Note: This question paper consists of three sections A, B and C.

SECTION A

1. Find the value of 'a' if \(2x^2 + ay^2 - 3x + 2y - 1 = 0\) represents a circle. Also find radius of circle.

2. Find the power of point \(P(5, -6)\) with respect to the circle \(S = x^2 + y^2 + 8x + 12y + 15 = 0\).

3. Find \(k\), if the circles \(x^2 + y^2 - 6x - 8y + 12 = 0\), \(x^2 + y^2 - 4x + 6y + k = 0\) are orthogonal.

4. Find coordinates of points on the parabola \(y^2 = 8x\) whose focal distance is 10.

5. Define Rectangular hyperbola and find its eccentricity.
6. Evaluate: \[ \int \frac{1}{\cosh x + \sinh x} \, dx \] on \( x \in \mathbb{R} \).

7. Evaluate: \[ \int x \log x \, dx \] on \((0, \infty)\).

8. Evaluate: \[ \int \frac{dx}{\sqrt{2x - 1}} \]

9. Find \[ \int_0^{\pi/2} \sin^4 x \cos^5 x \, dx \]

10. Find the general solution of \[ \frac{dy}{dx} = \frac{2y}{x} \]

SECTION - B
5 \times 4 = 20

II. Short answer type questions:
(i) Attempt any five questions.
(ii) Each question carries four marks.

11. Find the length of chord intercepted by the circle \( x^2 + y^2 - 8x - 2y - 8 = 0 \) on the line \( x + y + 1 = 0 \).

12. Find radical centre of the circles \( x^2 + y^2 + 4x - 7 = 0 \), \( 2x^2 + 2y^2 + 3x + 5y - 9 = 0 \), \( x^2 + y^2 + y = 0 \).

13. Find eccentricity, coordinates of foci, length of latus rectum and equations of directrices for the ellipse \( 9x^2 + 16y^2 = 144 \).
14. A man running on a race course notices that sum of distances of two flag posts from him is always 10 m. and distance between flag posts is 8 m. Find the equation of race course traced by the man.

15. Find equations of tangents to the hyperbola \( x^2 - 4y^2 = 4 \) which are (i) parallel to (ii) perpendicular to the line \( x + 2y = 0 \).

16. Evaluate: \( \int_0^{\pi/2} \frac{a \sin x + b \cos x}{\sin x + \cos x} \, dx \).

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

SECTION – C

III. Long answer type questions:

(i) Attempt any five questions.

(ii) Each question carries seven marks.

18. Show that the four points (1, 1), (-6, 0), (-2, 2), (-2, -8) are concyclic and find the equation of the circle on which they lie.

19. (a) Find pole of \( 3x + 4y - 45 = 0 \) with respect to \( x^2 + y^2 - 6x - 8y + 5 = 0 \).

   (b) Find the locus of \( P \), if the tangents drawn from \( P \) to \( x^2 + y^2 = a^2 \) are perpendicular to each other.

20. Prove that the area of the triangle inscribed in the parabola \( y^2 = 4ax \) is \( \frac{1}{8a} \left| (y_1 - y_2) (y_2 - y_3) (y_3 - y_1) \right| \) sq. units where \( y_1, y_2, y_3 \) are ordinates of its vertices.
21. Evaluate: \[ \int \frac{9 \cos x - \sin x}{4 \sin x + 5 \cos x} \, dx. \]

22. Obtain the reduction formula for \( I_n = \int \cot^n x \, dx \), \( n \) being a positive integer, \( n \geq 2 \) and deduce the value of \( \int \cot^4 x \, dx \).

23. Evaluate: \[ \int \frac{\log(1 + x)}{1 + x^2} \, dx. \]

24. Solve the Differential Equation
\[ \cos x \cdot \frac{dy}{dx} + y \sin x = \sec^2 x. \]