

22210

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 $f(x) = 2^x - \log_2 x$ then find $f(2)$.
- b) Test whether the function is even or odd, if $f(x) = 3x^4 - 2x^2 + \cos x$.
- c) Find $\frac{dy}{dx}$ if $y = e^x \cdot \cot x$.
- d) Evaluate $\int \frac{1}{3x-2} dx$.
- e) Evaluate $\int \frac{2+3\sin x}{\cos^2 x} dx$.
- f) Find the area bounded by the curve $y = 3x^2$, x -axis and the ordinates $x = 1$ and $x = 3$.
- g) Express into polar form $z = \frac{1}{2} + \frac{\sqrt{3}}{2}i$.

P.T.O.

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

- a) If $x^2 + y^2 + xy - y = 0$ find $\frac{dy}{dx}$ at $(1, 2)$.
- b) Find $\frac{dy}{dx}$ if $y = \tan^{-1} \left[\frac{2x}{1 + 35x^2} \right]$.
- c) Find the radius of curvature of the curve $y^2 = 4x$ at point $(2, \sqrt{2})$.
- d) An electric cable cost ₹ C per kilometer and $C = \frac{100}{x} + 625x$ where x is the area of cross-section. Find the value of x for which cost is minimum. What is minimum cost?

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

- a) Find the equation of tangent to the circle.
 $x^2 + y^2 - 8x + 4y + 12 = 0$ at point $(2, 0)$.
- b) If $x = a \sin \theta$ and $y = a(1 + \cos \theta)$, find $\frac{dy}{dx}$.
- c) If $e^x = x^y$, prove that $\frac{dy}{dx} = \frac{\log x - 1}{(\log x)^2}$.
- d) Evaluate $\int \frac{1}{x [16 + (\log_e x)^2]} dx$.

4. Solve any THREE of the following:

12

- a) Evaluate $\int \frac{1}{2x^2 + 3x + 1} dx$.
- b) Evaluate $\int \frac{1}{4 + 5\sin 2x} dx$.
- c) Evaluate $\int x \cdot \log (1 + x) dx$.
- d) Evaluate $\int \frac{e^x}{(e^x - 1)(e^x + 1)} dx$.
- e) Evaluate $\int_1^3 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5} + \sqrt[3]{9-x}} dx$.

5. Solve any TWO of the following:

12

- a) Find the area bounded by two parabolas
 $y^2 = 2x$ and $x^2 = 2y$.
- b) i) Find order and degree of differential equation.

$$\frac{d^2y}{dx^2} = \left[y + \frac{dy}{dx} \right]^{3/2}$$

ii) Solve $\frac{dy}{dx} = e^x \cdot e^{-y} + x e^{-y}$

- 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

$$L, R, E \text{ is } L \frac{di}{dt} + Ri = E.$$

6. Solve any TWO of the following:

12

a) i) Express $\frac{(3-i)^2}{2-i}$ in 'x + iy' form.

ii) Find $L \{e^{-t} \cos 2t\}$

b) Find $L^{-1} \left\{ \frac{4s + 5}{(s + 2)(s - 1)^2} \right\}$

c) Solve given differential equation by using Laplace transform.

$$\frac{dy}{dt} + 3y = 2 + e^{-t}, \text{ where } y(0) = 1$$
