

2022-26*Full Marks : 75**Time : 3 Hours*

Candidates are required to give their answer in their own words as far as practicable. Their figures in the margin indicate full marks.

Answer from **both** the Groups as directed.

Group - A**(Compulsory)**

1. Answer the following questions : 1×5=5
 - (a) Define curvature.
 - (b) Define definite integral.
 - (c) Define sphere.
 - (d) State Rolle's Theorem.
 - (e) Define Beta function.
2. Expand $\cos x$ by Maclaurin's Theorem. 5
3. Find the equation of a sphere whose centre is at (α, β, γ) and radius is a . 5

Group - B

Answer any **four** questions : 15×4=60

4. (a) State and prove Leibnitz's Theorem. 8
(b) If $y = \sin (m \sin^{-1}x)$, prove that : 7
(i) $(1 - x^2)y_2 - xy_1 + m^2y = 0$
(ii) $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$
5. (a) State and prove the Taylor's Theorem on the expansion of $f(x + h)$. 8
(b) State and prove Maclaurin's Theorem to expand $f(x)$. 7
6. (a) Find the radius of curvature for the Cartesian curve $y = f(x)$. 8
(b) Find the entire length of the Cardioid $r = a(1 + \cos \theta)$. 7
7. (a) Evaluate : $\int_0^{\pi/2} \cos^n x \cos nx dx$ 8
(b) Show that : 7

$$\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx = \frac{\pi}{4}$$

8. (a) Find the area of the loop of the curve $y^2 = x(x-1)^2$ 8
 (b) Find the perimeter of the circle $x^2 + y^2 = a^2$. 7
9. (a) Find the equation of a plane cutting off intercepts a, b, c from the axes. 8
 (b) Find the length and the equation of the shortest distance between two skew lines. 7

$$\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n} \text{ and } \frac{x-\alpha'}{l'} = \frac{y-\beta'}{m'} = \frac{z-\gamma'}{n'}$$

