

22224

23124

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) 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 $f(x) = x^3 + x$ find $f(1) + f(2)$
- b) State whether the function.
 $f(x) = 4x^4 + 3\cos x + x\sin x + 1$ is odd or even. Give reason.
- c) If $y = e^x \tan x$ find $\frac{dy}{dx}$
- d) Evaluate : $\int \left(\frac{1}{\sqrt{1-x^2}} - \cos x \right) dx$
- e) Evaluate : $\int \sqrt{1 + \cos 2x} dx$
- f) Find the order and degree of differential equation
$$\sqrt{1 + \left(\frac{dy}{dx} \right)^2} = 5 \left(\frac{d^2y}{dx^2} \right)$$
- g) Show that the root of $x^3 - 4x - 9 = 0$ lies in the interval (2, 3).

P.T.O.

2. Solve any THREE of the following:

12

- a) If $13x^2 + 2x^2y + y^3 = 1$ find $\frac{dy}{dx}$ at $(1, -2)$
- b) If $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ find $\frac{dy}{dx}$
- c) A metal wire 100cm long is bent to form a rectangle. Find its dimensions when its area is maximum.
- d) Find the radius of curvature of the curve $y^2 = 4ax$ at a point $(a, 2a)$

3. Solve any THREE of the following:

12

- a) Find the equation of tangent and normal to the curve $y = x(2 - x)$ at a point $(2, 0)$.
- b) Find $\frac{dy}{dx}$, if $y = \tan^{-1} \left(\frac{13x}{1 - 4x^2} \right)$
- c) If $e^x = x^y$ prove that $\frac{dy}{dx} = \frac{\log x - 1}{(\log x)^2}$
- d) Evaluate : $\int \frac{2x+3}{2x-1} dx$

4. Solve any THREE of the following:

12

- a) Evaluate : $\int \frac{1}{2x^2 + 3x + 1} dx$
- b) Evaluate : $\int \frac{dx}{4 + 5\sin 2x}$
- c) Evaluate : $\int x \cdot \sec^{-1} x dx$
- d) Evaluate : $\int_1^5 \frac{\sqrt[3]{9-x}}{\sqrt[3]{9-x} + \sqrt[3]{x+3}} dx$
- e) Evaluate : $\int_0^{\pi/2} \frac{\tan x}{1 + \tan x} dx$

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

- a) Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$.
- b) Solve the following.
- i) Form the differential equation by eliminating the arbitrary constants if $y^2 = 4ax$
- ii) Solve : $x \frac{dy}{dx} + y = x^3$
- c) The acceleration of a particle is given by $\frac{d^2x}{dt^2} = 3t^2 - 6t + 8$.
Find the distance covered in 2 seconds given that $V = 0$,
 $x = 0$ at $t = 0$.

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

- a) Solve the following.
- i) Using Bisection method find the approximate root of the equation $x^3 - x - 1 = 0$ in the interval (1, 2)
(Carry out two iterations)
- ii) Solve the following system of equations by using Jacobi's method (carry out two iterations)
- $$5x + 2y + z = 12, x + 4y + 2z = 15, x + 2y + 5z = 20$$
- b) Solve the following system of equations by using Gauss elimination method
- $$x + 2y + 3z = 14, 3x + 3y + 5z = 24, 4x + 5y + 7z = 35$$
- c) Using Newton-Raphson method find the approximate root of the equation $x^3 - 4x + 1 = 0$ (carry out four iterations)
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