01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
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 on heigher order derivative. If $y = e^{a\tan^{-1}x}$, prove that $(1+x^2)y_{n+2} + (2nx + 2x - a)y_{n+1} + n(n+1)y_n = 0$
2. State difference between Roll's Theorem and Lagrange's Mean value theorem. Verify Lagrange's mean value theorem for f(x) = x(x-1)(x-2) when $x \in \left[0, \frac{1}{2}\right]$.
3. Define inderminate form of a function. Evaluate
$$\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{1/x^2}$$
4. Define asymptote to a curve. Find the asymptotes of curve $y^3 + 2xy^2 + x^2y - y + 1 = 0$.
5. Find radius of curvature of the curve $x^3 + y^3 = 3axy$ at origin.

OR

Find the pedal equation of the polar curve $r^m = a^m \cos m\theta$.

6. Integrate : $\int_0^{\pi/2} \frac{\cos x \, dx}{(1+\sin x)(2+\sin x)}$
7. Apply differentiation under integral sign to evaluate $\int_0^{\infty} \frac{e^{-ax}\sin x}{x} dx$.
8. Define Beta and Gamma function. Use them to evaluate $\int_0^{2a} x^5\sqrt{2ax - x^2}\,dx$.
9. Show that the area of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ is $\frac{3}{8}\pi a^2$.

OR

Find the volume of the solid formed by the revolution of the cardoid $r = a(1+\cos\theta)$ about the initial line.

10. Solve: $(1+y^2)dx = (\tan^{-1}y - x)dy$
11. Solve: $y = px - \sqrt{m^2 + p^2}$ where $p = \frac{dy}{dx}$.

12. Solve: $(D^2+2D+1)y = e^x + x^2$.

13. Solve: Solve: $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4$.

OR

A resistance of 100 ohms, an inductance of 0.5 Henry are connected in series with a battery of 20 volts. Find the current in the circuit as a function of time.

14. What does the equation of lines $7x^2 + 4xy + 4y^2 = 0$ become when the axes are the bisectors of the angles between them?

15. Derive the equation of hyperbola in standard form.

16. Find the foci and eccentricity of the conic $x^2 + 4xy + y^2 - 2x + 2y - 6 = 0$.

OR

Describe and sketch the graph of the conic $r = \frac{12}{6+2\sin\theta}$.

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