SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act,1956)

Course & Branch :B.E/B.Tech - AERO/CHEM/CSE/E&C/EIE/ ETCE/IT/M&P/MECH

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

Sub. Code :4ET102A-5ET102A Time : 3 Hours

Date :03/12/2009 Session :FN

PART - A (10 x 2 = 20)

Answer ALL the Questions

1. Write the expansion of $\sin n\theta$.

2. Prove that $\cosh^2 x - \sinh^2 x = 1$.

3. Find the angle between the planes $2x - y + z + 8 = 0$ and $x + y + 2z - 12 = 0$.

4. Check whether 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 each other orthogonally.

5. State Cayley-Hamilton theorem.

6. Find the quadratic form corresponding to the matrix $\begin{pmatrix} 1 & 2 & 5 \\ 2 & 4 & 6 \\ 5 & 6 & 3 \end{pmatrix}$.

7. Evaluate $\int_0^{\frac{\pi}{2}} \sin^6 \theta \, d\theta$.

8. Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin x}{\sin x+\cos x}\,dx.$

9. Show that $\beta(m,n) = \beta(n,m)$.

10. Evaluate $\int_0^1 \frac{dx}{\sqrt{-\log x}}$.

PART – B (5 x 12 = 60)

Answer All the Questions

11. (a) Expand $\sin 6\theta$ in terms of $\sin\theta$.
(b) Separate $\tanh^{-1}(x + iy)$ into real and imaginary parts.

(or)

12. (a) Find $\frac{\cos 7\theta}{\cos\theta}$ in powers of $\cos\theta$.

(b) Show that $\cosh 2x+\sinh 2x=\frac{1+\tanh x}{1-\tanh x}$

13. Find the length and equation of the shortest distance between the lines

$$L1:\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1}$$

and

$$L2:\frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}$$

(or)

14. Find the equation of the sphere having the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0;\ x + y + z = 3$ as a great circle.

15. Reduce the quadratic form $8x_1^2+7x_2^2+3x_3^2-12x_1x_2-8x_2x_3+4x_3x_1$ into its canonical form using orthogonal reduction.

(or)

16. Using Cayley – Hamilton theorem find the inverse of the matrix.

$$A = \begin{pmatrix} -1 & 0 & 3 \\ 8 & 1 & -7 \\ -3 & 0 & 8 \end{pmatrix}$$

17. Evaluate $\int\int (1+xy)\,dxdy$ in the region bounded by the line $y = x - 1$ and the parabola $y^2 = 2x + 6$.

(or)

18. Prove that $\int_0^{\frac{\pi}{4}} \log(1+\tan\theta)\,d\theta = \frac{\pi}{8}\log 2$ and hence find the value of $\int_0^1 \frac{\log(1+x)}{1+x^2}\,dx.$

19. Find the area of the asteroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ using Gamma function.

(or)

20. Establish the relationship between Gamma and Beta function. Hence find the value of $\Gamma\left(\frac{1}{2}\right)$.