01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later 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 *(SH401)*

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

1. If $y = (\sin^{-1} x)^2$, then show that:
   i) $(1-x^2)y_2 - xy_1 - 2 = 0$
   ii) $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2 y_n = 0$
2. State Rolle's Theorem and verify the theorem for $f(x) = \frac{x(x+3)}{e^{x/2}}; x \in [-3,0]$
3. Evaluate: $\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{1/x}$
4. Find the asymptotes of the curve: $(a+x)^2(b^2+x^2) = x^2.y^2$
5. Find the pedal equation of the curve $r^2 = a^2 \cos 2\theta$
6. Evaluate $\int_0^{\pi/4} \frac{(\sin x + \cos x)}{(9+16\sin 2x)} dx$
7. Use Beta Gamma function to evaluate $\int_0^{2a} x^5.\sqrt{2ax - x^2}.dx$
8. Evaluate by using the rule of differentiation under the sign of integration.
   $\int_0^{\infty} \frac{e^{-x} \sin bx}{x}.dx$
9. Find the area of one loop of the curve r = a sin 3θ

   OR

   Find the volume of the solid formed by the revolution of the cardioid r = a (1+cosθ) about the initial line.

   Find center and eccentricity of conic $x^2 + 4xy + y^2 - 2x + 2y - 6 = 0$

   OR

   Describe and sketch the graph of the equation $r = \frac{10}{3 + 2\cos\theta}$

10. Find the condition that the line lx + my + n = 0 may be a normal to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

11. Show that the pair of tangents drawn from the center of a hyperbola are its asymptotes.

12. Solve the differential equation: $\frac{dy}{dx}=\frac{y}{x}+\tan\frac{y}{x}$

13. Solve: $y-2px+ayp^2=0$ where $p=\frac{dy}{dx}$

14. Solve the differential equation: $x\frac{dy}{dx}+y\log y=xy\,e^x$

15. Solve the differential equation: $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}-4y=x^2$

***