SRM VALLIAMMAI ENGEINEERING COLLEGE

(An Autonomous Institution)

(S.R.M.NAGAR, KATTANKULATHUR-603 203)

DEPARTMENT OF MATHEMATICS

QUESTION BANK

IV SEMESTER

B.TECH- ARTIFICIAL INTELLIGENCE & DATA SCIENCES

1918406 – NUMERICAL LINEAR ALGEBRA

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DEPARTMENT OF MATHEMATICS

<u>QUESTION BANK</u>

SUBJECT : 1918406 – NUMERICAL LINEAR ALGEBRA

SEMESTER / YEAR : IV/ II (AI&DS)

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17.	What are the possible subspaces of R^3	**BTL-4**	Analyzing
18.	Show that the vectors $\{(1,1,0),(1,0,1)$ and $(0,1,1)\}$ genarate F^3	**BTL-3**	Applying
19.	If $v_1,v_2 \in V(F)$ and $\alpha_1, \alpha_2 \in F$.show that the set $\{v_1,v_2, \alpha_1 v_1+\alpha_2 v_2\}$ is linearly dependent	**BTL-4**	Analyzing
20.	Test whether S={(2,1,0) , (1,1,0),(4,2,0)} in R^3 is a basis of R^3 over R	**BTL-5**	Evaluating
	PART-B		
1.	Determine whether the following set is linearly dependent or linearly independent $\begin{pmatrix}1 & 0\\ -2 & 1\end{pmatrix},\begin{pmatrix}0 & -1\\ 1 & 1\end{pmatrix},\begin{pmatrix}-1 & 2\\ 1 & 0\end{pmatrix}$ and $\begin{pmatrix}2 & 1\\ 2 & -2\end{pmatrix}$ generate $M_{2\times 2}(R)$	**BTL-3**	Applying
2.	If x, y and z are vectors in a vector space V such that $x+z=y+z$, then prove that $x=y$ i) The vector 0 (identity) is unique ii) The additive identity for any $x \in V$ is unique	**BTL-5**	Evaluating
3.	Show that the set ,S={(1,3,-4,2),(2,2,-4,0),(1,-3,2,-4),(-1,0,1,0)} is linearly dependent of the other vectors	**BTL-4**	Analyzing
4.	Determine whether the following subset of vector space $R^3(R)$ is a subspace $W_1=\{((a_1,a_2,a_3): 2a_1-7a_2+a_3=0\}$	**BTL-5**	Evaluating
5.	Illustrate that set of all diagonal matrices of order $n\times n$ is a subspace of the vector space $M_{n\times n}(F)$, where $M_{n\times n}$ is the set of all square matrices over the field F	**BTL-4**	Analyzing
6.	Evaluate that $W_1=\{(a_1,a_2,\dots a_n)\in F^n; a_1+a_2+\cdots+a_n=0\}$ is a subspace of F^n and $W_2=\{(a_1,a_2,\dots a_n)\in F^n; a_1+a_2+\cdots+a_n=1\}$ is not a subspace	**BTL-2**	Understanding
7.	Illustrate that the vectors $\{(1,1,0),(1,0,1),(0,1,1)\}$ generate R^3	**BTL-5**	Evaluating
8.	Determine the following sets $\{1-2x-2x^2, -2+3x-x^2, 1-x+6x^2\}$ are bases for $P_2(R)$	**BTL-3**	Applying
9.	Analyze that the matrices $\begin{pmatrix}1 & 1\\ 1 & 0\end{pmatrix},\begin{pmatrix}1 & 1\\ 0 & 1\end{pmatrix},\begin{pmatrix}1 & 0\\ 1 & 1\end{pmatrix}$ and $\begin{pmatrix}0 & 1\\ 1 & 1\end{pmatrix}$ generate $M_{2\times 2}(R)$	**BTL-2**	Understanding
10.	Identify whether the set $\{x^3+2x^2, -x^2+3x+1, x^3-x^2+2x-1\}$in $P_3(R)$ is linearly independent or not	**BTL-3**	Applying
11.	Determine the following sets $\{1+2x-x^2, 4-2x+x^2, -1+18x-9x^2\}$ are bases for $P_2(R)$	**BTL-3**	Applying
12.	Illustrate that the set $\{1, x, x^2, \dots . x^n\}$ is a basis for $P_n(F)$	**BTL-3**	Applying
13.	Determine whether the set of vectors { (1,0,0,-1),(0,1,0,-1),(0,0,1,-1),(0,0,0,1)} is a basis for R^4	**BTL-3**	Applying
14.	Determine the basis and dimension of the solution space of the linear homogeneous system x+y-z=0,-2x-y+2z=0,-x+z=0.	**BTL-3**	Applying
	PART-B		
1	Determine whether the vectors $v_1=(1,-2,3), v_2=(5,6,-1), v_3=(3,2,1)$ form a linearly dependent or linearly independent set in R^3.	**BTL-4**	Analyzing
2	Prove that the upper triangular matrices form a subspace of $M_{mxn}(F)$.	**BTL-4**	Analyzing
3	Decide whether or not the set $S=\{x^3+3x-2, 2x^2+5x-3, -x^2-4x+4\}$ is a basis for $P_2(R)$	**BTL-2**	Understanding
4	Determine whether the set of vectors $X_1=(1,1,2)$, $X_2=(1,0,1)$,and $X_3=(2,1,3)$ span R^3	**BTL-3**	Applying

