

TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2078 Kartik

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.
- ✓ All question carry Equal Marks.
- ✓ Assume suitable data if necessary.

1. State Leibnitz's theorem. If  $y^{1/m} + y^{-1/m} = 2x$ , prove that  $(x^2 - 1)y_2 + xy_1 - m^2 y = 0$ , and hence show that  $(x^2 - 1)y_{n+2} + (2n+1)xy_{n+1} + (n^2 - m^2)y_n = 0$ .

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

3. State L-Hospital's rule. Evaluate  $\lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right)^{1/x^2}$



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

5. Define the radius of curvature, obtain the radius of curvature for the curve at the origin  $x^3 + y^3 = 3axy$ .

6. Prove that:  $\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx = \frac{\pi}{2}(\pi - 2)$

7. Apply the method of differentiation under integral sign to prove.

$$\int_0^{\pi} \frac{dx}{(a + b \cos x)^2} = -\frac{\pi a}{(a^2 - b^2)^{3/2}}$$

8. State Beta and Gamma function. Use them to evaluate:  $\int_0^1 x^6 \sqrt{1-x^2} dx$

9. Define the term quadrature. Find the area bounded by the curve  $r = a(1 - \cos \theta)$ .

OR

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

10. Solve the differential equations:  $(x + y + 1)dx + (y - x)dy = 0$

11. Find the general solution of the differential equation:  $e^y - p^3 - p = 0$  where  $p = \frac{dy}{dx}$ .

12. Solve the different equation:  $(D^2 + 2D + 1)y = e^x + x^2$

13. Solve:  $(x^2 D^2 + xD - 1)y = x^2$

OR

A radioactive material has an initial mass 100mg. After 2 years, it is left to 80mg. Find the amount of material at any time  $t$ .

14. Through what angle the axes be rotated to remove the term containing  $xy$  in  $11x^2 + 4xy + 14y^2 - 5 = 0$ .

15. Define hyperbola as a locus of a point and deduce the equation of hyperbola in standard form.

16. Find the center, length of axes, and eccentricity of the following conic:

$$3x^2 + 8xy - 3y^2 - 20y - 40x + 50 = 0$$

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