01 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2070 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 $Y = \text{Sin}(m\sin^{-1}x)$, then show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2-n^2)y_n = 0$

2. Apply Maclaurin's series to find the expansion of $\frac{e^x}{1+e^x}$ as far as the term in x^3

3. Evaluate: $\lim_{x\to a}\left(2-\frac{x}{a}\right)^{\tan\frac{\pi x}{2a}}$

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

5. Find the pedal equation of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$

6. Apply the method of differentiation under integral sign to evaluate $\int_0^\infty \frac{\log(1+a^2x^2)}{1+b^2x^2}dx$

7. Show that $\int_0^\infty \frac{\log(1+x^2)}{1+x^2}dx = \pi\log 2$

8. Use Gamma function to prove that $\int_0^1 \frac{dx}{(1-x^6)^{\frac{1}{6}}} = \frac{\pi}{3}$

9. Find the area of two loops of the curve $a^2y^2 = a^2y^2 - x^4$

   OR

   Find the volume of the solid formed by the revolution of the cycloid $x = a(\theta+\sin\theta)$, $y = a(1-\cos\theta)$ about the tangent at the vertex.

10. Solve the differential equation $(1+y^2) + (x - e^{\tan^{-1}y})\frac{dy}{dx} = 0$

11. Solve: $y - 3px + ayp^2 = 0$

12. Solve: $(D^2 - 2D + 5)y = e^{2x}.\sin x$

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

14. What does the equation $3x^2 + 3y^2 + 2xy = 2$ becomes when the axes are turned through an angle 45° to the original axes.

15. Show that the locus of a point which moves in such a way that the differences of its distance from two fixed points is constant is a hyperbola.

16. Find the center, length of the axes and eccentricity of the conic $2x^2 + 3y^2 - 4x - 12y + 13 = 0$

    OR

    Describe and sketch the graph of the polar equation of conic $r = \frac{10\text{cosec}\theta}{\ldots}$