

Name Of Faculty: -----

Date of Submission: -----

Question:

Topic Name	No of Ques/Online Ques.	% Covered in Exam	% Ques. From old paper	Text /Reference books to refer**
Elementary Transformations	9	3 to 6	75	B V RAMANA (Pg.13.1 – 13.10) KREYSZIG (Pg. 182 – 200) B S GREWAL (Pg. 35 – 42)
Inverse of a matrix by elementary transformations				
Rank of a matrix by Normal form				
Rank of a matrix by Echelon Form				

➤ **Very Short Question:**

Q.1 For the given matrix $A = \begin{bmatrix} -5 & -3 \\ 2 & 0 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ prove that $A^3 = 19A + 30I$. [AKTU 2016]

Q.2 Prove that if A, B are symmetric, then so is A+B.

Q.3 If A is square matrix, prove that $A - A'$ is skew-symmetric.

Q.4 Find the rank of matrix by reducing it into normal form: $= \begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$. [AKTU-2017] Ans: 2j

Q.5 Find the rank of the matrix $\begin{bmatrix} 2 & 2 & 2 \\ 2 & 2 & 2 \\ 2 & 2 & 2 \end{bmatrix}$. [AKTU-2019] Ans: 1

➤ **Short Question:**

Q.6 Express matrix $\begin{bmatrix} 4 & 2 & -3 \\ 1 & 3 & -6 \\ -5 & 0 & -7 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix.

Q.7 Find the value of 'P' for which the rank of the matrix $\begin{bmatrix} 3 & P & P \\ P & 3 & P \\ P & P & 3 \end{bmatrix}$ is 1.
[MTU 2012] Ans: 3

Q.8 Find the inverse of the following matrices by using elementary transformations:

(i) $\begin{bmatrix} i & -1 & 2i \\ 2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$ [MTU 2013]

(ii) $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ [GBTU 2012, AKTU. 2017]

Ans: (i) $\frac{1}{4} \begin{bmatrix} 0 & 1 & -2 \\ -4 & 3i & 2i \\ 0 & 1 & 2 \end{bmatrix}$ (ii) $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$.

➤ **Long Question:**

Q.9 Find the rank of the matrices by reducing it to normal form or canonical form:

[UPTU(SUM)2010]

[GBTU(C.O.) 2011, UPTU 2006, AKTU 2017]

Ans: (i) Rank = 3 (ii) Rank = 3

Q.10 Find the rank of matrix by reducing into Echelon form $\begin{bmatrix} 1 & -2 & 3 & -1 \\ 2 & -1 & 2 & 2 \\ 3 & 1 & 2 & 3 \end{bmatrix}$

Ans: rank = 3

Q.11 Find the inverse employing elementary transformation $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$. [AKTU-2019]

Ans: $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$

Q.12 Reduce the matrix A to Normal form and hence find the rank of A where $A = \begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 4 \\ 1 & 2 & 3 & 4 \\ -1 & -2 & 6 & -7 \end{bmatrix}$.

[AKTU-2019]

Ans: rank = 3

Suggested Links:

Inverse of a matrix by elementary transformations

<https://www.youtube.com/watch?v=kcL5WWJjmIU>

Rank of a matrix by Normal form

<https://www.youtube.com/watch?v=VTHz4gjzsKI>

Rank of a matrix by Echelon Form

.com/wbe.com/watch?v=N33SOw1atch?v=njDiwB[https://www.youtube](https://www.youtube.com/watch?v=N33SOw1atch?v=njDiwB)43w80

[https://www.youtuA5fo](https://www.youtube.com/watch?v=A5fo)

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Topic Name	No of Ques/Online Ques.	% Covered in Exam	% Ques. From old paper	Text /Reference books to refer**
Linear dependence and Independence	10	6 to 8	50	B V RAMANA (Pg. 13.10-13.17) KREYSZIG (Pg. 201 – 220) B S GREWAL (Pg. 46 – 54)
System of Homogeneous Linear Equation				
System of Non-Homogeneous Linear Equation				

➤ **Very Short Question:**

Q.1 Discuss the condition of consistency and inconsistency of non-homogeneous linear equation.

Q.2 For what value of 'k', the system of equation $x + y + z = 2, x + 2y + z = -2, x + y + (k - 5)z = k$ has no solution.
Ans: $k = 6$ and $k \neq 2$.

Q.3 Find the value of k so that the equations $x + y + 3z = 0, 4x + 3y + kz = 0, 2x + y + 2z = 0$ have a non-trivial solution.

[UPTU (SUM) 2008] **Ans:** $k = 8$

Q.4 Test the consistency of system of equations and solve if possible by Gauss elimination method.

$$2x - y + 3z = 8$$

(i) $-x + 2y + z = 4$ **[U.P.T.U.2011]**

$$3x + y - 4z = 0.$$

$$2x - 3y + 7z = 5$$

(ii) $3x + y - 3z = 13$ **[U.P.T.U.2010]**

$$2x + 19y - 47z = 32$$

Ans: (i) $x = 2; y = 2; z = 2$ (ii) Inconsistent.

Q.5 Test the consistency for the following system of equations and if system is consistent, solve them: $x + y + z = 6, x + 2y + 3z = 14, x + 4y + 7z = 30$.

Ans: $x = k - 2, y = 8 - 2k, z = k$, where k is arbitrary.

Q.6 Find the values of λ and μ for which the system of equations has (i) no solution

(ii) unique solution (iii) infinite number of solutions.

$$2x - 5y + 2z = 8; 2x + 4y + 6z = 5; x + 2y + \lambda z = \mu.$$

[U.P.T.U.2015,(C.O.)2013,(SUM)2007, AKTU 2017]

Ans: (i) $\lambda = 3, \mu \neq 5/2$ (ii) $\lambda \neq 3, \mu$ may have any value (iii) $\lambda = 3, \mu = 5/2$

Q.7 Show that the equations do not have a solution unless $a + c = 2b$.

$$3x + 4y + 5z = a,$$

$$4x + 5y + 6z = b,$$

$$5x + 6y + 7z = c.$$

[U.P.T.U.(SUM) 2008; M.T.U 2011]

Q.8 Determine b such that the system of homogeneous equations:

$$2x + y + 2z = 0, \quad x + y + 3z = 0, \quad 4x + 3y + bz = 0$$

has (i) Trivial solution (ii) non-trivial solution. find the non-trivial solution.

Ans: (i) $b \neq 8$ (ii) $b = 8, x = k, y = -4k, z = k$.

Suggested Links:

Linear dependence and Independence

<https://www.youtube.com/watch?v=yLi8RxqfowA>

System of Homogeneous Linear Equation

www.math.ku.edu/~lerner/LAnotes/Chapter5.pdf

<http://www.math.hawaii.edu/~lee/linear/sys-eq.pdf>

System of Non-Homogeneous Linear Equation

https://www.youtube.com/watch?v=4jcvZmMK_28