

22210

12223

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. Attempt any FIVE of the following: 10

- a) If $f(x) = 3x^2 - 5x + 7$ show that $f(-1) = 3f(1)$.
- b) State whether the function $f(x) = \frac{x^3 - 3x}{x^2 + 4}$ is even or odd.
- c) Find $\frac{dy}{dx}$ if $y = \frac{x+1}{x-1}$
- d) Evaluate $\int \frac{1}{\sin^2 x \cdot \cos^2 x} dx$
- e) Evaluate $\int \frac{(1 + \sqrt{x})^2}{\sqrt{x}} dx$
- f) Find the area under the curve $y = x^2$ from $x = 0$ to $x = 3$ with X-axis.
- g) Express $Z = \frac{1}{2} + \frac{\sqrt{3}}{2} i$ in polar form.

P.T.O.

2. Attempt any THREE of the following: 12

- a) Find $\frac{dy}{dx}$ if $x^2 + y^2 = xy$.
- b) If $x = 3\sin 4\theta$, $y = 4\cos 3\theta$ find $\frac{dy}{dx}$.
- c) 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 $x = \frac{\pi}{2}$.
- d) In a potentiometer circuit R is given by $R = \frac{1}{x} - \frac{1}{x-a}$ where "a" is constant. Find the value of x which makes R minimum. Also calculate the minimum value of R.

3. Attempt any THREE of the following: 12

- a) Find the equation of tangent and normal to the curve $4x^2 + 9y^2 = 40$ at (1, 2).
- b) If $y = \log(\sec x + \tan x)$ find $\frac{dy}{dx}$.
- c) Find $\frac{dy}{dx}$ if $y = x^x + (\cos x)^x$
- d) Evaluate $\int \frac{\cos x}{1 + \sin^2 x} dx$

4. Attempt any THREE of the following: 12

- a) Evaluate $\int \frac{1}{\sqrt{3-x-x^2}} dx$
- b) Evaluate $\int \frac{dx}{2+3\cos x}$
- c) Evaluate $\int x \cdot \tan^{-1} x dx$
- d) Evaluate $\int \frac{x}{x^2+3x-4} dx$
- e) Evaluate $\int_0^{\frac{\pi}{2}} \frac{1}{1+\cot x} dx$

5. Attempt any TWO of the following:**12**a) Find the area between the parabola $y^2 = 2x$ and $x^2 = 2y$.

b) i) Find the order and degree of differential equation

$$\frac{d^2y}{dx^2} = \left(y + \frac{dy}{dx}\right)^{\frac{3}{2}}$$

ii) Solve $(x + 1) \frac{dy}{dx} - y = e^x(x + 1)^2$

c) In a closed circuit, the current "I" at time t is given by

 $E - RI - L \frac{dI}{dt} = 0$. Find the current I at time t, given that at $t = 0$, $I = 0$ and L, R, E are constants.**6. Attempt any TWO of the following:****12**a) i) Express $\frac{(2+i)^2}{2+3i}$ in the form $x + iy$.ii) Find $L[t^2 \cdot e^{3t}]$ b) Find $L^{-1}\left[\frac{3S+7}{S^2-2S-3}\right]$ c) Solve the differential equation, $L \frac{di}{dt} + Ri = V$ using laplace transform.
