01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 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. If $y = \log\left(x + \sqrt{(a^2 + x^2)}\right)$ show that $(a^2+x^2)y_{n+2} + (2n+1)xy_{n+1} + n^2y_n = 0$
2. State and prove Lagrange's Mean Value theorem.
3. If $\lim_{x \to 0} \frac{a \sin x - \sin 2x}{\tan^3 x}$ is finite, find the value of a and the limit.
4. Find asymptotes of $(x^2-y^2)^2 - 2(x^2+y^2) + x - 1 = 0$
5. Find the radius of curvature at any point (x,y) for the curve $x^{2/3}+y^{2/3}=a^{2/3}$
6. Prove that $\int_0^\infty \frac{\sin bx}{x} dx = \frac{\pi}{2} (b > 0)$
7. Use Beta and Gamma function to evaluate $\int_0^{2a} x^5 \sqrt{2ax - x^2}\, dx$
8. Evaluate $\int_0^\infty \frac{e^{-x} \sin bx}{x} dx$ by using the rule of differentiation under the sign of integration.
9. Find the volume of the solid formed by the revolution of the cardiod $r = a(1+\cos\theta)$ about initial line.

OR

Find the area bounded by the curve $x^2y = a^2(a-y)$ and the x-axies

10. Solve the differential equation $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$
11. Solve the differential equation $x\frac{dy}{dx} + y \log y = xye^x$
12. Solve the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = e^x + e^{-x}$
13. Solve $y = px - \sqrt{m^2 + p^2}$ where $p = \frac{dy}{dx}$

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. Solve that locus of a point which moves in such a way that the differences of it distance from two fixed point is constant is Hyperbola.
15. Find the equation of ellipse of the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where a>b
16. Describe and sketch the graph of the equation $r = \frac{4\sec\theta}{2\sec\theta - 1}$