SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code : MATHEMATICS-III(15A54301) **Course & Branch**: B.Tech(ECE)

Year & Sem: II-B.Tech & I-Sem **Regulation:** R15

UNIT –I

1. a) Find the rank of the matrix $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ by using Echelon form. [5 M]

   b) Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 4 \\ 3 & 0 & 5 & 10 \end{bmatrix}$ into normal form. Find its rank. [5 M]

2. Find whether the following system of equations are consistent. If so solve them

   $x + 2y + 2z = 2$; $3x - 2y - z = 5$; $2x - 5y + 3z = -4$; $x + 4y + 6z = 0$. [10 M]

3. Determine whether the following equations will have a non-trivial solutions, if so solve them $4x + 2y + z + 3w = 0$; $6x + 3y + 4z + 7w = 0$; $2x + y + w = 0$. [10 M]

4. Discuss for what values of λ and μ, the simultaneous equations $x + y + z = 6$

   $x + 2y + 3z = 10$; $x + 2y + \lambda = \mu$ have $i)$ no solution $ii)$ a unique solution

   $iii)$ An infinite many solutions. [10 M]

5. Find the characteristic equation of the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$. [10 M]

6. Verify Cayley Hamilton theorem for the matrix $\begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ find A^{-2} and A^4 using Cayley Hamilton theorem. [10 M]

7. Reduce the quadratic form to the sum of squares form by orthogonal reduction. Find index, Nature and Signature of the quadratic form $2x^2 + 2y^2 + 2z^2 - 2yz - 2zx - 2xy$. [10 M]

8. Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form by Orthogonal reduction. Find index, nature and signature of the quadratic form. [10 M]

9. a) If $A = \begin{bmatrix} 3 & 7 - 4i & -2 + 5i \\ 7 + 4i & -2 & 3 + i \\ -2 - 5i & 3 + i & 4 \end{bmatrix}$ then prove A is Hermitian and iA is Skew-Hermitian.

   b) Prove that $\frac{1}{2}\begin{bmatrix} 1+i & -1+i \\ 1+i & 1-i \end{bmatrix}$ is unitary matrix. [5 M]

10. a) Define rank of a matrix. [2 M]

b) Test for the consistency of $x + y + z = 6$; $x - y + 2z = 5$; $3x + y + z = -8$. [2 M]

c) Find the Eigen values of the matrix $\begin{bmatrix} 5 & -2 & 0 \\ -2 & 6 & 2 \\ 0 & 2 & 7 \end{bmatrix}$. [2 M]

d) Define Hermitian matrix and Skew- Hermitian matrix. [2 M]

e) State Cayley Hamilton Theorem. [2 M]

Prepared by: N.RAJAGOPAL REDDY

SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (OBJECTIVE)

Subject with Code : MATHEMATICS-III(15A54301) **Course & Branch**: B.Tech(ECE)

Year & Sem: II-B.Tech & I-Sem **Regulation:** R15

UNIT – I

1. If $A = \begin{bmatrix} a & c & b \\ b & a & c \\ c & b & a \end{bmatrix}$ is singular matrix then $a^3 + b^3 + c^3 =$ [ ]
   A) $3abc$ B) abc C)$(abc)^3$ D) 1
2. A square matrix A is symmetric if [ ]
   A)$A^T A = 0$ B) $A^T A = 1$ C)$A^T = -A$ D) $A^T = A$
3. A square matrix A is skew-symmetric if [ ]
   A)$A^T A = 0$ B) $A^T A = 1$ C)$A^T = -A$ D) $A^T = A$
4. The diagonal elements of a skew-symmetric matrix are all [ ]
   A) real B) imaginary C) zero D) one
5. A square matrix A is an orthogonal matrix if [ ]
   A) $A^{-1}A = I$ B) $A^T A = I$ C)$A^T = -A$ D) $A^T = A$
6. The rank of 3×3 non-singular matrix A is [ ]
   A)2 B) 0 C)1 D) 3
7. The rank of the singular matrix of order 3 is [ ]
   A) ≤ 3 B) ≤ 2 C)1 D) 3
8. The system of equations are consistent, if [ ]
   A) $\rho(A) < \rho(AB)$ B) $\rho(A) \neq \rho(AB)$ C) $\rho(A) = \rho(AB)$ D) None
9. The system of linear equations has infinite many solution, if [ ]
   A) $r < n$ B) $r \neq n$ C) $r = n$ D) None

10. The system of linear equations has unique solution, if [ ]
A) $r < n$ B) $r \neq n$ C) $r = n$ D) None

11. The system of linear equations has $AX = 0$ is [ ]
A) Homogeneous B) $non - homogeneous$ C)consistent D) None

12. The system of linear equations has trivial solution, if [ ]
A) $X < 0$ B) $X \neq n$ C) $X = n$ D) $X = 0$

13. The system of equations are inconsistent, if [ ]
A) $\rho(A) < \rho(AB)$ B) $\rho(A) \neq \rho(AB)$ C) $\rho(A) = \rho(AB)$ D) None