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION

Linear transformations –Null space-Range- Matrix representation of a linear transformation- Eigen values and Eigen vectors –Diagonalization

PART –A

Q.No	**Question**	**Bloom's Taxonomy Level**	**Domain**

1.	Define linear transformation of a function	**BTL-3**	Applying
2.	If $T: V \to W$ be a linear transformation then prove that $T(-v) = -v$ for $v \in V$	**BTL-3**	Applying
3.	If $T: V \to W$ be a linear transformation then prove that $T(x-y) = x - y$ for all $x, y \in V$	**BTL-3**	Applying
4.	Prove that the transformation T is linear if and only if $T(cx+y) = cT(x) + T(y)$	**BTL-3**	Applying
5.	Illustrate that the transformation $T: R^2 \to R^2$ defined by $T(a_1, a_2) = (2a_1 + a_2, a_2)$ is linear	**BTL-2**	Understanding
6.	Evaluate that the transformation $T: R^3 \to R^2$ defined by $T(x, y, z) = (x, 0,0)$ a linear transformation.	**BTL-5**	Evaluating
7.	Describe explicitly the linear transformation $T: R^2 \to R^2$such that $T(2,3) = (4,5) and\ T(1,0) = (0,0)$	**BTL-1**	Remembering
8.	Illustrate that the transformation $T: R^2 \to R^3$defined by $T(x, y) = (x+1, 2y, x+y)$ is not linear	**BTL-2**	Understanding
9.	Is there a linear transformation $T: R^3 \to R^3$such that $T(1,0,3) = (1,1)$ and $T(-2,0,-6) = (2,1)$?	**BTL-5**	Evaluating
10.	Define null space .	**BTL-1**	Remembering
11.	Define matrix representation of T relative to the usual basis {e_i}	**BTL-1**	Remembering
12.	Find the matrix $[T]_e$ whose linear operator $is\ T(x, y) = (5x + y,\ 3x - 2y)$	**BTL-2**	Understanding
13.	Find a basis for the null space of the matrix $A = \begin{pmatrix} 5 & 2 \\ 1 & 0 \end{pmatrix}$	**BTL-2**	Understanding
14.	Define diagonalizable of a matrix with linear operator T.	**BTL-1**	Remembering
15.	Find the matrix representation of usual basis {e_i} to the linear operator $T(x, y, z) = (2y + z, x - 4y, 3x)$	**BTL-2**	Understanding
16.	Define Eigen value and Eigen vector of linear operator T.	**BTL-1**	Remembering
17.	State Cayley-Hamilton Theorem	**BTL1**	Remembering
18.	Find the Eigenvalue of the matrix $A = \begin{pmatrix} 1 & 1 \\ 4 & 1 \end{pmatrix}$	**BTL2**	Understanding
19.	Find the matrix A whose minimum polynomial is $t^3 - 5t^2 + 6t + 8$.	**BTL-2**	Understanding
20.	State the dimension theorem for matrices.	**BTL-1**	Remembering

