SNS COLLEGE OF ENGINEERING, COIMBATORE

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Accredited by NAAC-UGC with 'A' Grade

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19MA101 – ENGINEERING MATHEMATICS I

UNIT – I

PART A

1. Find the sum and product of the Eigen values if the characteristic equation of the 3 x 3 matrix is $\lambda^3 - 7\lambda^2 + 36 = 0$
2. State cayley Hamilton theorem.
3. Find the nature of the quadratic form $x_1^2 + 2x_2^2 + x_3^2 - 2x_1x_2 + 2x_2x_3$.
4. What is the nature of the quadratic form $x^2 + y^2 + z^2$
5. If the sum of two Eigen values and the trace of the matrix A are equal then find $|A|$
6. Find the Eigen value of a matrix $\begin{pmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{pmatrix}$ corresponding to the Eigen vector $(-4 \quad -2 \quad 4)^T$
7. Discuss the nature of the quadratic form $2x^2 + 3y^2 + 2z^2 + 2xy$
8. The product of two Eigen values of $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ is 16. Find the third eigen value of A.
9. Write down the Quadratic form corresponding to the matrix A=$\begin{bmatrix} 0 & 5 & -1 \\ 5 & 1 & 6 \\ -1 & 6 & 2 \end{bmatrix}$
10. Can A=$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ be diagonalized? Why?
11. Using Cayley Hamilton theorem to find (A^4-4A^3-5A^2+A+2I) when A= $\begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix}$.
12. Check whether the matrix B is orthogonal? Justify. B = $\begin{pmatrix} cos\theta & sin\theta & 0 \\ -sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$

Part-B

1. Using Cayley – Hamilton theorem find A^4 for the matrix $\begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$. (8)
2. Using Cayley – Hamilton theorem find A^{-1},where $A = \begin{pmatrix} 7 & 2 & 2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{pmatrix}$ (8)
3. If $A = \begin{pmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{pmatrix}$ Verify Cayley – Hamilton theorem hence find A^{-1}. (8)
4. Show that $A = \begin{pmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{pmatrix}$ satisfies its own characteristic equation and hence find its inverse. (8)

5. Find the eigen values and eigen vectors of $\begin{pmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{pmatrix}$ (8)

6. Find the eigen values and eigen vectors of $\begin{pmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{pmatrix}$ (8)

7. Find the eigen values and eigen vectors of $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ (8)

8. Find the eigen values and eigen vectors of $\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$ (8)

9. Reduce the quadratic form $3x^2+5y^2+3z^2-2yz+2zx-2yx$ to the canonical form through orthogonal transformation. (16)

10. Reduce the quadratic form $6x_1^2+3x_2^2+3x_3^2-4x_1x_2-2x_2x_3+4x_3x_1$ to the canonical form through orthogonal transformation. Find index ,signature and nature of the quadratic form. (16)

11. Reduce the quadratic form $x^2+5y^2+z^2+2xy+2yz+6zx$ to the canonical form and hence find its rank. (16)

12. Reduce the quadratic form $10x^2+2y^2+5z^2+6yz-10zx-4xy$ to the canonical form through orthogonal transformation.Find index ,signature and nature of the quadratic form. (16)

13. Reduce the matrix $\begin{pmatrix} 10 & -2 & -5 \\ -2 & 2 & 3 \\ -5 & 3 & 5 \end{pmatrix}$ to diagonal form. (16)

14. Reduce the matrix $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ to diagonal form. (16)

15. Reduce the matrix $\begin{pmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{pmatrix}$ to diagonal form. (16)

16. Reduce the matrix $\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$ to diagonal form. (16)

UNIT – II

PART A

1. Describe convergence sequence.
2. Find the nature of the series 1+2+3+4+........+n+...
3. Define Bounded sequence
4. Define oscillating sequence with example.
5. Define monotonic sequence

6. Define comparison test.
7. Define D' Alembert's ratio test.
8. sTest the convergence for the sequence $\left\{\frac{1}{n}\right\}_{n=1}^{n=\infty}$

PART B

1. Show that the direct summation of **n** terms that the series $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+\cdots$ is convergent.
2. Using comparison test, examine the convergence of the series $\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+....\infty$.
3. Using comparison test, examine the convergence of the series $\frac{6}{1.3.5}+\frac{8}{3.5.7}+\frac{10}{5.7.9}+....\infty$
4. Using comparison test, examine the convergence of the series $\frac{1.2}{3.4.5}+\frac{2.3}{4.5.6}+\frac{3.4}{5.6.7}+....\infty$
5. Using D' Alembert's ratio test, examine the convergence or divergence of the series $x+2x^2+3x^3+.....$
6. Test the convergence of the series $\frac{1}{4\cdot 7\cdot 10}+\frac{4}{7\cdot 10\cdot 13}+\frac{9}{10\cdot 13\cdot 16}+\cdots\cdots$
7. Test the convergence of the series $\frac{x}{1\cdot 2}+\frac{x^2}{2\cdot 3}+\frac{x^3}{3\cdot 4}+\cdots\cdots$
8. Test the convergence of the series $\frac{1}{1+2}+\frac{2}{1+2^2}+\frac{3}{1+2^3}+\cdots\cdots$
9. Test the convergence of the series $1+\frac{3}{7}x+\frac{3.6}{7.10}x^2+\frac{3.6.9}{7.10.13}x^3+..........$

   by D' Alembert's ratio test
10. Test the convergence of the series $\sum_{n=1}^{\infty}\frac{n}{n^2+1}x^n,\ x>0.$