

TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2080 Baishakh

Exam. Level	BE	Back	
		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. If  $y = \log(x + \sqrt{a^2 + x^2})$ , then show that [5]
  - i)  $(a^2 + x^2) y_2 + xy_1 = 0$
  - ii)  $(a^2 + x^2) y_{n+2} + (2n+1) xy_{n+1} + n^2 y_n = 0$ .
2. Assuming the validity of expansion prove that the series by using Maclaurin's series: [5]
 
$$\frac{x}{e^x - 1} = 1 - \frac{x}{2} + \frac{x^2}{12} - \frac{x^4}{720} + \dots$$
3. Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right)^{\frac{1}{x^2}}$  [5]
4. Define an asymptotes to a curve. Find all the asymptotes of the cubic  $x^3 - 2y^3 + xy(2x-y) + y(x-y) + 1 = 0$ . [5]
5. Find the pedal equation of the curve:  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ . [5]
6. Show that  $\int_0^a \frac{\sqrt{\cot x}}{1 + \sqrt{\cot x}} dx = \frac{\pi}{4}$ . [5]
7. Evaluate:  $\int_0^\pi \frac{\log(1 + a \cos x)}{\cos x} dx$ , using the rule of differentiation under the sign of integration. [5]
8. Define Beta and Gamma function. Using Beta and Gamma function evaluate: [1+4]
 
$$\int_0^\pi \cos^2 \theta \sin^4 \theta d\theta.$$
9. Find the volume of the solid formed by revolution of cardioid  $r = a(1 - \cos \theta)$  about the initial line. [5]
10. Solve  $\frac{dy}{dx} = 2y \tan x + y^2 \tan^2 x$ . [5]
11. Solve the differential equation:  $y = yp^2 + 2px$  [5]
12. Solve the differential equation:  $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = xe^x \sin x$ . [5]
13. Solve the differential equation:  $x^2 \frac{d^2 y}{dx^2} + 4x \frac{dy}{dx} + 2y = e^x$ . [5]

OR

The current in a circuit containing resistance R and inductance L in a series with voltage source E. Find the current in the circuit as the function of time. [5]

14. Derive the standard equation of ellipse.

[5]

15. Find the angle through which the axes may be turned so that the equation  $x+2y+5=0$  may be reduced to  $x=c$  and also determine the value of  $c$ .

[5]

16. Show that the conic  $3x^2 + 10xy + 3y^2 - 26x - 22y + 43 = 0$  is a hyperbola. Also find the eccentricity.

[1+4]

OR

Describe and sketch the conic

$$r = \frac{4\sec\theta}{2\sec\theta - 1}$$

[5]

\*\*\*