ANNA UNIVERSITY COIMBATORE

B.E / B.TECH. DEGREE EXAMINATIONS : JAN – FEB 2009

REGULATIONS : 2007

FIRST SEMESTER

070030001 /SM0101 - ENGINEERING MATHEMATICS

(Common to All Branches of Engineering & Technology)

Time 3 Hours Max: 100 Marks

PART A (20 x 2 = 40 Marks)

Answer ALL Questions

1. If A = $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$ then find the eigen values of A^3 and A^{-1}
2. If the eigen values of A are 2,3, 4 find the eigen values of adj A
3. If the matrix of the quadratic form $3x^2+2axy+3y^2$ has eigen values 2 and 4, find the value of a
4. Find the nature of the quadratic form $x_1^2 -2x_1x_2+x_2^2+x_3^2$
5. Find the radius of curvature at the point where the curve $y=e^x$ crosses y axix
6. If ($2 + 3\cos\theta$, $3+4 \sin\theta$) is the centre of curvature at the point θ, find the evolute of the curve
7. Find the envelope of $y = mx + \sqrt{m^2-1}$ where m is parameter
8. Find the radius of curvature of any point any point on the curve $r=e^{\theta}$
9. Find $\frac{dy}{dx}$ when $f(x,y) = \log(x^2+y^2) + \tan^{-1}\left(\frac{y}{x}\right)$
10. If $Z=\phi(x,y)$ where $x=e^u \sin\theta$, $y = e^u \cos\theta$
11. Find the maximum and minimum of

    $f = 3x^2+y^2+12x=36$
12. If $u = \sin -1\left(\frac{x}{y}\right) +\tan-1\left(\frac{y}{x}\right)$, prove that $x \frac{\partial u}{\partial x}+ y \frac{\partial u}{\partial y} = 0$
13. Solve $(D^4-2D^2+1) y = 0$
14. Find the particular integral of $(D^2+1) y = \sin^2\left(\frac{x}{2}\right)$

15. Find the particular integral of $(D^2-4D+4)y = \cosh 2x$.
16. Transform the equation $(2x+3)^2 \frac{d^2y}{dx^2} - (2x+3) \frac{dy}{dx} - 12y = 6x$ into differential equation with constant coefficient
17. Define simple Harmonic motion.
18. In bending of beams, what do you infer if y = 0 when x = 0 and $x=\ell$ l
19. Solve $L \frac{dI}{dt} + RI = E_o$ where L, R,E_0 are constants.
20. Solve $L \frac{d^2q}{dt^2}+R\frac{dq}{dt}+\frac{q}{c} =0$ if $R^2 < \frac{4^2}{C}$

PART B (5 x 12 = 60 MARKS)

Answer Any FIVE Questions

21. Reduce the quadratic form $8x^2+7y^2+3z^2-12xy+4xz-8yz$ to canonical form by orthogonal transformation (12)

22. a Using Cayley-Hamilton theorem, find the inverse of (6)

$$A = \begin{pmatrix} 1 & 0 & -1 \\ 2 & 1 & 1 \\ 1 & 0 & -2 \end{pmatrix}$$

b Show that the radius of curvature at any point (x,y) on the astroid $x^{2/3}+y^{2/3} =a^{\frac{2}{3}}$ is $3(axy)^{\frac{1}{3}}$ (6)

23 a Find the evolute of $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ by considering the evolute as the envelope of the normals. (6)

b Find the envelope of $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ where a and b are parameters connected by $a^2 + b^2 = c^2$. (6)

24. a Show that of all rectangular parallelepiped with given volume, the cube has the least surface area. (6)

24. b Find the minimum value of $\sin x + \sin y + \sin(x+y)$ 6

$0 < x, y < \pi$

25. a Solve $(D^3 - 3D^2 + 3D - 1)\, y = x^3 e^{-x}$ 6

b Solve $(3x+2)^2 y'' + 3(3x+2) y' - 36y = 3x^2 + 4x + 1$ 6

26. a Solve $(D^2 + D + 1)y = e^{-x}\sin^2\left(\frac{x}{2}\right)$ 6

b Solve $x^2y'' + xy' + y = \log x \sin(\log x)$ 6

27 Solve $\frac{dx}{dt} + 2x - 3y = 5t,$ 12

$\frac{dy}{dt} - 3x + 2y = 2e^{2t}$

28 For a beam of length ℓ, clamped at one end x =0 and freely supported at the same level at the other end with a uniformly distributed load w per unit length, it is known that EI $\frac{d^2y}{dx^2} = \frac{1}{8} w\ell^2 - \frac{5}{8} w\ell x + \frac{1}{2} wx^2$. Find the equation of the deflection curve and prove that the max. deflection occurs at the point $x = \frac{\ell}{16}(15 - \sqrt{33})$ 12

*****THE END******