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PES UNIVERSITY	**PES University, Bengaluru** (Established under Karnataka Act 16 of 2013)	**UE18MA251**

END SEMESTER ASSESSMENT (ESA)
B TECH.- IV SEMESTER- MAY 2020
UE18MA251-LINEAR ALGEBRA

Time: 3 hours **Answer all questions** **Max marks: 100**

1(a)	Determine the values of a and b for which the system of equations $x + y + az = 2b$; $x + 3y + (2+2a)z = 7b$; $3x + y + (3+3a)z = 11b$ will have (i) unique trivial solution (ii) trivial solution (iii) no solution (iv) infinity of solutions.	6
(b)	Factor A=LDU, given $A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 1 & -1 \\ 1 & -1 & 4 \end{pmatrix}$. What is the relation between L and U matrices?	7
(c)	Apply Gauss-Jordan method to compute matrix A^{-1} given $A = \begin{pmatrix} 1 & -2 & 1 \\ 4 & -7 & 3 \\ -2 & 6 & 2 \end{pmatrix}$.	7
2(a)	If w_1, w_2, w_3 are linearly independent vectors verify whether $w_2 - w_3$, $w_1 - w_3$, $w_1 - w_2$ are linearly independent vectors or not.	6
(b)	For which $b = (b_1, b_2, b_3, b_4)$ is the system of equations $x + 2y + 3z = b_1$, $2x + 4y + 6z = b_2$, $2x + 5y + 7z = b_3$, $3x + 9y + 12z = b_4$ solvable?	7
(c)	If the column space of A is spanned by the vectors (1, 4, 2) , (2, 5, 1) and (3, 6, 0) find all those vectors that span the left null space of A. Determine whether or not the vector b = (4, -2, 2) is in that subspace. What are the dimensions of $C(A^T)$ and $N(A^T)$?	7
3(a)	Find all the vectors in R^4 that are orthogonal to (1, 4, 4, 1) and (2, 9, 8, 2)	6
(b)	Find the matrix of the linear transformation T on R^3 defined by $T(x, y, z) = (2y + z, x - 4y, 3x)$ with respect to the basis (1, 1, 1), (1, 1, 0), (1, 0, 0)	7
(c)	Find the least square solution of Ax=b given: $A = \begin{pmatrix} -1 & 2 \\ 2 & -3 \\ -1 & 3 \end{pmatrix}, b = \begin{pmatrix} 4 \\ 1 \\ 2 \end{pmatrix}$.	7

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4(a)	Determine a and b in eigen vectors $u=\begin{pmatrix}1\\a\\1\end{pmatrix}, v=\begin{pmatrix}-1\\b\\1\end{pmatrix}$ for $A=\begin{pmatrix}1 & 3 & 3\\-3 & -5 & -3\\3 & 3 & 1\end{pmatrix}$ .Write the corresponding eigen values for the eigen vectors u and v.	6
(b)	Use the Gram – Schmidt process to find a set of orthonormal vectors from the independent vectors a_1 = (1, 0, 1) , a_2 = (1, 0, 0). Also find the A = QR factorization where A = [a_1 a_2].	7
(c)	Diagonalize $A=\begin{pmatrix}-3 & 12\\-2 & 7\end{pmatrix}$ and hence find A^{47}.	7
5(a)	Fi1nd the Singular Value Decomposition of $A=\begin{pmatrix}1 & 1 & -1\\1 & 1 & 1\end{pmatrix}$	12
(b)	If $A=\begin{pmatrix}10 & 6\\6 & 10\end{pmatrix}$ is symmetric positive definite, then compute $\mathrm{R}=\mathrm{Q}\sqrt{\Lambda}\,Q^T$ its symmetric positive definite square root. Check whether R has positive or negative eigen values	8

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