



11/8/23

BHARATIYA VIDYA BHAVAN'S
SARDAR PATEL INSTITUTE OF TECHNOLOGY

MUNSHI NAGAR, ANDHERI (WEST), MUMBAI – 400 058, India
(Autonomous College Affiliated to University of Mumbai)

End Semester Examination(Special)Aug 2023	
Max. Marks: 100	Duration: 3hrs
Class: FYMCA	Semester: I
Course Code: MA501	Date: 7/8/2023
Subject: Linear Algebra	Time: – 10 AM – 01 PM
Instructions: (1) All questions are compulsory. (2) Use of scientific calculator is allowed. (3) Assume any necessary data but justify the same.	

Q.N		Marks	CO
1.	(a) Reduce the following matrix to row echelon form and find its rank. $A = \begin{bmatrix} 2 & 3 & 5 \\ 3 & 4 & 1 \\ 5 & 7 & 6 \end{bmatrix}$	[5]	1
	(b) Show that if $\lambda \neq -5$ the following system of equations has a unique solution. Find the solution when $\lambda = 0$. $3x - y + 4z = 3, x + 2y - 3z = -2, 6x + 5y + \lambda z = -3$	[15]	1
2.	Attempt any TWO . (a) Solve the following system of linear equations by LU decomposition. $2x_1 + 3x_2 + x_3 = 9, x_1 + 2x_2 + 3x_3 = 6, 3x_1 + x_2 + 2x_3 = 8$	[10]	2
	(b) Solve the following system of linear equations using Jacobi's method. $x_1 - \frac{1}{4}x_3 - \frac{1}{4}x_4 = \frac{1}{2}$ $x_2 - \frac{1}{4}x_3 - \frac{1}{4}x_4 = \frac{1}{2}$ $-\frac{1}{4}x_1 - \frac{1}{4}x_2 + x_3 = \frac{1}{2}$ $-\frac{1}{4}x_1 - \frac{1}{4}x_2 + x_4 = \frac{1}{2}$ Use initial guess as (0, 0, 0). (Only 3 iterations)	[10]	2
	(c) Solve the following system of linear equations using Gauss Seidel method.		



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	$x_1 - \frac{1}{4}x_3 - \frac{1}{4}x_4 = \frac{1}{2}$ $x_2 - \frac{1}{4}x_3 - \frac{1}{4}x_4 = \frac{1}{2}$ $-\frac{1}{4}x_1 - \frac{1}{4}x_2 + x_3 = \frac{1}{2}$ $-\frac{1}{4}x_1 - \frac{1}{4}x_2 + x_4 = \frac{1}{2}$ <p>Use initial guess as (0, 0, 0). (Only 3 iterations).</p>		
3.	<p>(a) Assign each letter of the alphabet (A-Z) to a number (1-26) and space to 0. Encode the message KHARGHAR STATION using the encoding matrix $\begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$. Find the corresponding decoding matrix. Verify that this decoding matrix correctly decodes the encoded message.</p> <p>(b) Is the matrix $A = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}$ diagonalizable? If Yes, then find its diagonal form and transforming matrix.</p>	[8] [12]	3 5
4.	<p>(a) Determine whether the vectors (2, 3, -1), (3, 4, 1) and (5, 7, 0) are linearly independent. If not, express one of the vectors as linear combination of others.</p> <p>(b) Show that the function $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$ defined by $T(a,b,c)=(a, b)$ is a linear transformation. Also find the rank and nullity of T.</p>	[8] [12]	4 4



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5.	<p>Attempt any TWO.</p> <p>(a) Find the page having maximum rank in the following graph.</p> <div> </div> <p>(b) If $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$, find A^{50}.</p> <p>(c) Solve the following system of differential equations using diagonalization.</p> $\frac{dy_1}{dt} = 4y_1 - 2y_2$ $\frac{dy_2}{dt} = y_1 + y_2$	[10]	6
		[10]	6
		[10]	6

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