

22224

23242

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  $f(x) = x^3 - 5x^2 - 4x + 20$ , show that  $f(0) = -2 f(3)$
- b) State whether the function  $f(x) = \frac{e^x + e^{-x}}{2}$  is odd or even.
- c) If  $y = e^{2 \log_e x}$ , find  $\frac{dy}{dx}$
- d) Evaluate:  $\int \log x \, dx$
- e) Evaluate:  $\int \frac{dx}{3x+4}$
- f) Find the area under the curve  $y = x^2$  from  $x = 0$  to  $x = 3$  with  $x$ -axis
- 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  $f(x) = \frac{3x+4}{5x-7}$  and  $t = \frac{7x+4}{5x-3}$  find  $f(t)$
- b) If  $x^2 + y^2 + xy - y = 0$  find  $\frac{dy}{dx}$  at  $(1, 2)$
- c) If  $x = a(2\theta - \sin 2\theta)$ ,  $y = a(1 - \cos 2\theta)$  find  $\frac{dy}{dx}$  at  $\theta = \frac{\pi}{4}$
- d) Divide 80 into two parts such that their product is maximum.

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

12

- a) Find the equation of the tangent and normal to the curve  $4x^2 + 9y^2 = 40$  at  $(1, 2)$
- b) 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  $x = \frac{\pi}{2}$
- c) If  $x^y = e^{x-y}$  then show that  $\frac{dy}{dx} = \frac{\log x}{(1 + \log x)^2}$
- d) Evaluate:  $\int \frac{(x-2)^2}{x} dx$

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

12

- a) Evaluate:  $\int \frac{dx}{2x^2 + 3x + 1}$
- b) Evaluate:  $\int \frac{dx}{3 + 2\sin x}$
- c) Evaluate:  $\int x \cdot \sin^{-1} x \, dx$
- d) Evaluate:  $\int \frac{\log x}{x(2 + \log x)(3 + \log x)} dx$
- e) Evaluate:  $\int_{\pi/6}^{\pi/3} \frac{\sin x}{\sin x + \cos x} dx$

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

- a) Find the area under the parabola  $y^2 = 4x$  bounded by the lines  $x = 0$ ,  $y = 0$  and  $x = 4$
- b) Attempt the following:
- i) Form a differential equation if  $y = A \cdot \sin x + B \cdot \cos x$
- ii) Solve  $(1 + x^2) dy - (1 + y^2) dx = 0$
- c) The velocity of a particle is given by  $v = t^2 - 6t + 7$ . Find the distance covered in 3 sec.

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

- a) Attempt the following:
- i) Solve the following system of equation by Jacobi's Iteration method (Two Iterations)
- $$10x + y + z = 12, \quad x + 10y + z = 12, \quad x + y + 10z = 12$$
- ii) Solve the following system of equation by Gauss Seidal method (Two Iterations)
- $$20x + y - 2z = 17, \quad 3x + 20y - z = -18, \quad 2x - 3y + 20z = 25$$
- b) Solve the following system of equation by Gauss Elimination method.
- $$x + 2y + 3z = 14, \quad 3x + y + 2z = 11, \quad 2x + 3y + z = 11$$
- c) By using Newton Raphson method, find a root of the equation  $x^4 - x - 9 = 0$  performing upto three iteration.
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