RAGHU ENGINEERING COLLEGE

Autonomous

(Approved by AICTE, New Delhi, Accredited by NBA (CIV, MECH, ECE, CSE), NAAC with 'A+' grade & Permanently Affiliated to JNTU-GV Vizianagaram)

Dakamarri (V), Bheemunipatnam (M), Visakhapatnam District – 531 162 (A.P)

Phone: +91-8922-248001, 248002 Fax: + 91-8922-248011

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Course Code: 23BS101 | **L T P C**

I Year-I Semester | **3 0 0 3**

LINEAR ALGEBRA & CALCULUS

(Common to All Branches of Engineering)

Course Objectives:

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

UNIT - I: Matrices **10 Lectures**

Rank of a matrix by echelon form, normal form. Cauchy –Inverse of Non- singular matrices by Gauss-Jordan method.

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method, Factorization Method.
(sections 2.7, 2.8, 2.10, 28.6 of the text book)

Learning Outcomes:
At the end of the unit, the student will be able to

1. discuss the rank of a matrix using elementary operations (L2)
2. test the consistency of a systems of linear equations (L5)
3. determine the eigenvalues and eigenvectors of a matrix (L3)

UNIT- II: Linear Transformation and Orthogonal Transformation: **12 Lectures**

Eigen values, Eigen vectors and their properties (without Proof), Diagonalization of a matrix, Cayley Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley- Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation
(sections 2.13, 2.14, 2.15 - 2.18 of the text book)

Learning Outcomes:
At the end of the unit, the student will be able to

1. illustrate the inverse and the power of a matrix using Cayley-Hamilton theorem (L4)
2. determine an orthogonal matrix to obtain the diagonal form (L3)
3. examine the nature of a quadratic form (L3)

UNIT- III : Calculus **8 Lectures**

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems
(sections 4.3, 4.4 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. apply a mean value theorem to a continuous function. (L3)
2. classify the Taylor's and Maclaurin's series expansions of a function. (L4)
3. test the convergence of an infinite series. (L5)

UNIT- IV: Partial differentiation and Applications (Multi variable calculus) **10 Lectures**

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers

(sections 5.2, 5.5 – 5.7, 5.9, 5.11, 5.12 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. calculate the partial derivatives and use them to analyze a function. (L3)
2. discuss the maxima and minima of a function of several variables. (L2)
3. determine the Jacobian of an implicit function. (L3)

UNIT – V : Multiple Integrals (Multi variable Calculus) **10 Lectures**

Double integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

(sections 7.1 – 7.5, 7.7 of the text book)

Learning Outcomes:

At the end of the unit, the student will be able to

1. use the concept of integration of higher dimensions to evaluate a multiple integral. (L3)
2. determine the area of a region using multiple integrals. (L3)
3. describe the concept of change of order of integration in double integrals. (L2)

Course Outcomes:

After successful completion of the course, the students will be able to:

CO	COURSE OUTCOMES	BT
1	Develop matrix algebra techniques that is needed by engineers for practical applications.	L3
2	Compute Eigen Values and Eigen Vectors of a square matrix and classify the nature of the quadratic forms.	L4
3	Demonstrate a deep understanding of the statements and conditions of Rolle's Theorem and the Mean Value Theorem.	L3
4	Familiarize with functions of several variables which is useful in optimization.	L3
5	Familiarize with double and triple integrals of functions of several variables in two and three dimensions.	L3

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Correlation of COs with POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	1	1	-	-	1
CO2	2	2	1	-	-	-	-	1	1	-	-	1
CO3	3	2	1	-	-	-	-	1	1	-	-	1
CO4	2	1	1	-	-	-	-	1	1	-	-	1
CO5	2	1	1	-	-	-	-	1	1	-	-	1

Text books:

1. B.S.Grewal,HigherEngineeringMathematics,44/e,KhannaPublishers,2017.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus,14/e, Pearson Publishers, 2018.
4. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
5. Michael Greenberg, Advanced Engineering Mathematics, 9thedition, Pearson edn
6. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand, 2021.

Web References:

1. https://nptel.ac.in/courses/111/106/111106051.