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PES University, Bengaluru-85

(Established under Karnataka Act No. 16 of 2013)

UE18MA251

DECEMBER 2020: END SEMESTER ASSESSMENT, B.TECH, IV-SEMESTER

UE18MA251 – LINEAR ALGEBRA AND ITS APPLICATIONS

Time: 03 Hours | Answer All Questions | Max Marks: 100

1	a)	Which number c forces a row exchange and what is the triangular system (non-singular) for that c? Which c makes the system singular? $2x + 5y + z = 0$; $4x + cy + z = 2$; $y - z = 3$	5
	b)	Use Gauss Elimination to solve the following system of equations: $a + b + c = 6$; $a + 2b + 2c = 11$; $2a + 3b - 4c = 3$	5
	c)	Apply elimination to produce factors L and U for the given matrix $A = \begin{bmatrix} 1 & -3 & 5 \\ 2 & -4 & 7 \\ -1 & -2 & 1 \end{bmatrix}$.	5
	d)	Find the inverse of $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ 1 & 0 & 8 \end{bmatrix}$ using Gauss-Jordan method.	5
2	a)	Determine whether the given vectors are linearly independent or not. $v_1=w_2+w_3$, $v_2=w_1+w_3$, $v_3=w_1+w_2$	4
	b)	Reduce matrix A to echelon form to find their rank, free and pivot variables. Also find the special solution to Ax=0. $A = \begin{bmatrix} 1 & 2 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 2 & 0 & 1 \end{bmatrix}$	8
	c)	Find the basis for column space and row space of the given matrix $A = \begin{bmatrix} 1 & 3 & 3 & 2 \\ 2 & 6 & 9 & 7 \\ -1 & -3 & 3 & 4 \end{bmatrix}$	8

SRN

3	a)	If S is the subspace spanned by the vectors (1, 1, 0, 1) and (0, 0, 1, 0) then find i) the vector in $S^{\perp}$ closest to the vector b=(0, 1, 0, -1) ii) a basis for the orthogonal complement $S^{\perp}$	8
	b)	If $A = \begin{bmatrix} 1 & 1 \\ 1 & -1 \\ -2 & 4 \end{bmatrix}$ and $b = \begin{bmatrix} 1 \\ 2 \\ 7 \end{bmatrix}$ then find the projection of b onto the column space of A. Also, split b into p+q such that p is in the column space and q perpendicular to that space.	8
	c)	Find the basis and dimension of a symmetric matrix of order 3.	4
4	a)	Test for Cayley-Hamilton theorem and find inverse of the matrix $\begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$.	10
	b)	Use power method to find the dominant eigen value of A. Use (1, 0, 0) as an initial approximation and carry out 6 iterations. $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$.	10
5	a)	Find the Singular Value Decomposition of $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$	12
	b)	For the given quadratic forms f_1 and f_2, write the corresponding matrices and apply the tests of pivots to check whether the obtained matrices are positive definite, positive semi-definite or indefinite. $f_1 = 2x_1^2 + x_2^2 + 4x_3^2 + 2x_1x_2 + 4x_1x_3 + 2x_2x_3$ $f_2 = 2x_1^2 + 2x_2^2 + 2x_3^2 - 2x_1x_2 - 2x_1x_3 - 2x_2x_3$	8