SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act,1956)

Course & Branch :B.Arch - ARCH
Title of the Paper :Mathematics – I — Max. Marks :80
Sub. Code :621101 — Time : 3 Hours
Date :07/12/2009 — Session :FN

PART - A (8 x 4 = 32)

Answer ALL the Questions

1. Write the matrix of quadratic form $10x_1^2 + 2x_2^2 + 5x_3^2 + 6x_2x_3 - 10x_3x_1 - 4x_1x_2$ and find its characteristic equation

2. Verify Cayley Hamilton theorem for the matrix $\begin{bmatrix} 1 & 2 \\ 0 & 2 \end{bmatrix}$

3. Evaluate $\int_0^1 dx \int_0^2 dy \int_1^2 x^2 yz\,dz$.

4. Find the reduction formula for $\tan^n x$.

5. Solve $(D^2 + 9)\, y = 2 \cos 3x$.

6. Solve $(x^2 D^2 + 4xD + 2)\, y = x^2$.

7. Show that the lines $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5}$ *and* $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$ are coplanar.

8. Prove that the spheres $x^2 + y^2 + z^2 + 6y + 2z + 8 = 0$ and $x^2 + y^2 + z^2 + 6x + 8y + 4z + 20 = 0$ intersect at right angles. Find their plane of intersection.

PART – B (4 x 12 = 48)

Answer All the Questions

9. Find the eigen values and eigen vectors of the matrix

$$\begin{bmatrix} 1 & 3 & 4 \\ 0 & 2 & 5 \\ 0 & 0 & 3 \end{bmatrix}$$

(or)

10. Diagonalise the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

11. (a) Evaluate $\int_0^{\pi} x \sin^9 x dx.$ (7)

(b) If In = $\int x^n e^{-x} dx$, n being a positive integer, prove that

$I_n = -x^n e^{-x} + n I_{n-1}$ Hence prove that $\int_0^{\infty} x^n e^{-x} dx = \angle n$

(or)

12. Change the order of integration in $\int_0^a \int_y^a \frac{x}{x^2 + y^2} dxdy$ and evaluate it

13. (a) Solve $(D^2 + 3D + 2) y = e^{-2x} + \sin x.$

(b) Solve $(X^2 D^2 – XD – 3) y = x^2 \log x.$

(or)

14. (a) Solve $(D^2 + 2D - 3)\, y = e^x \cos x$.

    (b) Using method of variation of parameter solve $y'' + y = \tan 2x$.

15. Find the equation of the sphere passing through the circle $x^2 + y^2 + z^2 - 6x - 2z + 5 = 0;\ y = 0$ and touching the plane $3y + 4z + 5 = 0$.

(or)

16. Find the length of the shortest distance between the lines

$$\frac{x-2}{2} = \frac{y+1}{3} = \frac{z}{4};\ 2x + 3y - 5z - 6 = 0 = 3x - 2y - z + 3.$$