PART –B

1. a)	For each of the following linear operators T on a vector space V and ordered basis β,compute $[T]_\beta$,and determine whether β is a basis consisting of eigen vectors of T. V=R^2,,$T\binom{a}{b}=\binom{10a-6b}{17a-10b}$,β={$\binom{1}{2}$,$\binom{2}{3}$}	**BTL-3**	Applying
1.b)	Let $T: P_2(R) \to P_3(R)$be defied by $T[f(x)] = 2f'(x) + \int_0^x 3f(t)dt$. Prove that T is linear, find the bases for$N(T)$and $R(T)$. Compute the nullity and rank of T. Determine whether T is one-to-one or onto.	**BTL-2**	Understanding
2.b)	Let $T: P_2(R) \to P_3(R)$be defined by $T[f(x)] = xf(x) + f'(x)$is linear. Find the bases for both $N(T)$, $R(T)$, nullity of T, rank of T and determine whether T is one –to-one or onto	**BTL-2**	Understanding
3.	Let $T: R^3 \to R^3$be a linear transformation defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$. Evaluate a basis and dimension of null space N(T) and range space R(T) and range space R(T). Also verify dimension theorem	**BTL-5**	Evaluating
4.	Find a linear map $T: R^3 \to R^4$whose image is generated by (1,2,0,-4) and (2,0,-1,-3)	**BTL-2**	Understanding
5.	Point out that T is a linear transformation and find bases for both N(T) and R(T).	**BTL-4**	Analyzing

	Compute nullity rank T. Verify dimension theorem also verify whether T is one –to-one or onto where $T: P_2(R) \to P_3(R)$ defined by $T[f(x)] = xf(x) + f'(x)$		
6.	For each of the following linear operators T on a vector space V and ordered basis β,compute $[T]_\beta$,and determine whether β is a basis consisting of eigen vectors of T. V=$P_1(R)$,T(a+bx)=(6a-6b)+(12a-11b)x and β={3+4x,2+3x}	**BTL-3**	Applying
7.	Let $T: R^2 \to R^3$ be defined by $T(x, y) = (x + 3y, 0, 2x - 4y)$. Compute the matrix of the transformation with respect to the standard bases of R^2 and R^3. Find N(T) and R(T) . Is T one –to-one ? IsT onto. Justify your answer.	**BTL-4**	Analyzing
8.	Let T be the linear operator on R^3 defined by $T(x, y, z) = (2x - 7y - 4z, 3x + y + 4z, 6x - 8y + z)$ (i) Find the matrix of T in the basis { f_1=(1,1,1), f_2=(1,1,0) f_3=(1,0,0) and (ii) Verify $[T]_f\ [T]_v = [T(v)]_f$ for any vector $v \epsilon R^3$	**BTL-2**	Understanding
9.	For the given matrix Evaluate all Eigen values and a basis of each Eigen space . $A = \begin{pmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{pmatrix}$	**BTL-5**	Evaluating
10.	Let α={$\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix}$} β={1,x,$x^2$}and γ={1} ,Define T:$M_{2x2}(F) \to M_{2x2}(F)$ by T(A)=A^T. Compute $[T]_\alpha$.	**BTL-3**	Applying
11.	Let $T: p_2(R) \to p_2(R)$ be defined as $T(f(x)) = f(x) + (x+1)f'(x)$ FInd eigen values and corresponding eigen vectors of T with respect to standard basis of $p_2(R)$.	**BTL-5**	Evaluating
12.	Let V be the space of 2X 2 matrices over R and let M=$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$. Let T be linear operator defined by T(A)=MA .Find the trace of T.	**BTL-2**	Understanding
13.	Let V and W be vector spaces over F,and suppose that$\{v_1, v_2 \dots \dots \dots . v_n\}$ is a basis for V, For $w_1, w_2 \dots \dots \dots . w_n$ in W Prove that there exists exactly one linear transformation $T: V \to W$ such that $T(v_i) = w_i$ for i=1,2,…n	**BTL-3**	Applying
14.	Consider the basis S={v_1,v_2,v_3} for R^3 where v_1=(1,1,1) , v_2=(1,1,0) and v_3=(1,0,0). Let T:$R^3 \to R^2$ be the linear transformation such that T(v_1)=(1,0), T(v_2)=(2,-1) and T(v_3)=(4,3) . Find the formula for T(x_1,x_2,x_3), then use this formula to compute T(2,-3,5)	**BTL-4**	Analyzing
	PART-C		
1	Let T be a linear operator $T(a, b, c) = (-4a + 3b - 6c, 6a - 7b + 12c, 6a - 6b + 11c)$,$\beta$be the ordered basis then find $[T]_\beta$ which is a diagonal matrix	**BTL-2**	Understanding
2	Let $A = \begin{pmatrix} 1 & 4 \\ 3 & 2 \end{pmatrix}$ Point out all eigen values of A and corresponding eigen vectors find an invertible matrix P such that $P^{-1}AP$ is diagonal.	**BTL-3**	Applying
3	Find an invertible matrix $\begin{pmatrix} 3 & 1 & 1 \\ 2 & 4 & 2 \\ -1 & -1 & 1 \end{pmatrix}$	**BTL-2**	Understanding
4	Let $T: R^3 \to R^2$ be defined by $T(x, y, z) = (2x - y, 3z)$ verify whether T is linear or not. Find N(T) and R(T) and hence verify the dimension theorem	**BTL-3**	Applying

