

312301

25226

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 answer 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) Evaluate: $\int [e^x + a^x + x^a + a^a] dx$.
- b) Evaluate: $\int \log x \, dx$.
- c) Evaluate: $\int_1^2 \frac{1}{3x+2} \, dx$.
- d) Find order and degree of the differential equation:
$$\frac{d^2y}{dx^2} = \left(y + \frac{dy}{dx} \right)^{\frac{3}{2}}$$
- e) Find a real root of the equation $x^3 + 4x - 9 = 0$ in the interval (1, 2) by using Bisection method. (Only one iteration)
- f) Show that root of the equation $x^2 - 20 = 0$ exists in (4, 5).

P.T.O.

- g) An unbiased coin is tossed 7 times. Find the probability of getting 3 heads.

2. Attempt any THREE of the following: 12

- a) Evaluate: $\int \frac{1}{x[9 + (\log_e x)^2]} dx$
- b) Evaluate: $\int \frac{2x^2 + 5}{(x-1)(x+2)(x+3)} dx$
- c) Evaluate: $\int x \cdot \tan^{-1} x \, dx$
- d) Evaluate: $\int \frac{dx}{4\cos^2 x + 9\sin^2 x}$

3. Attempt any THREE of the following: 12

- a) Evaluate: $\int \frac{dx}{4 + 5 \cos x}$
- b) Evaluate: $\int_1^5 \frac{\sqrt{9-x}}{\sqrt{9-x} + \sqrt{x+3}} dx$.
- c) Solve the differential equation:
 $e^{x+y} dx + e^{2y-x} dy = 0$.
- d) Solve the following system of equations by Jacobi's Iterative method (3 iterations)
 $5x + 2y + z = 12, \quad x + 4y + 2z = 15, \quad x + 2y + 5z = 20$.

4. Attempt any THREE of the following: 12

- a) Using Newton - Raphson method find the approximate root of the equation.
 $x^3 - 2x - 5 = 0$ (Use 3 iterations).
- b) Solve the following system of equations by using Gauss-Seidel method. (Use 3 iterations)
 $15x + 2y + z = 18, \quad 2x + 20y - 3z = 19,$
 $3x - 6y + 25z = 22$.
- c) Using Regula-Falsi method find the approximate root of the equation:
 $x^2 + x - 5 = 0$ (Use 3 iterations)

- d) If 2% of the electric bulbs manufactured by company are defective, find the probability that in a sample of 100 bulbs, at the most two bulbs will be defective.

[Given: $e^{-2} = 0.1353$]

- e) The probability that a bomb dropped from a plane will strike the target is $\frac{1}{5}$ if six bombs are dropped, find the probability that exactly two will strike the target.

5. Attempt any TWO of the following:

12

a) i) Evaluate: $\int \frac{\log x}{x[2 + \log x][3 + \log x]} dx.$

ii) Evaluate: $\int x \sin 2x \, dx$

b) i) Evaluate: $\int_0^{\pi/2} \frac{\tan x}{1 + \tan x} \, dx$

ii) Evaluate: $\int_0^{\pi/2} \log (\cot x) \, dx$

c) i) Evaluate: $\int_{\pi/6}^{\pi/3} \frac{dx}{1 + \sqrt[n]{x+3}} \, dx$

ii) Evaluate: $\int_0^{\pi/2} \sin^2 x \cdot \cos x \, dx$

6. Attempt any TWO of the following:

12

- a) i) Form a differential equation by eliminating arbitrary constants if: $y = A \sin x + B \cos x$

ii) Solve the differential equation:
 $x(1 + y^2) \, dx + y(1 + x^2) \, dy = 0.$

- b) i) Solve the differential equation:

$$x \frac{dy}{dx} - y = x^2.$$

- ii) Solve the differential equation:

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

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[4]

Marks

- c) Weight of 4000 students are found to be normally distributed with mean 50 kgs and standard deviations 5 kgs. Find the number of students with weights:
- i) less than 45 kgs.
 - ii) between 45 and 60 kgs.

[Given: $A(1) = 0.3413$
 $A(2) = 0.4772$ under normal curve]
