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PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Odd Semester Session 2023-24 CT -I

B. Tech. I Semester

Engineering Mathematics I (BAS103)

CO Number	Course Outcome
CO1	**Find/state/Define (L1-Remember)** the various terms and concepts of matrices and calculus such as rank of a matrix, maxima and minima of functions of two variables, beta and gamma functions, divergence theorem, etc. including ethics.
CO2	**Discuss/ Explain (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 compute **(L3- Apply)** the values of variables involved in matrices and calculus such as to solve the system of simultaneous linear equations including professional engineering practice 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 such as to examine maxima and minima of a function of two variables.

Time: 1.5 Hrs. M. M. 20

Section A

Q1. Attempt all questions: **(1X5 = 5 Marks)**

a) **Define** Skew-Symmetric matrix with an example. CO1

b) **Define** Rank of matrix. CO1

c) **Find** the eigen values of $3A^2$, If the eigen values of a matrix A of order 2 are 3, 5. CO1

d) If A is a non-singular matrix of order n, then **find** the rank of matrix A. CO1

e) **Find** the 3rd derivative of $e^x \log x$ CO1

Section B

Q2. Attempt all questions: **(2.5X4 = 10 Marks)**

a i) Examine the rank of the given matrix by reducing it to normal form CO2

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

OR

ii) Describe the inverse of the following matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ CO2

b i) **Explain** the Cayley-Hamilton theorem and verify theorem for the matrix $A=\begin{bmatrix} 2 & 1 & -1 \\ -1 & 2 & -1 \\ 1 & -2 & 2 \end{bmatrix}$ and hence compute A^{-1}. CO2

OR

ii) **Explain** the process of successive differentiation and verify the result $y_n = \frac{(n-1)!}{x}$, if $y = x^{n-1}\log x$ CO2

c i) **Calculate** the nth derivative, if $y = \frac{1}{6x^2 - 5x + 1}$ CO3

OR

ii) **Solve** the following system of equation,

$x+y+z = 3,\ x+2y+3z = 4,\ x+4y+9z = 6$ CO3

d i) **Show** that the matrix $\begin{bmatrix} \alpha + i\gamma & -\beta + i\delta \\ \beta + i\delta & \alpha - i\gamma \end{bmatrix}$ is unitary if $\alpha^2 + \beta^2 + \gamma^2 + \delta^2 = 1$ CO3

OR

ii) **Apply** the concept of elementary operations reduce the given matrix into diagonal form,

$$A=\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -1 \\ 0 & 0 & 3 \end{bmatrix}$$ CO3

Section C

Q 3. **(5X1 = 5 Marks)**

i) **Evaluate** the Eigen values and Eigen vectors for the given matrix $A=\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$. CO4

OR

ii) **Evalulate** $(y_n)_0$, If $y = (sin^{-1}x)^2$ CO4