UNIT III –INNER PRODUCT SPACE

Inner product and norms - Gram Schmidt Orthonormalization process - Orthogonal Complement - Least square approximation.

PART -A

Q.No.	Questions	Bloom's Taxonomy Level	Domain
1.	Define inner Product Space and give its axioms.	**BTL-1**	Remembering
2.	Define orthogonal	**BTL-1**	Remembering
3.	Find the norm of $v = (3,4) \in R^2$ with respect to the usual product.	**BTL-2**	Understanding
4.	In $c([0,1])$let $f(t) = t, g(t) = e^t$ Evaluate $< f, g >$.	**BTL-5**	Evaluating
5.	If x, y and z are vector of inner product space such that $< x, y > = < x, z >$then prove that $y = z$.	**BTL-3**	Applying
6.	Normalize $u = (2,1,-1)$ in Euclidean space R^2.	**BTL-2**	Understanding
7.	Prove that the norm in a inner product space satisfies $\|v\| \geq 0$ and $\|v\| = 0$ if and only if v = 0.	**BTL-3**	Applying
8.	Find the norm of $v = (1,2) \in R^2$with respect to the inner product $< u, v >= x_1y_1 - 2x_1y_2 - 2x_2y_1$.	**BTL-2**	Understanding
9.	Define unit vector	**BTL-1**	Remembering
10.	Let S={$(1,0,i)(1,2,1)$} in c^3 Pointout $S^{\perp}$	**BTL-4**	Analyzing
11.	Let W= span ({i,0,1}) in c^3 find the orthonormal bases of w and $w^{\perp}$	**BTL-2**	Understanding
12.	What is an adjoint of linear operator.	**BTL-3**	Applying
13.	Let T be a linear operator on v,β is an orthonormal basis then prove that $[T^*]_\beta$=$[T]_\beta$	**BTL-3**	Applying
14.	Let S and T be linear operators on V then prove that $(S + T)^*$=$S^* + T^*$	**BTL-3**	Applying
15.	Let V=R^2,T(a,b)=(2a+b,a-3b) x=(3,5) find T^*at the given vector in V, when T is a Linear operator.	**BTL-2**	Understanding
16.	Let V be a vector space of polynomials with inner product defined by $< f(x), g(x) > = \int_0^1 f(x)g(x)dx$ .If $f(x) = x^2 + x - 4$, g(x)= x-1, then find $< f, g >$	**BTL-3**	Applying
17.	Let $g: v \to f$ be the linear transformation ,find a vector y such that g(x)=$< x, y >$ for all x∈v such that V=R^3 g(a_1, a_2, a_3)= $a_1 - 2a_2 + 4a_3$	**BTL-2**	Understanding
18.	Show that I^*=I for every u,v∈ v	**BTL-3**	Applying
19.	Define orthonormal.	**BTL-1**	Remembering
20.	Let P_2 have the inner product $< p, q > = \int_{-1}^1 p(x)q(x)dx$. Find the angle between p and q, where p=x and q=x^2 with respect to the inner product on P_2	**BTL-3**	Applying
	PART-B		
1.	Let V be an inner product space. Prove that (a) $\|x \pm y\|^2 = \|x\|^2 \pm 2R < x, y > + \|y\|^2$for all x, y ∈ V, where $R < x, y >$ denotes the real part of the complex number $< x, y >$. (b) $\|\|x\| - \|y\|\|^2 \leq \|x - y\|$ for all x, y ∈ V.	**BTL-3**	Applying
2.	Let V be an inner product space, for x, y, z ∈ V and C∈ F, checkwhether the following are true. (i) $< x, y + z > = < x, y > + < x, z >$ (ii) $< x, cy > = \bar{c} < x, y >$ (iii) $< x, 0 > = < 0, x > = 0$ (iv) $< x, x > = 0$if and only if x=0.	**BTL-4**	Analyzing

