

13141

3 Hours / 100 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.

Marks

1. Attempt any TEN of the following :

20

(a) Evaluate $\int \left(\frac{3}{x} + a^x \right) dx$.

(b) Evaluate $\int \frac{x-1}{x+1} dx$.

(c) Evaluate $\int \sin^2 x dx$.

(d) Evaluate $\int_1^3 \sqrt[3]{x} dx$.

(e) Evaluate $\int_2^3 \frac{dx}{x+1}$.

(f) State order and degree of the diff. equation.

$$\left[1 + \left(\frac{dy}{dx} \right)^3 \right]^{\pi/3} = 2 \frac{d^2y}{dx^2}$$

(g) Solve $(x+1) dy + (y+1) dx = 0$.

(h) When a die is thrown, find the probability of getting even numbers.

P.T.O.

- (i) From 20 tickets marked 1 to 20 one ticket is drawn at random. Find the probability that it is marked with multiple of 3 or 5.
- (j) Two cards are drawn from a well shuffled pack of 52 cards. What is the probability that both are kings ?
- (k) Find the area of the region bounded by the parabola $y = 4x - x^2$ and the x -axis.
- (l) Two coins are tossed. Find the probability of getting at least one head.

2. Attempt any FOUR of the following :

16

- (a) Evaluate $\int \frac{dx}{x^2 + 4x + 5}$.
- (b) Evaluate $\int_0^{\pi/2} \frac{\cos x \, dx}{1 + \sin^2 x}$.
- (c) Evaluate $\int x \tan^{-1} x \, dx$.
- (d) Evaluate $\int_0^{\pi/2} \frac{1}{1 + \tan x} \, dx$.
- (e) Find the area of the circle $x^2 + y^2 = 4$ by using definite integration.
- (f) The velocity of a particle is given by $v = t^2 - 6t + 7$, find displacement covered in 3 seconds.

3. Attempt any FOUR of the following :

16

- (a) Evaluate $\int_1^2 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{3-x}} \, dx$.
- (b) Evaluate $\int \frac{x}{(x+1)(x-2)} \, dx$.
- (c) Find the volume of the solid generated by revolving the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ about the x -axis.
- (d) Find c.g. of the area in the first quadrant bounded by the parabola $y^2 = 4ax$ and the ordinate $x = h$.
- (e) Find the area enclosed by $y^2 = 8x$ and the line $x = 2$.
- (f) Solve $y - x \frac{dy}{dx} = a(y^2 + \frac{dy}{dx})$.

4. Attempt any FOUR of the following :

16

(a) Solve $(x + y)^2 \frac{dy}{dx} = a^2$.

(b) Solve $x^2 y dx - (x^3 + y^3) dy = 0$.

(c) Solve $(2x^2 + 6xy - y^2) dx + (3x^2 - 2xy + y^2) dy = 0$.

(d) Solve using Jacobi's Method (three iterations)

$$x + y - z = 1, x + 3y - z = 7, x + y + 2z = 13$$

(e) Solve the equation by using Gauss-elimination method.

$$x + y + z = 6, 2x + y + 3z = 13 \text{ and } 3x + 3y + 4z = 20$$

(f) Solve by using Gauss-Seidal method.

$$10x + 2y + z = 9, x + 10y - z = -22 \text{ and } -2x + 3y + 10z = 22$$

(Three iterations)

5. Attempt any FOUR of the following :

16

(a) Solve $\frac{dy}{dx} + \frac{y}{x} = y^3$.

(b) A particle starting with velocity 6 m/s has an acceleration $(1 - t^2)$ m/s².
When does it first come to rest ? How far has it then travelled ?(c) A particle executes S.H.M. according to the law $\frac{d^2x}{dt^2} = -4x$ if $x = 2$ and $\frac{dx}{dt} = 3$ at $t = 0$, find displacement "x" at any time "t".(d) Find a root of $x^3 - 4x - 9 = 0$ using bisection method up to three iterations.(e) Using Newton's iterative method, find the real root of $x \log_{10}^x = 12$,
Correct to three decimal places.

(f) Solve $x \frac{dy}{dx} + y = x^3$.

6. Attempt any FOUR of the following :**16**

- (a) Find the root of the equation $x^3 + 2x^2 - 8 = 0$ using Regula Falsi Method (Three iterations only).
- (b) An urn contains 10 red, 5 white and 5 black balls. Two balls are drawn at random. Find the probability that they are not of the same colour.
- (c) A card is drawn at random from a pack of 52 cards. Find the probability that the card is an ace or a king.
- (d) An unbiased coin is tossed 5 times. Find the probability of getting
- (i) three heads
 - (ii) at least 4 heads
- (e) If a random variable has a poisson distribution such that $P(3) \simeq P(4)$, find $P(0)$ and $P(1)$.
- (f) In a sample of 1000 cases the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal find :
- (i) How many students score between 12 & 15 ?
 - (ii) How many students score above 18 ?
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