

22201

11819

3 Hours / 70 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
  - (2) Illustrate your answers with neat sketches wherever necessary.
  - (3) Figures to the right indicate full marks.
  - (4) Assume suitable data, if necessary.
  - (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. Attempt any FIVE of the following :

10

- (a) Define odd and even function with suitable example.
- (b) If  $f(x) = \frac{x^2 + 9}{\sqrt{x - 3}}$ , find  $f(4) + f(5)$ .
- (c) Find  $\frac{dy}{dx}$  if  $y = (3a)^x + x^{(\log 3)} + x^a + a^a$
- (d) Evaluate  $\int x^2 \cdot \log x \, dx$
- (e) Evaluate  $\int \frac{dx}{x^2 + 4x + 5}$

- (f) Find the area bounded by the curve  $y = \sin x$ ,  $x$  axis and the ordinate  $x = 0$ ,  
 $x = \frac{\pi}{2}$ .
- (g) State the trapezoidal rule of numerical integration.

2. Attempt any THREE of the following :

12

- (a) Find  $\frac{dy}{dx}$  if  $x^2 + y^2 + xy - y = 0$  at  $(1, 2)$
- (b) If  $x = a(\cos t + t \sin t)$  and  $y = a(\sin t - t \cos t)$ , find  $\frac{dy}{dx}$  at  $t = \frac{\pi}{4}$
- (c) The rate of working of an engine is given by the expression  $10V + \frac{4000}{V}$ , where 'V' is the speed of the engine. Find the speed at which the rate of working is the least.
- (d) A telegraph wire hangs in the form of a curve  $y = a \cdot \log \left[ \sec \left( \frac{x}{a} \right) \right]$ . Where 'a' is constant. Show that the curvature at any point is  $\frac{1}{a} \cos \left( \frac{x}{a} \right)$ .

3. Attempt any THREE of the following :

12

- (a) Find equation of tangent to curve  $x = \frac{1}{t}$ ,  $y = 1 - \frac{1}{t}$  when  $t = 2$ .
- (b) Find  $\frac{dy}{dx}$  if  $y = x^x + x\sqrt{x}$
- (c) Find  $\frac{dy}{dx}$  if  $y = \tan^{-1} \left[ \frac{x}{\sqrt{1-x^2}} \right]$
- (d) Evaluate  $\int \frac{\sec^2 x}{(1 + \tan x)(3 + \tan x)} dx$ .

4. Attempt any THREE of the following :

12

(a) Evaluate  $\int \frac{1}{x[9 + (\log_e x)^2]} dx$

(b) Evaluate  $\int \frac{1}{2 \sin x + 3 \cos x} dx$

(c) Evaluate  $\int \sec^3 x dx$

(d) Evaluate  $\int \frac{2x^2 + 5}{(x-1)(x+2)(x+3)} dx$

(e) Evaluate  $\int_0^{\pi/2} \frac{1}{1 + \sqrt{\cot x}} dx$

5. Attempt any TWO of the following :

12

(a) Find area of the region by the parabolas.

$$y^2 = 9x \text{ and } x^2 = 9y$$

(b) Attempt the following :

(i) Form a differential equation by eliminating arbitrary constant. If

$$y = A \sin x + B \cos x.$$

(ii) Solve  $(1 + x^3)dy - x^2y dx = 0$

(c) An electrical circuit containing an inductance L henries resistance R in series

with an electromotive force.  $E \sin \omega t$  satisfies the equation  $L \frac{di}{dt} + Ri = E \sin \omega t$ .

Find the value of the current at any time t, if initially there is no current.

P.T.O.

6. Attempt any TWO of the following :

12

- (a) (i) Using trapezoidal rule, calculate the approximate value of  $\int_0^4 \sqrt{x} \, dx$ ,

given by

$x$	0	1	2	3	4
$y = \sqrt{x}$	0	1	1.4142	1.7321	2

- (ii) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  using trapezoidal rule by using following data :

$x$	0	1	2	3	4	5	6
$y = \frac{1}{1+x^2}$	1	0.5	0.2	0.1	0.588	0.0385	0.027

- (b) Evaluate  $\int_0^1 \frac{dx}{1+x^2}$  by Simpson's  $\frac{1}{3}$  rule by taking 6 sub intervals.
- (c) Using Simpson's  $\frac{3}{8}$  rule to find  $\int_0^{0.6} e^{-x^2} \, dx$  by taking seven ordinates.

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