22224

21718

3 Hours / 70 Marks Seat No. | | | | | | | | |

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) 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) State whether the function $f(x) = \frac{e^x + e^{-x}}{2}$ is odd or even.

b) If $f(x) = \frac{x^2 + 1}{x^3 - 1}$ find $f\left(\frac{1}{2}\right)$.

c) Find $\frac{dy}{dx}$, if $y = (x^2 + 1)^5$

d) Evaluate $\int (\tan x + \cot x)^2 dx$

e) Evaluate $\int \log x \ dx$

f) Find the area between the lines $y = 3x$, x–axis and the ordinates $x = 1$ and $x = 5$.

P.T.O.

Marks

g) Show that there exists a root of the equation $x^2 - 2x - 1 = 0$ in (–1, 0) and find approximate value of the root by using Bisection method. (Use two iterations)

2. Attempt any <u>THREE</u> of the following: **12**

a) Find $\frac{dy}{dx}$ if $\cos(x^2 + y^2) = \log(xy)$

b) If $x = a\ \cos^3\theta$ and $y = a\ \sin^3\theta$ find $\frac{dy}{dx}$ at $\theta = \pi/4$

c) Find maximum and minimum values of $2x^3 - 3x^2 - 36x + 10$.

d) 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 $x = \pi/2$.

3. Attempt any <u>THREE</u> of the following: **12**

a) Find the points on the curve $y = x^3 + 3x^2 - 9x + 7$ at which tangents drawn are parallel to x–axis.

b) Differentiate $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ w.r.t. $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$

c) Find $\frac{dy}{dx}$ if $y = (\log x)^x + x^{\cos^{-1}x}$

d) Evaluate : $\int \frac{\sec x\ \text{cosec}\ x}{\log \tan x}\ dx$

4. Attempt any <u>THREE</u> of the following: **12**

a) Evaluate : $\int \frac{1}{2x^2 + 3x + 1}\ dx$.

b) Evaluate : $\int \frac{1}{a^2\sin^2 x + b^2\cos^2 x}\ dx$

c) Evaluate : $\int x\ \text{cosec}^{-1}x\ dx$

Marks

d) Evaluate : $\int \frac{1}{x(2-\log x)(2\log x-1)}\,dx$

e) Evaluate : $\int_1^4 \frac{\sqrt[3]{9-x}}{\sqrt[3]{9-x}+\sqrt[3]{x+4}}\,dx$

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

a) Find the volume of the solid generated by revolving the ellipse $\frac{x^2}{9}+\frac{y^2}{4}$ about x–axis.

b) **Attempt the following:**

(i) Form the differential equation by eliminating the arbitrary constants if $y = a\ \cos(\log x) + b\ \sin(\log x)$

(ii) Solve the differential equation:

$$\frac{dy}{dx} + y\tan x = \cos^2 x$$

c) In a single closed electrical 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 $t = 0$, I = 0 and L, R, E are constants.

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

a) **Attempt the following.**

(i) Solve the following system of equations by Jacobi's – Iteration method. (Two iterations)

$5x + 2y + z = 12,\ x + 4y + 2z = 15,\ x + 2y + 5z = 20$

(ii) Solve the following system of equations by using Gauss-Seidal method. (Two iterations)

$15x + 2y + z = 18,\ 2x + 20y - 3z = 19,\ 3x - 6y + 25z = 22$

b) Solve the following system of equations by using Gauss-elimination method $6x - y - z = 19,\ 3x + 4y + z = 26,\ x + 2y + 6z = 22$

c) Find the approximate root of the equation $x^4 - x - 10 = 0$, by Newton–Raphson method. (Carry out four iterations).