SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act,1956)

Course & Branch :B.E/B.Tech – Common to ALL Branches (Except Bio Groups)

Title of the Paper :Engineering Mathematics I Max. Marks :80

Sub. Code :6C0002 Time : 3 Hours

Date :11/05/2010 Session :AN

PART - A (10 x 2 = 20)

Answer ALL the Questions

1. Find sum and product of Eigen values of $A = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 0 & 3 \\ -2 & -1 & -3 \end{bmatrix}$.
2. Write the matrix of quadratic form $(x_1^2+3x_2^2+6x_3^2-2x_1x_2+6x_1x_3+5x_2x_3)$.
3. Write the formula for radius of curvature in polar coordinates.
4. Define evolute and involute.
5. Find Taylor's Expansion for the function e^{2x-y} in the neighbourhood of (0, 0).
6. Find the Jacobin $\frac{\partial(r,\theta)}{\partial(x,y)}$ if $x = r\cos\theta; y = r\sin\theta$.
7. Solve $\left(\frac{dy}{dx}\right)^2 - 3\left(\frac{dy}{dx}\right) + 2 = 0$
8. Find particular integral of $(D^2 - 2D + 1)y = e^x$.
9. If $y = (x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + ...\infty)$ show that $x = (y + \frac{y^2}{21} + \frac{y^3}{31} + ...\infty)$.
10. When x is large, prove $\sqrt{x^2+16} - \sqrt{x^2+9} = \frac{7}{2x}$ nearly.

PART – B (5 x 12 = 60)

Answer ALL the Questions

11. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. Hence compute A^{-1}.

(or)

12. Reduce the matrix $A = \begin{bmatrix} 2 & 0 & 4 \\ 0 & 6 & 0 \\ 4 & 0 & 2 \end{bmatrix}$ to diagonal form by orthogonal transformation.

13. (a) Show that $\frac{15}{16} + \frac{15 \cdot 21}{16 \cdot 24} + \frac{15 \cdot 21 \cdot 27}{16 \cdot 24 \cdot 32} + \ldots \infty = \frac{47}{9}$. (9)

(b) Find the Coefficient of x^n in $\frac{1}{(1+x)(3-x)}$ (3)

(or)

14. (a) Find sum to ∞ of the series $\frac{1.2}{1!} + \frac{2.3}{2!} + \frac{3.4}{3!} + \frac{4.5}{4!} + \ldots . \infty$

(b) Show that $(\log_3 e - \log_9 e + \log_{27} e \ldots . \infty) = \log_3 2$

15. Find the radius of curvature at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$ on the curve $x^3 + y^3 = 3axy$.

(or)

16. Find the envelope of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where $a^2 + b^2 = c^2$.

17. If $u = x^2 - y^2$, $v = 2xy$, prove that

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 4(x^2 + y^2)\left[\left(\frac{\partial z}{\partial u}\right)^2 + \left(\frac{\partial z}{\partial v}\right)^2\right]$$

(or)

18. Find maximum value of $x^m y^n z^p$ when $x + y + z = a$

19. Solve: $(x^2D^2 - xD + 4)y = x^2 \sin(\log x)$

(or)

20. Solve $\frac{d^2y}{dx^2} + y = \tan x$, by the method of Variation of parameters.