Dr.S.N.S. Rajalakshmi College of Arts and Science(Autonomous), Coimbatore-49
Question Bank
Subject Code: 21UMA503 **Subject Name:** Linear Algebra **Programme** B.Sc. Mathematics
Section -A

4040 1 . Define Symmetric Matrix with Example

4041 2 . Define Conjugate transpose of a matrix with Example

4042 3 . A is any symmetric matri then show that, $A + A^T$ is symmetric and $A - A^T$ is skew symmetric.

4043 4 . Show that, $(iA)^* = iA^*$.

4044 5 . Show that If a matrix A is symmetric and invertible , then A^{-1} is also symmetric..

4045 6 . Compare Orthogonal and Unitary matrices with example.

4046 7 . Compare Hermitian and Skew Hermitian Matrix through definition Approach.

4047 8 . Show that the given matrix $A = \begin{pmatrix} 1 & 2+3i & -1 \\ 2-3i & \sqrt{5} & \sqrt{2}+i \\ -1 & \sqrt{2}-i & 3/2 \end{pmatrix}$ is Hermitian matrix.

4048 9 . The product of the two symmetric matrices need not be symmetric. Examine this result for the matrices $A = \begin{pmatrix} 1 & 4 \\ 4 & 2 \end{pmatrix}$ $B = \begin{pmatrix} 1 & 1 \\ 1 & 5 \end{pmatrix}$

4049 10 . Make use of the matrix $A = \begin{pmatrix} 1 & -2i \\ 2+3i & -1 \end{pmatrix}$ find $\overline{A}$ and $A^\star$

4050 11 . Identify the type of the matrix $P = \begin{pmatrix} cos\alpha & sin\alpha \\ -sin\alpha & cos\alpha \end{pmatrix}$

4051 12 . Examine whether the given matrix $U = 1/5 \begin{pmatrix} -1+2i & -4-2i \\ 2-4i & -2-i \end{pmatrix}$ is unitary matrix..

4052 13 . Simplify the characteristic polynomial and find the eigen values of the matrix $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 0 & -1 \\ 2 & -1 & 0 \end{pmatrix}$

4053 14 .

4054 15 . Define Binary Operators.

4055 16 . What is algebraic structure? Also give example.

4056 17 . Define Semi Group. Also give example.

4057 18 . Define Group. Also give example.

4058 19 . Explain Abelian Group and give example.

4059 20 . Explain ring and give example.

4060 21 . Compare skew field and field.

4061 22 . If U is a subspace of a vector space V, then prove that dim U ≤ dim V.

Section -B

4062 1 . If A and B are invertible, symmetric and commuting matrices then show the following (i) $A^{-1}B$ is symmetric (ii) AB^{-1} is symmetric (iii) $A^{-1}B^{-1}$ is symmetric

4063 2 . Define Eigen values and Eigen vectors of a matrix A.

4064 3 . Find the eigen values of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$

4065 4 . If a matrix A has complex entries, then show that $\overline{\overline{A}} = A$

4066 5 . (i) Show that Any square matrix can be explained as the sum of the symmetric and skew symmetric matrix. (ii) Also prove that this representation is unique.

4067 6 . Interpret about Rank of a given matrix. with an example. .

4068 7 . If a matrix H is Hermitian, then show that the principal diagonal entries are real numbers.

4069 8 . If a matrix H is skew - Hermitian, then show that the principal diagonal entries are Zero.

4070 9 . Construct the characteristic polynomial and find the characteristics roots or eigen values of the matrix $A = \begin{pmatrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{pmatrix}$

4071 10 . Solve the system of equations if it is consistent or in consistent x + 2y + 3z = 14 , 3x + y – z = 2 , 8x + 6y + 4z = 32.

4072 11 . By applying orthogonal definition , prove that the product of any two orthogonal matrices is orthogonal.

4073 12 . Simplify the matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 2 & 2 & 3 \\ 1 & 4 & 9 \end{pmatrix}$ as the sum of the symmetric and skew symmetric matrix

4074 13 . Define Vector space

4075 14 . Define the following terms (i) Commutative ring (ii) Integral domain.

4076 15 . Let F be a field of rational numbers and V be an set of n tuples i.e $V = \{x_1, x_2, ...x_n\}$. Then Show that V is a vector space over F.

4077 16 . Define Subspace and give example.

4078 17 . Interpret the following terms. (i) Homomorphism of a mapping $T : U \to V$. where U and V are vector spaces over the field F. (ii) Kernel of T .

4079 18 . Show that the vectors (1, 1, 0) , (1, 0, 1) and (0, 1, 1) are linearly independent in R3

4080 19 . Show that the vectors (1, 2, 3) , (3, -1, 2) and (5, 3, 8) are linearly dependent in R3

4081 20 . Show that L(S) is a subspace of V.

4082 21 . If S and T are subspaces of V then show that (i) If S⊆ T, them L(S) ⊆ L(T) (ii) L(S ∪ T) = L(S) + L(T) (iii) L(L(S)) = L(S)

4083 22 . If $v_1, v_2, v_3, ...v_n \in$ V are linearly independent then prove that their span has a unique representation of the form $\lambda_1 v_1, \lambda_2 v_2, \lambda_3 v_3, ...\lambda_n v_n$

Section -C

4084 1 . Show that the given system of equations is consistent $2x_1 + x_2 + x_3 + x_4 = 1; x_1 + 2x_2 + x_3 + x_4 = 2; x_1 + x_2 + 2x_3 + x_4 = 3; x_1 + x_2 + x_3 + 2x_4 = 4.$

4085 2 . If A and B are skew symmetric matrices then show that (i) A+B is skew symmetric matrix (ii) $A^{2n} issymmetric.$ (iii) A^{2n+1} is skew symmetric matrix where n∈ Z.

4086 3 . By applying the row elementary transformation techniques fin the rank of the matrix $A = \begin{pmatrix} 1 & -1 & 0 & 2 & 1 \\ 3 & 1 & 1 & -1 & 2 \\ 4 & 0 & 1 & 0 & 3 \\ 9 & -1 & 2 & 3 & 7 \end{pmatrix}$.

4087 4 . Verify Cayley –Hamition theorem for the matrix $A = \begin{pmatrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{pmatrix}$ Also find A^{-1}

4088 5 . Verify Cayley –Hamition theorem for the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$ Also find A^{-1}

4089 6 . Analyze the statement Every square matrix satisfies its Characteristic equation.

4090 7 . Inspect the following result. The given system of equations w + x + y + z = 4; - w + x +y + z = 2; -w + x-y + z = 0; -w + x – y - z = 0 are consistent with Rank 4.

4091 8 . Analyze whether the given system of equations is consistent or inconsistent x - 3y + z = 4 , 7x -21y + 14z = 28 , -3x + 9y - 6z = -12.

4092 9 . If V is a vector space over F , then show that (i) α.0 =0 for every α \in F. (ii) 0.v=0 for every v ∈ V. (iii) (– α) v= -(α v) for every α ∈ F, v ∈ V. (iv) If α ≠ 0 , then α v=0 v = 0 for every α ∈ F , v ∈ V.

4093 10 . If V is a vector space over the field F and W is a subspace of V, then show that $\frac{V}{W}$ is a vector space over F.

4094 11 . If A and B are finite dimensional subspace of a vector space V, then prove that dim (A+B) = dim A + dim B – dim (A $\cap$ B).

4095 12 . If $v_1, v_2, v_3, ...v_n \in$ V then either they are linearly indepndent or some v_k is a linear combination of preceding ones $v_1, v_2, v_3, ...v_{k-1}$. Verify this result.