

Exam.	New Back (2066 & Later Batch)		
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.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. If  $y = \log(x + \sqrt{a^2 + x^2})$ , then show that  $(a^2 + x^2)y_{n+2} + (2n+1)xy_{n+1} + n^2y_n = 0$  [5]
2. State and prove Logrange's Mean Value theorem. [5]
3. Evaluate:  $\lim_{x \rightarrow \pi} (\sin x)^{\tan x}$  [5]
4. Find the asympn of the curve  $a^2y^2 + x^2y^2 - a^2x^2 + 2ax^3 - x^4 = 0$  [5]
5. Find the radius of curvature at the origin for the curve  $x^3 + y^3 = 3axy$
6. Evaluate  $\int_0^a \frac{\sqrt{x}}{\sqrt{x} + \sqrt{a-x}} dx$  [5]
7. Apply differentiation under integral sign to evaluate  $\int_0^\infty \frac{e^{-ax} - e^{-bx}}{x} dx$  [5]
8. Using Gamma function show that  $\int_0^{\frac{\pi}{4}} \sin^4 x \cos^2 x dx = \frac{3\pi - 4}{192}$  [5]
9. Find the area bounded by the curve  $x^2 = 4y$  and the line  $x = 4y - 2$

**OR**

Find the volume of the solid generated by the revolution of the cardioid  $r = a(1 - \cos\theta)$  about the initial line.

10. Solve:  $\sin x \frac{dy}{dx} + y \cos x = x \sin x$  [5]
11. Solve:  $xp^2 - 2yp + ax = 0$  where  $p = \frac{dy}{dx}$  [5]
12. Solve:  $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x^2e^{3x}$  [5]
13. Solve:  $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$  [5]
14. Transform the equation  $x^2 - 2xy + y^2 + x - 3y = 0$  to axes through the point  $(-1, 0)$  parallel to the lines bisecting the angles between the original axes. [5]
15. Find the center, length of axes and the eccentricity of the ellipse  $2x^2 + 3y^2 - 4x - 12y + 13 = 0$  [5]
16. Find the length of axes and ecentricity of the conic [5]

$$14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$$

**OR**