	(v) $< x, y > = < x, z >$ for all x∈V then y=z		
3.	In $C([0,1])$, let f(t) = t and g(t) = e^t. Compute$< f, g >$, $\|f\|$, $\|g\|$ and $\|f + g\|$. Then verify both the Cauchy-Schwarz inequality and the triangle inequality.	**BTL-4**	Analyzing
4.	Let P_2 be a family of polynomials of degree 2 atmost. Define an inner product on P_2 As $< f(x), g(x) > = \int_0^1 f(x)g(x)dx$. Let {1,x, x^2} be a basis of the inner product space P_2 . Find out an orthonormal basis from this basis.	**BTL-5**	Evaluating
5.	Evaluate by the Gram Schmidt Process to the given subset $S = \{(1,-2,-1,3),(3,6,3,-1),(1,4,2,8)\} and\ x = (-1,2,1,1)$ of the inner product space $V = R^4$ to obtain an orthogonal basis for span(S). Then normalize the vectors in this basis to obtain an orthonormal basis β for span(S), and compute the Fourier coefficients of the given vector relative to β.	**BTL-5**	Evaluating
6.	Apply the Gram-Schmidt process to the vectors u_1=(1,0,1) , u_2=(1,0,-1), u_3=(0,3,4) to obtain an orthonormal basis for R^3(R) with standard inner product.	**BTL-4**	Analyzing
7.	Evaluate by applying the Gram Schmidt Process to the given subset with the inner product $< f(x), g(x) > = \int_0^1 f(t)g(t)dt$, $S = \{1, x, x^2\}, and\ h(x) = 1 + x$ .of the inner product space $V = P_2(R)$ to obtain an orthogonal basis for span(S). Then normalize the vectors in this basis to obtain an orthonormal basis β for span(S), and compute the Fourier coefficients of the given vector relative to β.	**BTL-2**	Understanding
8.	Let V=C({-1,1}) with the inner product $< f, g > = \int_{-1}^{1} f(t)g(t)dt$, and let W be the subspace $P_2(R)$, viewed as a space of functions. Use the orthonormal basis obtained to compute the "best"(closet) second degree polynomial approximation of the function h(t)=e^t on the interval [-1,1]	**BTL-2**	Understanding
9.	Compute < x,y > for x=(1-i,2+3i) and y=(2+i,3-2i)	**BTL-3**	Applying
10.	For each of the sets of data that follows, use the least squares approximation to find the best fits with both (i) a linear function and (ii) a quadratic function. Compute the error E in both cases. {(-3, 9), (-2, 6), (0, 2),(1, 1)}	**BTL-2**	Understanding
11.	Consider the system $x + 2y + z = 4$; $x - y + 2z = -11$; $x + 5y = 19$; find the minimal solution	**BTL-2**	Understanding
12.	For each of the following inner product spaces V and linear operators Ton V, evaluate T* at the given vector in V. $V = R^2, T(a,b) + (2a + b, a - 3b)$, $x = (3,5)$	**BTL-5**	Evaluating
13.	Let V be an inner product space, and let T and U be linear operators on V. then verify(a) (T+U)*=T*+U*; (b) (cT)*=$\bar{c}\,T$* for any $c \in F$; (c) (TU)* = U*T*; (d) T** = T; I* = I	**BTL-4**	Analyzing
14.	For each of the sets of data that follows, use the least squares approximation to find the best fits with both (i) a linear function and (ii) a quadratic function. Compute the error E in both cases. {(-2, 4), (-1, 3), (0, 1), (1, -1), (2, -3)}	**BTL-4**	Analyzing
	Part-C		
1.	Let x = (2, 1+i, i) and y = (2-i, 2, 1+2i) be vectors in C^3. Compute $< x, y >$.$\|x\|$, $\|y\|$and $\|x + y\|$. Then verify both the Cauchy Schwarz inequality and the triangle inequality.	**BTL-1**	Remembering

