

SECTION - A**10 × 2 = 20****VERY SHORT ANSWER TYPE QUESTIONS**Attempt **ALL** questions. Each question carries **2** marks.

1. If $x^2 + y^2 + 2gx + 2fy - 12 = 0$ is a circle with centre $(2, 3)$, find g, f and radius of the circle.
2. Find the equation of the sphere whose centre is $(2, -3, 4)$ and radius is 5.
3. Find the coordinates of the point on the parabola $y^2 = 2x$ whose focal distance is $5/2$.
4. If e_1, e_2 are the eccentricities of two conjugate hyperbolas then show that $e_1^2 + e_2^2 = e_1^2 e_2^2$.
5. Find the n th derivative of $y = x^2 \cos 2x$.
6. Evaluate $\int \cos^3 x \sin x \, dx$.
7. Evaluate $\int \log x \, dx$.
8. Evaluate $\int_0^{16} \frac{x^{1/4}}{1 + x^{1/2}} \, dx$.
9. Find the area cut off between $y = 0, y = x^2 - 4x + 3$.
10. Find the order of the differential equation of the family of all circles with their centres at the origin.

SECTION - B**5 × 4 = 20****SHORT ANSWER TYPE QUESTIONS**Attempt **any 5** questions. Each question carries **4** marks.

11. Find the equation of the circle passing through the points $(4, 1), (6, 5)$ and having the centre on the line $4x + y - 16 = 0$.
12. Find the equation of the ellipse whose focus is $(1, -1)$, eccentricity is $2/3$ and directrix is $x + y + 2 = 0$.
13. Show that the length of the latus rectum of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is $\frac{2b^2}{a}$.

14. If PSQ is a focal chord of a conic whose focus is S and the length of the semilatus rectum is l then show that $\frac{1}{SP} + \frac{1}{SQ} = \frac{2}{l}$.
15. Evaluate $\int \frac{x^2}{\sqrt{x+5}} dx$.
16. Solve $(e^x + 1)y dy + (y + 1) dx = 0$.
17. Solve $(x + 2y^3) \frac{dy}{dx} = y$.

SECTION - C

5 × 7 = 35

LONG ANSWER TYPE QUESTIONS

Attempt any 5 questions. Each question carries 7 marks.

18. Find the equation of the circle which has a radius $\sqrt{13}$ and tangent as the line $2x - 3y + 1 = 0$ at $(1, 1)$.
19. Find the equation of the circle which cuts orthogonally the three circles $x^2 + y^2 + 2x + 17y + 4 = 0$, $x^2 + y^2 + 7x + 6y + 11 = 0$, $x^2 + y^2 - x + 22y + 3 = 0$.
20. Show that the locus of the poles of tangents of the parabola $y^2 = 4ax$ with respect to the parabola $y^2 = 4bx$ is $ay^2 = 4b^2x$.
21. If $x = \cos t$, $y = \sin pt$ then prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 - p^2)y_n = 0$.
22. Evaluate $\int \frac{9 \cos x - \sin x}{4 \sin x + 5 \cos x} dx$.
23. Evaluate $\int_0^{\pi/2} \frac{\sin^2 x dx}{\sin x + \cos x}$.
24. Using Trapezoidal rule to approximate the integral, $\int_0^1 \sqrt{1+x^3} dx$ with $n = 10$.