JYOTHY INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS

Subject: Calculus and Linear Algebra (18MAT11) (Common to all Sections)

ASSIGNMENT-I (Module-1, 2, 5)

1. Find the angle between the tangent and the radius vector for the following curves:
   $a)\ r^2 \cos 2\theta = b^2$ and b) $r = a(1+\sin\theta)$ $at\ \theta = \pi/2$

2. Show that the curves $r = a(1+\cos\theta)$, and $r = b(1-\cos\theta)$ intersect at right angle.

3. Prove with usual notations $\frac{1}{p^2} = u^2 + \left(\frac{du}{d\theta}\right)^2$ $where\ u = \frac{1}{r}$.

4. Find the pedal equation of the following curves:
   a) $r^m = a^m(\cos m\theta + \sin m\theta)$
   b) $\frac{2a}{r} = 1 - \cos\theta$

5. Find the radius of curvature for the curve x = a log (sec t + tan t), y = a sec t

6. Find the radius of curvature of the curve $x^3+y^3= 3axy$ at the point (3a/2, 3a/2)

7. Show that the radius of curvature at any point θ on the cycloid x = a(θ + sin θ), y = a(1- cos θ) 4a cos (θ/2)

8. If ρ be the radius of curvature at any point $P\ (x, y)$ on the parabola $y^2 = 4ax$, show that ρ^2 varies as $(SP)^3$ where S is the focus of the parabola.

9. Obtain the Taylor's series expansion of $log(\cos x)$ about the point $x = \pi/3$ up to the fourth degree term.

10. a. Prove that $e^{x\cos x} = 1 + x + \frac{x^2}{2!} - 2\frac{x^3}{3!} - 11\frac{x^4}{4!} + \ldots\ldots\ldots\ldots\ldots$

    b. Expand $\frac{e^x}{1+e^x}$ using Maclaurin's series upto and including 3^{rd} degree terms.

11. Test for consistency and solve:

$$\boldsymbol{x+y+z=6}\,,\qquad \boldsymbol{x-y+2z=5}\,,\quad \boldsymbol{3x+y+z=}\ 8$$

12. Find the rank of the following matrix A = $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$

13. Solve by Gauss Elimination method

$$\boldsymbol{2x+5y+7z=52}\,,\ \ \boldsymbol{2x+y-z=0}\,,\quad \boldsymbol{x+y+z=9}$$

14. Solve by Gauss Seidel Method performing 4 iterations

$$10x+y+z=12\,,\qquad x+10y+z=12\,,\qquad x+y+10z=12$$

15. Find the largest Eigen valve and the corresponding Eigen vector of the following matrices using power method compute 8 iterations $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$