Total nos. of printed pages: 2

PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Odd Semester

Session 2023-24



B. Tech. I Semester

Engineering Mathematics I (BAS103)

CO Number	Course Outcome
C01	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 problem 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 3^{rd} derivative of $e^x \log x$

CO₁

Section B

Q2. Attempt all questions:

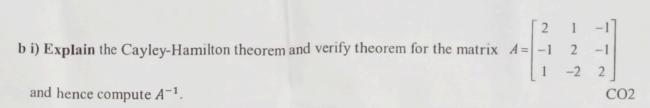
a i) Examine the rank of the given matrix by reducing it to normal form

(2.5X4 = 10 Marks)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
$$A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$$



OR

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

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

OR

ii) Solve the following system of equation,

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

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

Q3. (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 $y = (sin^{-1}x)^2$