2.	Find the minimal solution of to the following system of linear equations x+2y+z=4 , x-y+2z= -11,x+5y=19	**BTL-3**	Applying
3.	Let A and B be $n\ X\ n$ matrices. Then prove that (a) $(A+B)^* = A^* + B^*$ (b) $(cA)^* = \bar{c}A^*$ for all $c \in F$ (c) (AB)* = B*A*(d) A** = A (e) I* = I	**BTL-3**	Applying
4.	For each of the following inner product spaces V and linear operators T on V, evaluate T* at the given vector in V. $V = P_1$(R) with $< f,g > = \int_{-1}^{1} f(t)g(t)dt. T(f) = f' + 3f, f(t) = 4 - 2t$	**BTL-5**	Evaluating

UNIT IV-NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS

Solution of linear system of equations – Direct method: Gauss elimination method – Pivoting – Gauss-Jordan method - LU decomposition method – Cholesky decomposition method - Iterative methods: Gauss-Jacobi and Gauss-Seidel.

PART- A

Q.No	**Question**	**Bloom's Taxonomy Level**	**Domain**
1.	State the order and condition for Convergence of Iteration method.	BTL -2	Understanding
2.	State the principle used in Gauss Jordon method.	BTL -2	Understanding
3.	Solve the following equations by Gauss Jordan method x+y=2,2x+3y=5	BTL -3	Applying
4.	Solve by Gauss Elimination method 2x + 3y = 5 and 3x-y=2	BTL -2	Understanding
5.	Distinguish the advantages of iterative methods over direct method of solving a system of linear algebraic equations.	BTL -4	Analyzing
6.	Solve by Gauss Elimination method 2x + y = 3 and 7x-3y=4.	BTL -3	Applying
7.	Compare Gauss Elimination, Gauss Jordan method.	BTL -4	Analyzing
8.	State the condition for the convergence of Gauss Seidel iteration method for solving a system of linear equation.	BTL -2	Understanding
9.	Compare Gauss seidel method, Gauss Jacobi method.	BTL -4	Analyzing
10.	Which of the iterative methods is used for solving linear system of equations it converges fast? Why?	BTL -1	Remembering
11.	Compare Gauss seidel method, Gauss Elimination method.	BTL -4	Analyzing
12.	Explain Power method to find the dominant Eigen value of a square matrix A	BTL -2	Understanding
13.	How will you find the smallest Eigen value of a matrix A.	BTL -4	Analyzing
14.	Find the dominant Eigen value of $A = \begin{pmatrix} 2 & 3 \\ 5 & 4 \end{pmatrix}$ by power method up to 1 decimal place accuracy. Start with $X^{(0)} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$	BTL -3	Applying

15.	Write the necessary conditions for Cholesky decomposition of a matrix.	**BTL -1**	Remembering
16.	Find the Cholesky decomposition **of** $\begin{pmatrix} 4 & 2 \\ 2 & 10 \end{pmatrix}$	**BTL -2**	Understanding
17.	Define Real Symmetric Matrix.	**BTL -2**	Understanding
18.	Define LU decomposition mehod	**BTL -1**	Remembering
19.	Solve by Gauss Elimination method 4x -3y = 11 and 3x+2y=4.	BTL -2	Understanding
20.	Solve by Gauss jordan method 2x + y = 3 and 7x-3y=4.	BTL -2	Understanding

