02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	**Full Marks**	80
Programme	ALL (Except B. Arch)	**Pass Marks**	32
Year / Part	I / I	**Time**	3 hrs.

Subject: - Engineering Mathematics I *(SH401)*

- ✓ 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 $y^{\frac{1}{m}} + y^{\frac{-1}{m}} = 2x$, show that $(x^2-1)y_2 + xy_1 - m^2y = 0$ and hence prove that $(x^2-1)y_{n+2} + (2n+1)xy_{n+1} + (n^2-m^2)y_n = 0$. [2+3]
2. State Roller's theorem. Does the theorem hold when the function is not continuous at the end points? Justify your answer. Verify the theorem for $f(x) = x^2 - 4x + 3$ on [1,3]. [5]
3. State L-Hospital's theorem and evaluate $\lim_{x \to 0}\left(\frac{\sin x}{x}\right)^{\frac{1}{x^2}}$ [5]
4. Find the asymptotes of curve $4x^3 - 3xy^2 - y^3 + 2x^2 - xy - y^2 - 1 = 0$ [5]
5. Find the pedal equation of the curve $y^2 = 4c(x+c)$ [5]
6. Show that $\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x + \cos x}dx = \frac{1}{\sqrt{2}}\log(\sqrt{2}+1)$ [5]
7. Evaluate, by using differentiation under the sign of integration [5]

   $\int_0^{\infty} \frac{\log(1+a^2x^2)}{1+b^2x^2}dx$
8. Define Beta-Gamma function and use it to evaluate $\int_0^{\frac{\pi}{6}} \cos^4 3\theta.\sin^2 6\theta.d\theta$ [5]
9. Find the surface area of the solid generated by the revolution of the cardioids $r = a(1+\cos\theta)$ about the initial line. [5]
10. Transform the equation $12x^2 - 10xy + 2y^2 + 11x - 5y + 2 = 0$ by translating the axes into an equation with linear term missing. [5]
11. Derive the standard equation of hyperbola. [5]
12. Find the centre, Length of axes and eccentricity of the conic [5]

    $9x^2 + 4xy + 6y^2 - 22x - 16y + 9 = 0$

    OR

    Describe and sketch the graph of the equation $r = \frac{12\sec\theta}{2+3\sec\theta}$.
13. Solve $\frac{dy}{dx} + \frac{\sin 2y}{x} = x^3\cos^2 y$ [5]
14. Solve the differential equation of $xp^2 - 2yp + ax = 0$ [5]
15. Solve $(D^2-1)y = \sinh(x)$ [5]
16. $(x^2D^2 + xD + 1)y = \sin(\log x^2)$ [5]

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