) Find the area under the curve $y = e^x$ from the ordinate $x = 0$ to $x = 1$.
- g) Find the order and degree of the differential equation.
$$\frac{d^2 y}{dx^2} = \left[1 + \left(\frac{dy}{dx}\right)^2\right]^3$$

P.T.O.

2. Solve any THREE of the following:**12**

- a) If $x^2 + y^2 = 4xy$, find $\frac{dy}{dx}$ at $(2, -1)$
- b) If $x = a \sec t$ and $y = b \tan t$ then find $\frac{dy}{dx}$ at $t = \frac{\pi}{2}$
- c) Find radius of curvature of the curve $y = \log (\sin x)$ at $x = \frac{\pi}{2}$
- d) Find the maximum and minimum values of $x^3 - 9x^2 + 24x$.

3. Solve any THREE of the following:**12**

- a) Find equation of normal and tangent to the curve $y = 4xe^x$ at the origin $(0, 0)$.
- b) Find $\frac{dy}{dx}$, If $y = \cos^{-1} \left(\frac{2x}{1+x^2} \right)$.
- c) If $y = (\sin x)^{\log x}$, find $\frac{dy}{dx}$.
- d) Evaluate $\int \frac{(\tan^{-1} x)^3}{1+x^2} dx$.

4. Solve any THREE of the following:**12**

- a) Evaluate $\int \frac{dx}{5+4x-x^2}$
- b) Evaluate $\int \frac{e^x}{(e^x-1)(e^x+1)} dx$.
- c) Evaluate $\int_0^{\pi/2} \frac{\sin x}{\cos x + \sin x} dx$.
- d) Evaluate $\int \frac{1}{3-2 \sin x} dx$.

5. Solve any TWO of the following:**12**

- a) Find the area between the curves $y = x$ and $y = x^2$.
- b) i) Form a differential equation by eliminating arbitrary constant.
If $y = A \sin x + B \cos x$.
- ii) Solve $(y + x^2y) \frac{dy}{dx} - (3x + xy^2) = 0$.
- c) The velocity of a particle is given by $v = t^2 - 6t + 7$.
Find distance covered in 3 seconds.

6. Solve any TWO of the following:

12

- a) Evaluate $\int_2^7 \frac{dx}{x}$ using trapezoidal rule, taking $n = 5$.
- b) Evaluate $\int_0^4 x^2 dx$ with $h = \frac{1}{2}$ using Simpson's $\frac{3}{8}$ rule.

c) Attempt the following:

- i) Using trapezoidal rule. Calculate approximate value of:

$$\int_{-1}^1 (1 + x + x^2 + x^3) dx \text{ by taking } n = 2.$$

- ii) Using Simpson's $\frac{1}{3}$ rd rule, calculate the approximate value of $\int_0^4 e^x dx$ by using following data.

x	0	1	2	3	4
$y = e^x$	1	2.72	7.39	20.09	54.60
