LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

THIRD SEMESTER – **NOVEMBER 2024**

UST 3502 – MATRIX AND LINEAR ALGEBRA

Date: 12-11-2024 Dept. No. Max. : 100 Marks
Time: 09:00 am-12:00 pm

	SECTION A - K1 (CO1)
	Answer ALL the Questions (10 x 1 = 10)
1.	Define the following
a)	Equality of two matrices
b)	Fundamental set of solution of the equation AX=0
c)	Addition of two vectors
d)	Rank - Multiplicity theorem
e)	Real quadratic form
2.	**Fill in the blanks**
a)	If p and q are two scalars and a is any m x n matrix, then (q+p)A=_______
b)	The rank of the matrix in __________form is equal to the number of non - zero rows of the matrix.
c)	The set consisting only of the zero vector is ______ ______
d)	The characteristic root of a ___________ matrix are either pure imaginary or zero.
e)	Every matrix congruent to a symmetric matrix is a _______ matrix.
	SECTION A - K2 (CO1)
	Answer ALL the Questions (10 x 1 = 10)
3.	**True or False**
a)	Matrix multiplication is associated if conformability is assured.
b)	The number of linearly independent solution of m homogeneous linear equation in variables is n.
c)	If A and B are two n - rowed square matrices then Rank (AB)≥ Rank (A)+Rank (B) - n.
d)	Matrices A and A′ have same Eigen values.
e)	The range of values of two congruent quadratic forms are distinct.
4.	**Match the following**
a)	$\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$ - 1. Linear transformation
b)	A^{-1} - 2. $x_1^2-18x_1x_2+5x_2^2$
c)	X′AX= Y′BY - 3. $a_{11}a_{22}-a_{12}a_{21}$
d)	$\lvert A-\lambda I\rvert=0-4. \frac{Adj\ A}{\lvert A\rvert}$
e)	$A=\begin{bmatrix} 1 & -9 \\ -9 & 5 \end{bmatrix}$ - 5. Characteristic Equation
	SECTION B - K3 (CO2)
	Answer any TWO of the following in 100 words each. (2 x 10 = 20)
5.	Let A be a square matrix of order n, show that $\lvert\overline{A}\rvert=\overline{\lvert A\rvert}$.
6.	Prove the necessary and sufficient condition for a square matrix A to possess the inverse is $\lvert A\rvert\neq 0$.
7.	Determine the Eigen values of the matrix $A=\begin{bmatrix} a & h & g \\ 0 & b & 0 \\ 0 & c & c \end{bmatrix}$.
8.	Obtain the matrix of the quadratic forms (i) $x^2+2y^2+3z^2+4xy+5yz+6zx$.

	(ii) $ax^2+by^2+cz^2+2fyz+2gzx+2hxy$.

SECTION C – K4 (CO3)	
Answer any TWO of the following in 100 words each.	**(2 x 10 = 20)**
9.	Let A and B be two square matrices of order n and λbe a scalar. Prove that (i) tr(λA) = λ. Tr(A) (ii) tr(A+B) = tr (A)+tr(B) (iii) tr(AB) = tr(BA).
10.	Discuss Homogenous and Non-Homogenous system of equations.
11.	If $\lambda_1, \lambda_2 \ldots \lambda_n$ are Eigen values of A, Show that $k\lambda_1, k\lambda_2 \ldots \lambda_{kn}$ are Eigen value o KA.
12.	Reduce the following quadratic form to canonical form, $2x_1^2+x_2^2-3x_3^2-8x_2x_3-4x_3x_1+12x_1x_2$.
SECTION D – K5 (CO4)	
Answer any ONE of the following in 250 words	**(1 x 20 = 20)**
13.	Solve the equations: λx+2y - 2z -1 = 0 4x+2λy - z - 2 = 0 6x+6y+λz - 3 = 0
14.	State and Prove Cayley-Hamilton Theorem.
SECTION E – K6 (CO5)	
Answer any ONE of the following in 250 words	**(1 x 20 = 20)**
15.	Obtain the characteristic equation of the matrix $A=\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}$ and verify that it satisfied by A and hence find A^{-1}
16.	Determine a non- singular matrix P such that P′AP is a diagonal matrix, where $A=\begin{bmatrix}0 & 1 & 2\\ 1 & 0 & 3\\ 2 & 3 & 0\end{bmatrix}$

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