

Exam.	Regular		
Level	BE	Full Marks	80
Programme	ALL (Except B. Arch)	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Mathematics I (SH401)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. State Leibnitz's theorem. If $y = (x^2 - 1)^n$, then prove that

$$(x^2 - 1)y_{n+2} + 2xy_{n+1} - n(n-1)y_n = 0$$

2. Assuming the validity of expansion, expand $\log(1 + \sin x)$ by Maclaurin's theorem.

3. Evaluate $\lim_{x \rightarrow 0} \frac{(1+x)^{1/x} - e}{x}$

4. Find the asymptotes of the curve: $x(x-y)^2 - 3(x^2 - y^2) + 8y = 0$

5. Find the radius of curvature at any point (r, θ) for the curve $a^2 = r^2 \cos 2\theta$ ✓✓

6. Show that: $\int_0^\pi \frac{x \sin x}{1 + \cos^2 x} dx = \frac{\pi^2}{4}$

7. Apply differentiation under integral sign to evaluate $\int_0^{\pi/2} \log \frac{a + b \sin x}{a - b \sin x} \frac{dx}{\sin x}$

8. Define Gamma function. Apply Beta and Gamma function to evaluate:

$$\int_0^{\pi/6} \cos^2 6\theta \cdot \sin^4 3\theta = \frac{7\pi}{192}$$

9. Find the area inclosed by $y^2(a-x) = x^3$ and its asymptotes.

10. If the axes be turned through an angle of $\tan^{-1} 2$, what does the equation $4xy - 3x^2 - a^2 = 0$ become?

11. Find the center, length of axes, eccentricity and directrices of the conic.

$$2x^2 + 3y^2 - 4x - 12y + 13 = 0$$

OR

Describe and sketch the graph of the conic $r = \frac{10}{3 + 2 \cos \theta}$.

12. Deduce standard equation of hyperbola.

13. Solve the differential equation: $x \log x \frac{dy}{dx} + y = 2 \log x$

14. Solve: $(x-a)p^2 + (x-y)p - y = 0$: where $p = \frac{dy}{dx}$

15. Solve: $(D^2 - D - 2)y = e^x + \sin 2x$

16. Find a current $i(t)$ in the RLC circuit assuming zero initial current and charge q , if $R = 80$ ohms, $L = 20$ Henry, $C = 0.01$ Faradays and $E = 100$ volts.