Exam.		Regular	
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. State Leibnity's theorem on Leigher derivatives:

    If $y = \sin(m \sin^{-1} x)$ then show that

    $(1-x^2) y_{n+2} - (2n+1) xy_{n+1} + (m^2-n^2)y_n = 0$

2. Assuming the validity of expansion, find the expansion of the function $\dfrac{e^x}{1+e^x}$ by Maclaurin's theorem.

3. Evaluate $\lim_{x \to 0} \dfrac{xe^x - (1+x)\log(1+x)}{x^2}$

4. Find the asymptotes of the curve $y^3 + 2xy^2 + x^2y - y + 1 = 0$

5. Find the radius of curvature of the curve $y = x^2(x-3)$ at the points where the tangent is parallel to x-axis

OR

    Find the pedal equation of the curve $r^2 = a^2 \cos 2\theta$

6. Show that $\displaystyle\int_0^a \dfrac{dx}{x + \sqrt{a^2 - x^2}} = \dfrac{\Pi}{4}$

7. Apply differentiation under integral sign to evaluate $\displaystyle\int_0^{\Pi/2} \dfrac{dx}{(a^2 \sin^2 x + b^2 \cos^2 x)^2}$

8. Use gamma function to prove that $\displaystyle\int_0^1 \dfrac{dx}{(1 - x^6)^{1/6}} = \Pi/3$

9. Find the volume or surface area of solid generated by revolving the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about its base.

10. If the line lx+my+n=0 is normal to the ellipse $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}=1$ then show that

$$\dfrac{a^2}{l^2}+\dfrac{b^2}{m^2}=\dfrac{(a^2-b^2)^2}{n^2}$$

11. Solve the locus of a point which moves in such a way that the difference of its distance from two fixed points is constant is Hyperbola.

12. Solve the differential equation $x\dfrac{d^2y}{dx^2}+2\dfrac{dy}{dx}=6x$

13. Solve $(x^2D^2+xD+1)y=\sin(\log x^2)$

14. Solve $y=yp^2+2px$ where $p=\dfrac{dy}{dx}$

15. Solve: $\dfrac{d^2y}{dx^2}+3\dfrac{dy}{dx}+2y=e^{2x}\sin x$

16. Describe and sketch the graph of the equation $r=\dfrac{10}{2-3\sin\theta}$

OR

Show that the conic section represented by the equation

$14x^2-4xy+11y^2-44x-58y+71=0$ is an ellipse. Also find its center, eccentricity, latus rectuns and foci

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