01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashwin

Exam.	New Back (2066 Batch)		
Level	BE	Full Marks	80
Programme	All (Except B.Arch.)	Pass Marks	32
Year / Part	I/I	Time	3 hrs.

Subject: - Engineering Mathematics I

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *<u>All</u> questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1. If $y = \sin(m \sin^{-1}x)$, Prove that
   a) $(1-x^2)y_2 - xy_1 + m^2y = 0$
   b) $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2-n^2)\,y_n = 0$
2. Obtain the series expansion of $e^{\sin x}$ by Machaurin's theorem as far as the term x^4.
3. Evaluate $\lim_{x \to 0}\left(\frac{\tan x}{x}\right)^{\frac{1}{x}}$.
4. Find the asymptotes of the curve $(x+y)^2(x+2y) + 2(x+y)^2 - x - 9y + 2 = 0$.
5. Show that the radius of curvature for the curve $r^m = a^m \cos m\theta$ is $\frac{a^m}{(m+1)r^{m+1}}$.
6. Show that $\int_0^{\pi/2} \frac{x \sin x \cos x}{\cos^4 x + \sin^4 x}\,dx = \frac{\pi^2}{16}$.

   OR

   Evaluate $\int_1^{\infty} \frac{x\,dx}{(1+x^2)^2}$.
7. Apply differentiation under integral sign to evaluate $\int_0^{\infty} \frac{\log(1+a^2x^2)}{(1+b^2x^2)}$.
8. Prove that $\int_0^1 \frac{dx}{(1-x^6)^{1/6}} = \frac{\pi}{3}$. (Using Gamma function)
9. Find the area of astroid, $x^{2/3} + y^{2/3} = a^{2/3}$.

   OR

   Find the surface area of solid generated by the revolution of cardioid $r = a(1+\cos\theta)$.
10. Through what angle should the axes be rotated so that the equation $9x^2 - 2\sqrt{3}xy + 7y^2 = 10$ may be changed to $3x^2 + 5y^2 = 5$.