Part-B

1	Solve by Gauss Elimination method 3x + y - z = 3 ; 2x – 8y + z = -5 ; x -2y + 9z = 8	BTL -3	Applying
2	Solve by Gauss Jordan method 10x + y+ z = 12 ; x+10y + z = 12 ; x +y +10z = 12	BTL -3	Applying
3	Solve by Gauss Jacobi method 14x -5y =5.5 ; 2x +7y =19.3.	BTL -3	Applying
4.	Apply Gauss Seidel method to solve system of equations 10x – 5y -2z = 3 ; 4x -10y +3z = -3 ;x + 6 y +10z = -3	BTL -3	Applying
5.	Solve by Gauss Elimination method 2x + 4y+z = 3 ; 3x +2y -2z = -2 ;x -y + z =6	BTL-2	Understanding
6.	Solve by Gauss Jacobi method 8x -3y +2z =2 ; 4x +11y -z = 33 ; 6x +3y + 12z = 35.	BTL-2	Remembering
7.	Find the Cholesky decomposition of the matrix $\begin{bmatrix} 4 & 2i & 2 \\ -2i & 10 & 1-i \\ 2 & 1+i & 9 \end{bmatrix}$	BTL -2	Understanding
8.	Solve by Gauss Jordan method 10 x + y + z =12 ; 2x + 10y + z = 13; x + y + 5z =7.	BTL -3	Applying
9.	Solve by Gauss Elimination method x + 5y +z =14 ; 2x + y + 3z = 13 ; 3x+y+4z =17	BTL -3	Applying
10.	Apply Gauss seidel method to solve system of equations x – 2y +5z = 12 ; 5x + 2y - z = 6 ; 2x + 6 y – 3z = 5 (Do up to 6 iterations)	BTL -3	Applying
11.	Solve by Gauss Elimination method 6x -y+z = 13 ; x + y +z = 9 ;10x +y -z =19	BTL -3	Applying
12.	By Gauss seidel method to solve system of equations x + y + 54z = 110; 27x + 6y –z = 85; 6x + 15y – 2z =72.	BTL -4	Analyzing
13.	Solve by Gauss Elimination method 3x + 4y+5z = 18 ; 2x – y + 8z = 13 ;5x -2y + 7z =20	BTL -3	Applying
14.	Solve by using Gauss-Seidal method	BTL -5	Evaluating

	$8x - 3y + 2z = 20,\ 4x + 11y - z = 33,\ 6x + 3y + 12z = 35$.		

Part-C

1	Solve by Gauss Jordan method 10 x + y + z =12 ; 2x + 10y + z = 13; x + y + 5z =7.	BTL -2	Understanding
2	Solve by Gauss Elimination method 3x – y+ 2z = 12 ; x+2y +3z =11 ;2x -2y -z =2	BTL -2	Understanding
3	Solve the system of equations using Cholesky decomposition $4x_1 - x_2 - x_3 = 3$; $-x_1 + 4x_2 - x_3 = -0.5$; $-x_1 - 3x_2 + 5x_3 = 0$	BTL -5	Evaluating
4	Solve the linear system 6x +18y +3z = 3 2x +12y + = 19 4x +15y +3z = 0 by LU decomposition method	BTL -2	Understanding

UNIT V -NUMERICAL SOLUTION OF EIGEN VALUE PROBLEMS AND GENERALISED INVERSES

Eigen value Problems: Power method – Jacobi's rotation method – Conjugate gradient method – QR decomposition - Sin
Singular value decomposition

Q.No	Question	Bloom's Taxonomy Level	Domain
1.	Define Eigen value.	BTL -2	Understanding
2.	Find the sum and product of all Eigen values of $\begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$	BTL -5	Evaluating
3.	Find the sum and product of all Eigen values of $\begin{bmatrix} 1 & 2 & -2 \\ 1 & 0 & 3 \\ -2 & -1 & -3 \end{bmatrix}$	BTL -5	Evaluating
4.	Define singular matrix with an example.	BTL -2	Understanding
5.	Find the all Eigen values of $\begin{bmatrix} 2 & 3 \\ 5 & 1 \end{bmatrix}$	BTL -5	Evaluating
6.	If the sum of two eigenvalues and trace of a 3x3 matrix A are equal find the value of |A|.	BTL -2	Understanding
7.	Define Jacobi rotation method	BTL -2	Understanding
8.	Let $\boldsymbol{A} = \begin{pmatrix} \mathbf{1} & \mathbf{1} \\ \mathbf{1} & \mathbf{3} \end{pmatrix} = \boldsymbol{A_1}$ .Compute A_2 using QR algorithm.	BTL -5	Evaluating
9.	Find eigen values of the matrix A = $\begin{bmatrix} \mathbf{3} & \mathbf{5} \\ \mathbf{-2} & \mathbf{-4} \end{bmatrix}$.	BTL -3	Applying
10.	Define the generalized Eigen vector, chain of rank m, for a square matrix.	BTL -2	Understanding
11.	Find the eigen values of $\begin{bmatrix} 15 & 1 \\ 0 & 1 \end{bmatrix}$	BTL -5	Evaluating
12.	Find the determinant value of A if A= $\begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix}$	BTL4	Analyzing
13.	Give the nature of quadratic form without reducing into canonical form $x_1^2 - 2x_1x_2 + x_2^2 + x_3^2$	BTL -4	Analyzing

