Total nos. of printed pages:02 Roll

PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Odd Semester Session 2021-22 CT -I

B. Tech. First Semester

Engineering Mathematics-I (KAS103T)

CO Number	Course Outcome (Please include all COs of your Course here)
CO1	**Define/state/find (L1-Remember)** the various terms and concepts of matrices and calculus.
CO2	**Discuss/ Explain/Compute (L2-Understand)** the various derivatives, Jacobian, multiple integral, approximate values and the value of basic terms (e.g. rank, inverse, eigenvalues, eigenvectors, etc.) of matrices and calculus including life-long learning.
CO3	**Apply/use (L3-Apply)** the basic concepts to **solve (L3- Apply)** various problems and to **calculate (L3- Apply)** the values of variables involved in matrices and calculus related to applications in engineering including health and society.
CO4	**Examine/Test (L4-Aanalysis)** the dynamical system involved in various problems of matrices and calculus to **prove and verify (L5-Evaluate)** results including societal and environmental contexts.

Time: 1.5 Hrs. M. M. 15

Section A

Q1. Attempt all questions: ***(1X3 = 3 Marks)***

a) Define Hermitian and Skew-Hermitian matrix. CO1

b) Find the eigen values of $3A^3 + 5A^2 - 6A + 2I$, where $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$ CO1

c) Find the value of b for which the rank of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 2 \\ b & 0 & 1 \end{bmatrix}$ is 2 CO1

Section B

Q2. Attempt all questions: **(2X4 = 8 Marks)**

a i) Compute the inverse of the given matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$ by using elementary transformations. CO2

Or

ii) Compute the non-singular matrices P and Q such that PAQ is in the normal form for the matrix $A = \begin{bmatrix} 1 & -1 & -1 \\ 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ CO2

b i) Compute the rank of the matrix $A = \begin{bmatrix} 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \\ 1 & 1 & 1 & 2 \end{bmatrix}$ by reducing into normal form. CO2

Or

ii) Compute the rank and nullity of the matrix $A = \begin{bmatrix} 1 & -1 & 2 \\ 2 & 1 & -1 \\ -1 & -2 & 0 \end{bmatrix}$ CO2

c i) Calculate the values of λ and μ such that the system CO3
$2x - 5y + 2z = 8,\ 2x + 4y + 6z = 5,\ x + 2y + \lambda z = \mu$
has (i) no solution, (ii) a unique solution, (iii) infinite number of solutions.

Or

ii) Solve the system of linear equations by matrix method: CO3
$x_1 + 3x_2 + 2x_3 = 0, 2x_1 - x_2 + 3x_3 = 0, 3x_1 - 5x_2 + 4x_3 = 0, x_1 + 17x_2 + 4x_3 = 0$

d i) Calculate A^*A is a Hermitian matrix where A^* is the conjugate transpose of the matrix A CO3
if $A = \begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$

Or

ii) Calculate the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ CO3

Section C

(4X1 = 4 Marks)

Q3.

i) Verify Cayley-Hamilton theorem for the matrix $= \begin{bmatrix} 2 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$. CO4
Also evaluate A^{-1} by Using Cayley-Hamilton theorem .

Or

ii) Prove that the matrix $(I - N)(I + N)^{-1}$ is unitary if $N = \begin{bmatrix} 0 & 1+2i \\ -1+2i & 0 \end{bmatrix}$, where I is unit matrix of the same order of N. CO4