Roll No: | | | | | | | | | | | |

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
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Bengaluru

Mid Term Examinations - October 2026

Date: 07/10/2026 **Time:** 02:00 PM - 03:30 PM

Course Code: MAT2303 **Course Name:** Linear Algebra and Vector Calculus

Semester: Third Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3
Marks	48	42	90

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Show that the following matrices are row equivalent: $A=\begin{bmatrix}1&2&-3&1&2\\2&4&-4&6&10\\3&6&-9&9&13\end{bmatrix}$ and $B=\begin{bmatrix}1&2&-3&1&2\\0&0&2&4&6\\0&0&0&6&7\end{bmatrix}$.	2	CO1	BT2
2	Find the eigenvalues of the matrices A^2 and A^{-1}, given the matrix $A=\begin{bmatrix}3&0&0\\5&4&0\\3&6&1\end{bmatrix}$.	2	CO2	BT2
3	Show that the set $W=\{(x,y,0): x,y\in R\}$ is a subspace of R^3.	2	CO1	BT2
4	Determine whether the set $S=\{(1,2,3),(2,5,7),(1,3,5)\}$ is linearly dependent or independent.	2	CO3	BT2
5	Let $B=\{(1,0),(0,1)\}$ and $C=\{(1,1),(2,1)\}$ be two bases of the vector space R^2. Find the transition matrix from the basis C to B.	2	CO3	BT2

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	A cloud computing system uses three types of resources: CPU capacity, memory capacity, and storage capacity. Let x_1, x_2, and x_3 represent the allocated amounts of these resources. The resource requirements are modelled by the system: $2x_1-x_2+x_3=3$, $4x_1+x_2+3x_3=15$, and $x_1-x_2+5x_3=14$. Determine the complete solution of the system using Gauss-elimination method and hence, interpret the obtained solution for the cloud computing system.	10	CO1	BT3

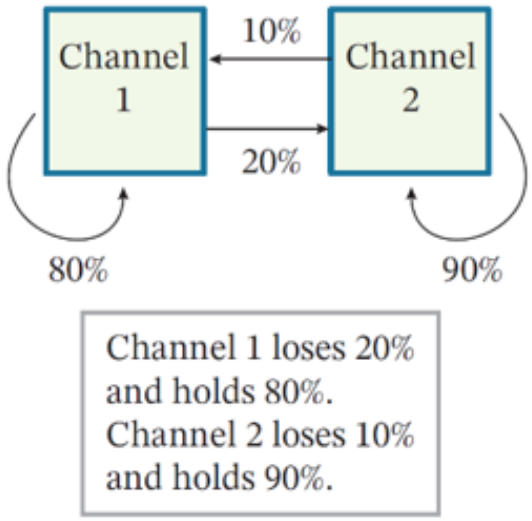
PTO (Please Turn Over)

7	Using *LU*-decomposition method find the solution to the following system of equations: $2x - y + 3z = 9, x + y + z = 6, x - y + z = 2$.	10	CO1	BT3

PART C: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
8	Find all the eigenvalues and corresponding eigenvectors of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.	10	CO2	BT3
9	Find the canonical form of the quadratic form $2x_1x_2 + 2x_1x_3 + 2x_2x_3$ and hence find the nature of the quadratic form.	10	CO2	BT3

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	Determine whether the set $S = \{(1,1,0), (1,0,1), (0,1,1)\}$ is a basis of the vector space R^3. If so, express an arbitrary vector (x,y,z) as a linear combination of the vectors in S.	10	CO3	BT3
11	Apply the Gram-Schmidt orthogonalization process to the basis $B = \{(1,1,0), (1,2,0), (0,1,2)\}$ to construct an orthonormal basis for R^3.	10	CO3	BT3

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	(a) Let $B = \{(2,2), (4,-1)\}$ and $C = \{(1,3), (-1,-1)\}$ be two bases of the vector space R^2. Find the transition matrix from the basis B to C. (b) Find a basis for the set of all solutions to the difference equation $y_{k+3} - y_{k+2} - 4y_{k+1} + 4y_k = 0$ for all k.	10	CO3	BT3

13	Suppose that two competing television channels, channel 1 and channel 2, each have 50% of the viewer market at some initial point in time. Assume that over each one-year period channel 1 captures 10% of channel 2's share, and channel 2 captures 20% of channel 1's share (see figure). Track the market shares of channels 1 and 2 over a four-year period.  Channel 1 loses 20% and holds 80%. Channel 2 loses 10% and holds 90%.	10	CO3	BT3