01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Chaitra

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 theorem. If $y = e^{x^2}$, then show that $y_{n+1} - 2xy_n - 2ny_{n-1} = 0$.
2. Expand $e^x \log_e(1+x)$ in ascending powers of x upto the term containing x^4 in Maclaurin's series.
3. State L-hospital's rule. Evaluate,
$$\lim_{x \to 0} \left(\frac{1}{x^2}\right)^{\tan x}$$
4. State the types of asymptotes to a curve. Find the asymptotes of the curve $(x^2 - y^2)(x + 2y + 1) + x + y + 1 = 0$.
5. Find the chord of curvature through the pole for the curve r = a (1+cosθ).
6. Show that $\int_0^\infty \frac{\log(1+x^2)}{1+x^2} dx = \pi \log 2$
7. Apply the method of differentiation under integral sign to prove
$$\int_0^{\pi/2} \frac{dx}{(a^2 \sin^2 x + b^2 \cos^2 x)^2} = \frac{\pi(a^2 + b^2)}{4a^3 b^3}$$
8. Using Beta -Gamma Function, show that
$$\int_0^{\pi/4} \sin^4 x . \cos^2 x \, dx = \frac{3\pi - 4}{192}$$
9. Find the area included between an arc of cycloid x = a (θ-sinθ), y = a (1- cosθ) and its base.

OR

Find the volume of the solid formed by the revolution of the cardoid r = a (1+cosθ) about the initial base.

10. What does the equation $x^2 + 2\sqrt{3}xy - y^2 = 2a^2$ become when the axes are turned through an angle 30° to the original axes?
11. Derive the equation of an ellipse in the standard form.

12. Find the eccentricity of the conic,

$$x^2 + 4xy + y^2 - 2x + 2y - 6 = 0$$

OR

Describe and sketch the conic

$$r = \frac{10\,\mathrm{cosec}\theta}{2\,\mathrm{cosec}\theta + 3}$$

13. Solve: $\frac{dy}{dx} = \frac{x + 2y - 3}{2x + y - 3}$

14. Solve: $\frac{dy}{dx} + y \tan x = \sec x$

15. Solve: $y = 2px + p^3y^2$; where $p = \frac{dy}{dx}$

16. Solve: $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} + 2y = \frac{1}{x}$

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