14.	Find the eigen values of $\begin{bmatrix} -1 & 1 \\ 9 & 1 \end{bmatrix}$	BTL-4	Analyzing
15.	Write short note on Singular value decomposition of complex matrix A.	BTL-1	Remembering
16.	State Singular value decomposition theorem	BTL-1	Remembering
17.	If A is a nonsingular matrix, then what is A^+?	BTL -2	Understanding
18.	Define conjucate gradient method	BTL -2	Understanding
19.	Write the numerical example of a conjucate gradient method	BTL-1	Remembering
20.	Find the generalized inverse of $\begin{bmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \end{bmatrix}$	BTL-3	Applying

Part-B

1	Find the dominant eigen value and vector of $A = \begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ using Power method.	BTL-4	Analyzing
2	Find the largest Eigen value and Eigen vector of $A = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$ using Power method.	BTL-4	Analyzing
3	Find the QR factorization of $A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 0 & 0 \\ 1 & 0 & -2 \\ 1 & 1 & 1 \end{bmatrix}$	BTL-4	Analyzing
4	Evaluate the singular value decomposition of $\begin{bmatrix} 5 & 5 \\ -1 & 7 \end{bmatrix}$	BTL-5	Evaluating
5	Evaluate the dominant Eigen value and vector of $A = \begin{pmatrix} 3 & 2 & 4 \\ -1 & 4 & 10 \\ 1 & 3 & -1 \end{pmatrix}$ using Power method.	BTL-5	Evaluating
6	Find the QR factorization of $A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$	BTL-4	Analyzing
7	Consider the decomposition of $A = \begin{bmatrix} 12 & -51 & 4 \\ 6 & 167 & -68 \\ -4 & 24 & -41 \end{bmatrix}$	BTL-4	Analyzing
8	Find the singular value decomposition of $A=\begin{bmatrix} 2 & -1 \\ -2 & 1 \\ 4 & -2 \end{bmatrix}$	BTL-4	Analyzing
9	Using Power method , Identify all the eigen values of $A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$	BTL-3	Applying
10	Get the singular value decomposition of $\begin{pmatrix} 2 & 2 \\ -1 & 1 \end{pmatrix}$	BTL-3	Applying
11	Calculate the eigen values and eigenvectors of the matrix with an accuracy of ε = 10-1 where	BTL-3	Applying

	$A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$ by jacobi's rotation method		
12	Find the conjugate gradient method of 5x+y=2 and x+2y = 2	BTL-3	Applying
13	Determine the largest eigenvalue and the corresponding eigenvectors of the matrix $\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$	BTL-3	Applying
14	Find the dominant Eigen value of $A = \begin{pmatrix} 2 & 3 \\ 5 & 4 \end{pmatrix}$ by power method up to 1 decimal place accuracy. Start with $X^{(0)} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$	BTL -3	Applying
	Part-C		
1	Evaluate the dominant Eigen value and vector of $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ using Power method.	BTL-5	Evaluating
2	Obtain A^{+} of $A = \begin{bmatrix} 2 & -1 \\ -1 & 1 \\ 4 & -3 \end{bmatrix}$ the generalized inverse.	BTL-3	Applying
3	Determine the largest eigen value and the corresponding eigenvectors of the matrix $\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$ by using Power method.	BTL-3	Applying
4	Find the singular value decomposition of $\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$	BTL-3	Applying