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PES	**PES University, Bengaluru** (Established under Karnataka Act 16 of 2013)	**UE17MA251**

END SEMESTER ASSESSMENT (ESA)
B TECH.- IV SEMESTER- MAY 2019
UE17MA251-LINEAR ALGEBRA

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

1(a)	If $A=\begin{pmatrix}1&2&1&2\\1&3&2&2\\2&4&3&4\\3&7&4&6\end{pmatrix}$ and $b=\begin{pmatrix}b_1\\b_2\\b_3\\b_4\end{pmatrix}$. Using Gaussian elimination method find a condition on [b] which makes the system Ax=b consistent. Is the system consistent for b = (2, 3, 0, 1)?	6
(b)	Factor A=LDU, given $A=\begin{pmatrix}a&a&0\\a&a+b&b\\0&b&b+c\end{pmatrix}$. What is the relation between L and U matrices?	7
(c)	Apply Gauss-Jordan method to compute matrix A whose inverse is $B=\begin{pmatrix}1&2&3\\2&5&3\\1&0&8\end{pmatrix}$.	7
2(a)	If u,v,w are linearly independent check for the independence of the vectors {u+v, u-v, u-2v+w}	6
(b)	Find matrix A such that the given set is column space of A. $\left\{\begin{pmatrix}b-c\\2b+c+d\\5c-4d\\d\end{pmatrix} \textit{such that } b,c,d \textit{ are real}\right\}$. Hence find solutions to Ax=0 and $A^T y=0$.	7
(c)	Find a basis for the plane x +2y -3z = 0 in R^3, Then find a basis for the intersection of that plane with xy-plane. Also find a basis for all vectors perpendicular to the plane x +2y -3z = 0 .	7
3(a)	Find the Range and kernel of these transformations T: (i) $T(v_1,v_2)=(v_2,v_1)$ (ii) $T(v_1,v_2,v_3)=(v_1,v_2)$ (iii) $T(v_1,v_2)=(v_1,v_1)$	6
(b)	If V is the subspace spanned by (1, 1, 0,1) and (0, 0, 1, 0), find (i) a basis for the orthogonal complement $V^{\perp}$. (ii) the vector in $V^{\perp}$ closest to the vector b=(0, 1, 0, -1) .	7
(c)	Find the projection of b onto the column space of A: $A=\begin{pmatrix}1&1\\1&-1\\-2&4\end{pmatrix}, b=\begin{pmatrix}1\\2\\7\end{pmatrix}$. Split b into p+q with p is in the column space and q perpendicular to that space.	7

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4(a)	Find matrix A whose trace is 5 and whose determinant value is 4 and its eigen vectors are $x_1 = \begin{pmatrix} 2 \\ 1 \end{pmatrix}, x_2 = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ where x_1 is the eigen value of λ_1 and x_2 is the eigen value of $\lambda_2 (\lambda_1 > \lambda_2)$. And hence find A^K.	6
(b)	If W=span{x_1, x_2} where $x_1 = \begin{pmatrix} 3 \\ 6 \\ 0 \end{pmatrix}, x_2 = \begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix}$, construct an orthogonal basis {V_1, V_2} for W by Gram-Schmidt process. Factor W=QR with orthonormal vectors in Q.	7
(c)	Determine the largest eigen value and its corresponding eigen vector using power method for matrix $A = \begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$ with initial approximation of eigen vector as $\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ upto 6 iterations. (correct to 3 decimal places)	7
5(a)	Fi1nd the Singular Value Decomposition of $A = \begin{pmatrix} 1 & -1 \\ -2 & 2 \\ 2 & 2 \end{pmatrix}$	12
(b)	Write the matrices A and B (3x3) from the given quadratic forms f_1 and f_2. $f_1 = 2x_1^2 + x_2^2 + 4x_3^2 + 2x_1x_2 + 4x_1x_3 + 2x_2x_3$ $f_2 = 2x_1^2 + 2x_2^2 + 2x_3^2 - 2x_1x_2 - 2x_1x_3 - 2x_2x_3$ Apply the tests of pivots to check whether the matrices A & B are positive definite, positive semi-definite or indefinite.	8

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