14. The rank of a unit matrix order 4 is [ ]
A)2 B) 4 C)1 D) 3

15. The rank of the singular matrix of order 3 is [ ]
A) ≤ 3 B) 2 C)1 D) 3

16. The transpose of an orthogonal matrix is [ ]
A) symmetric B) unitary C) orthogonal D) Hermitian

17. The maximum value of the rank of a 4×5 matrix is [ ]
A)2 B) 4 C)5 D) 3

18. If A is a symmetric matrix then A^n(n is positive integer) is [ ]
A) symmetric B) unitary C) orthogonal D) Hermitian

19. The diagonal elements of a Skew-Hermitian matrix are all [ ]
A) real B) *purly* imaginary C) *zero* D) None

20. The diagonal elements of a Hermitian matrix are all [ ]
A) *purly* imaginary B) real C) *zero* D) None

21. A square matrix is said to be unitary if [ ]
A) $A^\theta A^T = A$ B) $A^\theta A = I$ C) $A^\theta A = 0$ D) None

22. Inverse f a unitary matrix is [ ]
A)Hermitian B) unitary C) orthogonal D) symmetric

23. The Eigen values of the unit matrix of order 3 is [ ]
A) 0,0,1 B) 1,1,0 C) 1,1,1 D) $1, -1, 1$

24. If one of the Eigen value is of a square matrix A, then the trace of A is [ ]
A) singular B)symmetric C) orthogonal D) $non - singular$

25. If $1, -1, 2$ be the Eigen value is of a square matrix A, then the trace of A is [ ]
A)-2 B)0 C) 3 D) 2

26. The characteristic equation of the square matrix A is [ ]
A) $|A - \lambda I|$ B)$|A - \lambda I| \neq 0$ C) $|A - \lambda I| = 0$ D) $[A - \lambda I] = 0$

27. The latent root of $\begin{bmatrix} a & h & g \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$ are [ ]
A) a, 0, c B)a, b, c C) a, h, c D) 0,0,0

28. If $D = P^{-1}AP$ then $A^2 =$ [ ]
A) $P^{-1}A^2P$ B)$P^{-1}AP$ C)PDP^{-1} D) PD^2P^{-1}

29. The Eigen values of $\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ are [ ]
A) i, i B)$1, -1$ C)$i, -i$ D) $-1, -1$

30. If a square matrix A satisfies $A^TA = I$, then the matrix is [ ]
A) symmetric B) hermitian C)unitary D) orthogonal

31. The symmetric matrix associated with the quadratic form $x^2 + 3y^2 - 8xy$ [ ]
A) $\begin{bmatrix} 1 & -4 \\ -4 & 3 \end{bmatrix}$ B) $\begin{bmatrix} 1 & -4 \\ 4 & -3 \end{bmatrix}$ C) $\begin{bmatrix} 1 & 4 \\ 4 & -3 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 4 \\ -4 & -3 \end{bmatrix}$

32. If A is Hermitian matrix then iA is [ ]
A) symmetric B) $skew-$ hermitian C)hermitian D) None

33. The symmetric matrix of the quadratic form $ax^2 + by^2 - 2hxy$ is [ ]
A) $\begin{bmatrix} a & -1 \\ -1 & b \end{bmatrix}$ B) $\begin{bmatrix} a & -h \\ -1 & b \end{bmatrix}$ C) $\begin{bmatrix} a & -h \\ -h & b \end{bmatrix}$ D) $\begin{bmatrix} a & -1 \\ -h & b \end{bmatrix}$

34. The Eigen values of A are 0,1,2 then the nature of the quadratic form is [ ]
A) positive definite B) positive semi definite
C)negative definite D) indefinite

35. The Eigen values of A are -1,-4,-4 then the index of the quadratic form is [ ]
A) 1 B) 2 C)3 D) 0

36. The Eigen values of A are 0,0,6 then the signature of the quadratic form is [ ]
A) 1 B) 2 C)3 D) 0

37. The index and signature of the quadratic form $x^2 + 3y^2 + 3z^2 - 2zy$ are [ ]
A) 2,3 B) 2,1 C) 3,3 D) 0,1

38. If the canonical form of a quadratic form is ${y_1}^2 + 2{y_2}^2 - 8{y_3}^2$ then index and Signature of the quadratic form is [ ]
A) 1,3 B) 2,1 C) 3,2 D) 0,1

39. The quadratic form corresponding to the symmetric matrix $\begin{bmatrix} 1 & 2 \\ 2 & -4 \end{bmatrix}$ is [ ]
A) $x^2 \quad 4y^2 \mid 4xy$ B) $x^2 \quad 4y^2 \quad 4xy$
C) $x^2 + 4y^2 + 4xy$ D) $x^2 + 4y^2 - 4xy$

40. The Eigen values of A are 0,1,0 then the rank of the quadratic form is [ ]
A) 1 B) 2 C)3 D) 0

Prepared by: N.RAJAGOPAL REDDY