Total nos. of printed pages:02 Roll No: [redacted]

PRANVEER SINGH INSTITUTE OF TECHNOLOGY, KANPUR

Odd Semester Session 2020-21 CT - I

B. Tech. First Semester (For All Branch)

Engineering Mathematics-I (KAS-103)

CO Number	Course Outcome
CO1	**Define (L1-Knowledge)** the various terms and concepts of matrices and calculus.
CO2	**Compute/ Explain (L2-Comprehension)** 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 (L3-Application)** the basic concepts to solve various problems matrices and calculus related to applications in engineering including environment and sustainability.
CO4	**Test and Calculate (L4-Aanalysis)** the value of variables involved in various problems of matrices and calculus.

Time: 1.5 Hrs. M. M. 15

Section A

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

a) Define Hermitian matrix with an example. CO1

b) Define Limit and continuity of a function. CO1

c) Define Lagrange's Mean Value theorem. CO1

Section B

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

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

Or

ii) Compute the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 4 \\ 1 & 2 & 3 & 4 \\ -1 & -2 & 6 & -7 \end{bmatrix}$ by reducing into normal form. CO2

b i) Compute the values of α and β such that the system of equations: CO2
$2x - 5y + 2z = 8,\ 2x + 4y + 6z = 5\ and\ x + 2y + \alpha z = \beta$ has
(i) no solution (ii) a unique solution (iii) infinite number of solutions.

Or

ii) Explain the Cayley-Hamilton theorem is verified or not for the given matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. If possible compute A^{-1} by using Cayley-Hamilton theorem for the given matrix A. CO2

c i) Apply the concept of matrices determine two non-singular matrices P and Q from the given matrix $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$. CO3

Or

ii) Apply the concept of matrices show that the given matrix $A = \begin{bmatrix} \alpha + i\gamma & -\beta + i\delta \\ \beta + i\delta & \alpha - i\gamma \end{bmatrix}$ is Unitary if $\alpha^2 + \beta^2 + \gamma^2 + \delta^2 = 1$. CO3

d i) Apply the concept of continuity and differentiability show that the function $f(x) = \begin{cases} x^2 \sin\frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ is continuous and differentiable at $x = 0$. CO3

Or

ii) Apply Rolle's theorem discuss it's applicability for $f(x) = e^x \sin x$, in $[0, \pi]$. CO3

Section C

(4X1 = 4 Marks)

Q3.

i) Calculate the n^{th} derivative of $y = \sin(m\sin^{-1}x)$ at $x = 0$ *i.e.*, $y_n(0)$. CO4

Or

ii) Calculate the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ and reduce the matrix A into diagonal form by similarity transformation. CO4