SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E/B.Tech – Common to ALL Branches (Excepts to Bio Groups)
Title of the paper: Engineering Mathematics - I
Semester: I — Max.Marks: 80
Sub.Code: 6C0002(2006-2007-2008) — Time: 3 Hours
Date: 14-05-2009 — Session: AN

PART - A (10 X 2 = 20)

Answer ALL the Questions

1. Two Eigen values of the matrix A = $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are equal to 1 each. Find the third Eigen value.

2. State Cayley-Hamilton Theorem.

3. Find k, if $\left(1+\frac{1}{2!}+\frac{1}{4!}+...\right)^2 = k+\left(1+\frac{1}{3!}+\frac{1}{5!}+...\right)^2$.

4. Show that $\log_3^e - \log_9^e + \log_{27}^e - \log_{81}^e + ... = \log_3^2$.

5. Find the radius of curvature of the curve given by $y = e^x$ *at* $x = 0$.

6. Find the envelope of the family of lines $y = mx + \frac{a}{m}$, m being the parameter.

7. If $x = r\cos\theta$, y = rsinθ, then find $\frac{\partial(x, y)}{\partial(r, \theta)}$.

8. If $z = f(x + ct) + \phi(x - ct)$, show that $\frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$.

9. Solve $(D^2 + 4)\, y = 0$.

10. Solve: $x^2 y'' - xy' + y = 0$.

PART – B (5 x 12 = 60)

Answer All the Questions

11. Reduce the quadratic form $2x_1^2 + x_2^2 + x_3^2 + 2x_1x_2 - 2x_1x_3 - 4x_3x_2$ to canonical form by an orthogonal transformation.

(or)

12. Verify Cayley-Hamilton Theorem for the matrix $A = \begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$ and hence find A^{-1}.

13. Prove that $\frac{1}{1.2} - \frac{1}{2.3} + \frac{1}{3.4} - \frac{1}{4.5} + \ldots = 2\log 2 - 1$.

(or)

14. Resolve $\frac{2x^2 + 1}{(x^2 + 1)(x + 1)}$ into partial fractions.

15. Find the evolute of the parabola $y^2 = 4ax$.

(or)

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

17. A rectangular box, open at the top, is to have a volume of 32c.c. Find the dimensions of the box that requires the least material for its construction.

(or)

18. Expand $x^2y + 3y - 2$ in powers of $(x - 1)$ and $(y + 2)$ upto 3rd degree terms.

19. Solve the equation $\frac{d^2y}{dx^2} + a^2 y = \tan ax$, by the method of variation of parameters.

(or)

20. (a) Solve: $(D^2 - 4D + 3)\, y = \sin 3x$.

(b) Solve: $(x^2D^2 - 2xD - 4)\, y = 32 (\log x)^2$.