UT-1/J-26: 51001
CALCULUS AND LINEAR ALGEBRA
BS-133

M.M. 75
Time-3 Hrs

Note: All questions in Part-A and Part-B are compulsory. Attempt any four questions from Part-C selecting at least one from each unit.

PART-A (15 Marks)

Q. No. – 1 Answer the following questions. 15x1=15

(i) Define Rolle's theorem.

(ii) Define Beta function.

(iii) Define Gamma function.

(iv) Find the formula to evaluate surface area of revolution?

(v) Define rank of a matrix.

(vi) Define linearly independent set of vectors.

(vii) Define Cramer's rule to solve the system of linear equation.

(viii) Give an example which shows that Q is not a vector space over R.

(ix) Define vector space over a field.

(x) Define basis of a vector space.

(xi) What is the Basis of C over R?

(xii) Define characteristics equation of a linear transformation.

(xiii) The sum of two eigen values and trace of a 3×3 matrix A are equal, then the value of det(A) is…...?

(xiv) Eigen values of an symmetric matrix are..?

(xv) Eigen values of a skew symmetric matrix are ….?

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PART-B (20 Marks)

UNIT-I

2 Solve $\lim_{x\to 0} \frac{sinx-x}{x^3}$ 5

UNIT-II

3 Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 1 & 1 & 1 \end{bmatrix}$ 5

UNIT-III

4 Find kernel and range of linear transformation $T(x+y, x-y)$. 5

UNIT-IV

5 Show that the matrix $\begin{bmatrix} 2 & -1 \\ 1 & 2 \end{bmatrix}$ is not orthogonal. 5

PART-C (40 Marks)

UNIT-I

6 Evaluate using Beta and Gamma function $\int_0^1 x^{3/2}(1-x)^{5/2}\,dx$ 10

7 Verify mean value theorem for $f(x) = x^3 - 3x + 1$ on $[-1,2]$ and find the value of c. 10

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UNIT-II

8 Reduce the following matrix to normal form and hence find the rank $\begin{bmatrix} 1 & 0 & 2 & 1 \\ 0 & 1 & -2 & 1 \\ 1 & -1 & 4 & 0 \\ -2 & 2 & 8 & 0 \end{bmatrix}$ 10

9 Investigate for consistency of the following equation and hence find the solution 10
$x + y + z = 6, \quad 2x - y + 3z = 11, \quad 3x + 4y - z = 2$

UNIT-III

10 Find the basis and dimension of the subspace generated by $(1,2,1), (2,4,2), (3,5,4)$. 10

11 Find the matrix representation of the linear transformation $T(x,y) = (2x+y, x-3y)$ with respect to the basis $\{(1,-1), (1,2)\}$ 10

UNIT-IV

12 Express the matrix $\begin{bmatrix} 1 & 2 & 1 \\ 0 & 2 & 1 \\ 1 & 1 & 3 \end{bmatrix}$ as a sum of symmetric and skew symmetric matrix. 10

13 Diagonalize the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. 10