SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E/B.Tech – Common to ALL Branches (Except to Bio Groups)
Title of the paper: Engineering Mathematics - I
Semester: I Max. Marks: 80
Sub.Code: 6C0002 Time: 3 Hours
Date: 06-12-2007 Session: FN

PART – A (10 x 2 = 20)

Answer All the Questions

1. Find the sum and product of all eigen values of the matrix
$$A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 2 \\ 1 & 2 & 3 \end{pmatrix}.$$

2. State Cayley Hamilton theorem.

3. Prove that $a^x = 1 + x \log_e a + \frac{x^2}{2!} (\log_e a)^2 + \ldots \infty$

4. Find the coefficient of x^n in the expansion of $1+\left(\frac{1+2x}{1!}\right)+\frac{(1+2x)^2}{2!}+\ldots\infty$

5. Find the curvature of the circle $x^2 + y^2 = 25$.

6. Find the envelope of $y = mx + \sqrt{a^2m^2 + b^2}$, where m is the parameter.

7. If $x = r\cos\theta$, $y = r\sin\theta$ find $J(x, y)$.

8. Expand $e^x \sin y$ in powers of x and y as far as the terms of the second degree.

9. Find the particular integral of $(D^2 - 4D + 4)\, y = \cosh 2x$.

10. Solve $(x^2 D^2 - 3xD + 4)\, y = 0$.

PART – B (5 x 12 = 60)

Answer All the Questions

11. Reduce the Quadratic form $2x^2 + 5y^2 + 3z^2 + 4xy$ to canonical form by an orthogonal reduction.

(or)

12. Verify Cayley Hamilton theorem and hence find A^{-1} and A^4 for $A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$

13. Find the sum to infinity of the series $\frac{5}{3.6} + \frac{5.7}{3.6.9} + \frac{5.7.9}{3.6.9.12} + \ldots\ldots\infty.$

(or)

14. Find the sum to infinity of the series $\frac{1}{1.2.3} + \frac{5}{3.4.5} + \frac{9}{5.6.7} + \ldots\infty$

15. Find the equation of the circle of curvature of the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ $\quad at\left(\frac{a}{4}, \frac{a}{4}\right)$

(or)

16. Find the evolute of the parabola $y^2 = 4ax$ considering it as the envelope of its normals

17. (a) Find the maxima and minima of $f(x, y) = x^3 + y^3 - 3axy$.

(b) Evaluate $\int \frac{x^{\alpha} - 1}{\log x} dx$. by applying differentiation under the integral sign.

(or)

18. (a) If $u = f(x - y, y - z, z - x)$ show that $\frac{\delta u}{\delta x} + \frac{\delta u}{\delta y} + \frac{\delta u}{\delta z} = 0.$ (4)

(b) A rectangular box open at the top is to have a given capacity k. Find the dimensions of the box requiring least material for its construction.

(8)

19. Solve $\frac{dx}{dt} + y = \sin t, \frac{dy}{dt} + x = \cos t.$

(or)

20. (a) Solve $y'' + y = \sec x$ by the method of variation of parameters.

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