

22224

11819

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. Solve any FIVE of the following:

10

- a) If $f(x) = x^3 - x$ find $f(1) + f(2)$
- b) State whether the function $f(x) = x^3 - 3x + \sin x + x \cdot \cos x$ is even or odd.
- c) Find $\frac{dy}{dx}$ if $y = e^{2x} \cdot \log(x+1)$
- d) Evaluate $\int \left(e^{2x} + \frac{1}{1+x^2} \right) dx$
- e) Evaluate $\int \frac{dx}{9x^2 - 16}$
- f) Find the area enclosed by the curve $y = x^3$, x -axis and the ordinates $x = 1$ and $x = 3$
- g) Show that the root of $x^3 - 9x + 1 = 0$ lies between 2 and 3.

P.T.O.

2. Solve any THREE of the following:

12

a) If $x^2 + y^2 + 2xy - y = 0$ find $\frac{dy}{dx}$ at (1, 2)

b) If $x = a(2\theta - \sin 2\theta)$ and $y = a(1 - \cos 2\theta)$
find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$

c) Find the maximum and minimum value of

$$y = x^3 - \frac{15}{2}x^2 + 18x$$

d) A beam is bent in the form of the curve $y = 2\sin x - \sin 2x$.
Find the radius of curvature of the beam at the point $x = \frac{\pi}{2}$

3. Solve any THREE of the following:

12

a) Find the equation of tangent and normal to the curve
 $2x^2 - xy + 3y^2 = 18$ at point (3, 1)

b) A manufacturer can sell x items at a price of ₹ (330- x) each.
The cost of producing x items is ₹ $x^2 + 10x + 12$. Determine
the number of items to be sold so that the manufacturer can
make the maximum profit.

c) If $x^y = e^{x-y}$ then prove that

$$\frac{dy}{dx} = \frac{\log x}{(1 + \log x)^2}$$

d) Evaluate $\int \frac{dx}{2x + x \cdot \log x}$

4. Solve any THREE of the following:

12

a) Evaluate $\int \frac{dx}{x^2 + 4x + 25}$

b) Evaluate $\int \frac{dx}{2 + 3 \cos 2x}$

c) Evaluate $\int x \cdot \tan^{-1} x \, dx$

d) Evaluate $\int \frac{x^2 + 1}{(x + 1)(x + 2)(x - 3)} \, dx$

e) Evaluate $\int_0^{\pi/2} \frac{dx}{1 + \sqrt[3]{\tan x}}$

5. Solve any TWO of the following: 12

- a) Find the volume of the solid generated by revolving the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ about the x -axis
- b) Solve the following.
- (i) Form the differential equation by eliminating the arbitrary constants if $y^2 = 4ax$
- (ii) Solve $(1 + x^2)dy - (1 + y^2)dx = 0$
- c) A resistance of 100Ω and inductance of 0.1 henries are connected in series with a battery of 20 volts. Find the current in the circuit at any instant, if the relation between L , R and E is
- $$L \frac{di}{dt} + Ri = E$$

6. Solve any TWO of the following: 12

- a) Solve the following
- (i) Find the approximate root of the equation $x^2 + x - 3 = 0$ in the interval $(1, 2)$ by using Bisection method (use two iterations)
- (ii) Solve the following system of equations by using Gauss elimination method
- $$x + y + z = 6, 2x - 3y + 3z = 5, 3x + 2y - z = 4$$
- b) Solve the following system of equations by using Gauss Seidal method (use four iterations) correct upto 3 places of decimals.
- $$x + 7y - 3z = -22, 5x - 2y + 3z = 18, 2x - y + 6z = 22$$
- c) Using Newton-Raphson method find the approximate root of the equation correct upto 3 places of decimals.
- $$x^3 - 2x - 5 = 0 \text{ (Use four iterations)}$$
