TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	All (Except BAR)	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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. State Leibnitz's theorem. If $y = \log(x + \sqrt{a^2 + x^2})$ then using the theorem show that $(a^2 + x^2)y_2 + xy_1 = 0$ and hence show that $(a^2 + x^2)y_{n+2} + (2n + 1)xy_{n+1} + n^2y_n = 0$. [1+4]
2. Assuming the validity of expansion, find the expansion of: log(secx) by using Maclaurin's theorem. [5]
3. What do you mean by indeterminate form? State various forms of indeterminacy. Evaluate $\lim_{x \to 0}\left(\frac{\sin x}{x}\right)^{\frac{1}{x^2}}$. [5]
4. Define asymptotes and its types. Find the asymptotes of the curve $x^3 + 4x^2y + 5xy^2 + 2y^3 + 2x^2 + 4xy + 2y^2 - x - 9y + 1 = 0$. [1+4]
5. Find the pedal equation of the curve of $r^m = a^m \cos m\theta$. [5]
6. Show that $\int_0^{\pi/2} \frac{x}{\sin x + \cos x} dx = \frac{\pi}{2\sqrt{2}} \log(\sqrt{2} + 1)$. [5]
7. Evaluate, by using the rule of differentiation under the sign of integration: $\int_0^{\pi} \frac{\log(1 + a\cos x)}{\cos x} dx$. [5]
8. Define Beta and Gamma function and use these to evaluate $\int_0^1 \frac{dx}{(1 - x^6)^{1/6}}$. [5]
9. Find the area included between an arc of cycloid $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ and its base.

   OR

   Find the volume of the solid formed by revolution of the cardoid $r = a(1 + \cos\theta)$ about the initial base. [5]
10. Solve the differential equation $\frac{dy}{dx} + \frac{x}{1 - x^2} y = x\sqrt{y}$. [5]
11. State Clairatut's equation, find the general and singular solution of $y = px + p - p^2$. [5]
12. Find the particular integral and hence solve the differential equation $y'' - 2y' + 5y = e^{2x} \sin x$. [5]
13. Solve the differential equation $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + 2y = x \log x$. [5]
14. Through what angle should the axes be rotated to reduce the equation $3x^2 + 2xy + 3y^2 - \sqrt{2}x = 0$ into one with the xy term missing? Also obtain the transformed equation. [2+3]
15. Deduce the standard equation of the hyperbola. [5]
16. Describe and sketch the graph of the equation $r = \frac{10}{2 - 3\sin\theta}$

    OR

    Find the centre, length of axes and eccentricity of the conic $3x^2 + 8xy - 3y^2 - 40x - 20y + 50 = 0$. [5]

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