

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)

CLASS: IMSC  
BRANCH: QE & DS

SEMESTER : II  
SESSION : SP/2022

SUBJECT: ED117 LINEAR ALGEBRA, VECTORS AND MATRICES

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) Consider the mapping  $T(u,v,w) = (0,v,w)$ . Find the Kernel. Is it an isomorphism? [4]  
Q.1(b) Is the intersection of 2 sub spaces of a vector space also a sub space? State your logic. [4]  
Q.1(c) State the condition for diagonalisability of a linear operator from n-space to n-space. [2]
- Q.2(a) Matrix A has first row ( 5 -1), second row (8 3). Find the polynomial for which A is a root. Explain. [3]  
Q.2(b) When is the diagonal matrix  $\text{diag} ( a b c d )$  invertible? State the inverse. [3]  
Q.2(c) What is the coordinate vector of ( 3, 1, -4) relative to the vectors: (1,1,1), (0,1,1),(0,0,1)? Are these 3 vectors a basis for  $R^3$ ? Explain. [4]
- Q.3(a) L is a non singular linear mapping from V to W. Take 3 independent vectors in V. Prove that their images are independent in W. [4]  
Q.3(b) True or False? If A is 5X7 matrix,  $Au = 0$  has non trivial solution. Give reason. [3]  
Q.3(c) Choose any symmetric square matrix and show that eigenvectors of distinct eigenvalues are orthogonal. [3]
- Q.4(a) Obtain a value of K for which F is concave or convex.  $F = - 6x^2 + (2K + 4)xy - y^2 + 4Ky$ . Explain. [4]  
Q.4(b) Identify the extreme point/points of  $G = - 2x^2 - y^2 + 4x + 4y - 12$  [3]  
Q.4(c) Construct a system of non homogeneous linear equations with unique solution and show that rank condition for uniqueness is satisfied. [3]
- Q.5(a) M is a  $p \times q$  matrix. When will it have a right inverse? What is the order of the inverse? [2]  
Q.5(b) Take any  $2 \times 2$  matrix A with positive entries. Use another matrix P to construct a matrix B similar to A. Compare the eigenvalues of A and B. [4]  
Q.5(c) Consider  $L(x,y) = ( 4x, 3y - x)$ . What is the associated matrix for the standard basis? Obtain the associated matrix for the basis: (1,3), (2,5). [4]

:::::22/07/2022:::::