TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	All (Except BAE)	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Mathematics I *(SH 401)*

- ✓ 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 $y = e^{a\sin^{-1}x}$, then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$

2. Assuming the validity of expansion, find the expansion of $\log(1+e^x)$ by using Machlaurin's Theorem.

3. Evaluate: $\lim_{x\to 0} \left(\frac{\sin x}{x}\right)^{1/x}$

4. Find the asymptotes of the curve:
$$y^2 = \frac{(a-x)^2}{a^2+x^2}x^2$$

5. Show that for the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, the radius of curvature at the extremity of major axis is equal to half of the latus rectum.

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

7. Evaluate by using the rule of differentiation under the sign of integration
$$\int_0^{\pi} \frac{\log(1+a\cos x)}{\cos x}dx$$

8. Prove that: $\int_0^{\infty} \sqrt{y}e^{-y^2}dy \times \int_0^{\infty} \frac{e^{-y^2}}{\sqrt{y}}dy = \frac{\Pi}{2\sqrt{2}}$

9. Find the surface area of solid generated by revolution of cycloid.
$x = a(\theta + \sin\theta), y = a(1+\cos\theta)$ about its axis.

10. Solve the differential equation:
$$\frac{dy}{dx} + \frac{1}{x}\sin 2y = x^3\cos^2 y$$

11. If p denotes $\frac{dy}{dx}$, then solve $p^3 - 4xyp + 8y^2 = 0$.

12. Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x^2e^{3x}$

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

14. Derive the standard equation of an ellipse.

15. Find the condition that the line xcosα + ysinα = p to touch hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and also find point of contact.

16. Find the centre, length of axes and eccentricity of conic $9x^2 + 4xy + 6y^2 - 22x - 16y + 9 = 0$.

OR

Describe and sketch the graph of polar equation: $r = \frac{4}{1-3\cos\theta}$

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