



CVM UNIVERSITY

Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2025-26

Programme: B. Tech.

Semester: 2

Course Code: 102000216

Course Title: Linear Algebra, Vector Calculus and ODE

Course Group: Basic Science Course

Course Objectives: The course is intended to develop computational proficiency involving procedures in Matrices, Linear algebra, Vector Calculus and Differential Calculus which are useful to all engineering disciplines.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	1	0	4	50 / 18	50/18	Choose an item.	Choose an item.	100 /36

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Applications of Matrices: Matrices and Elementary Row Operations, Elementary matrices, Row equivalent matrices, Echelon and Reduced Row Echelon forms of a Matrix, Solutions of System of Nonhomogeneous and Homogeneous Linear Equations: Gaussian Elimination and Gauss-Jordan Method, Inverse of a Matrix by Gauss-Jordan Elimination Method, Rank of a Matrix, Cramer's rule, Eigenvalues and Eigenvectors of a Matrix, Caley-Hamilton Theorem.	10
2	Linear Algebra: Vector Spaces, Subspaces of a Vector Space, Linear combination of vectors, Linear Independence and Dependence of Vectors, Dimension of standard finite dimensional vector spaces, Basis.	6



3	Vector Calculus: Vector and Scalar Functions and Fields, Limits and Continuity of Vector Functions Derivatives of Vector Functions, Gradient of a Scalar Field, Directional Derivative and Applications, Divergence of a Vector Field and its Physical Interpretation, Curl of a Vector Field and its Physical Interpretation, Line Integrals, Line Integrals Independent of Path, Green's Theorem in the Plane (Without Proof), Application of Green's Theorem to find area of a plane region as a line integral, Surface Integrals, Divergence Theorem of Gauss (Without Proof), Stoke's Theorem (Without Proof)	11
4	Differential Equations of First Order: Bernoulli's Equation, Exact Differential Equations, Equations Reducible to Exact Equations, Clairaut's Equation	5
5	Higher Order Ordinary Differential Equations: Linear Differential Equations with Constant Coefficients, Inverse Operator, Rules for Finding Particular Integral when $X=e^{ax}$, $\sin(ax + b)$, $\cos(ax+b)$, x^m , $e^{(ax)}V$, V being a function of x . Method of Variation of Parameters (Second order only), Euler – Cauchy differential equations.	10

List of Practicals / Tutorials:

1	System of Linear Equations- Non-Homogeneous and Homogeneous
2	Rank of a matrix and inverse of a matrix by Gauss Jordan Method
3	Eigen Values and Eigen Vectors. Cayley's Hamilton Theorem and it's applications
4	Vector Spaces and Sub Spaces
5	Linear independence and linear dependence. Span of a vector space and Basis, Dimension
6	Gradient, directional derivative, divergence, curl
7	Line integral. Green's Theorem, Gauss Divergence Theorem and Stoke's Theorem
8	First Order differential equations- Bernoulli's Equation, Exact, Clairaut's
9	Higher order differential equations with constant coefficients having standard functions as X given in the syllabus
10	Method of Variation of Parameters, Euler-Cauchy differential equations



Reference Books:

1	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Student Edition
2	Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers
3	Engineering Mathematics Vol II S S Sastry, Prentice Hall of India
4	Elementary Linear Algebra Howard Anton, John Wiley & Sons
5	Introduction to Engineering Mathematics- Vol II H K Dass, S Chand Publication

Supplementary learning Material:

1	Lecture Note and video lectures prepared by faculties of CVM University
2	NPTEL Video Lectures Matrices and Linear Algebra: https://nptel.ac.in/courses/111106051/
3	NPTEL Video Lectures Differential Equations https://nptel.ac.in/courses/111106100/
4	NPTEL Vector Calculus https://nptel.ac.in/courses/111/105/111105122/

Pedagogy:

<ul style="list-style-type: none">• Direct Classroom teaching• Audio Visual presentations/demonstrations• Assignments/Quiz• Continuous assessment (Tutorials)• Interactive methods• Seminar/Poster presentation
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Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
15%	35%	30%	15%	5%	0%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Solve systems of linear equations and compute eigenvalues/eigenvectors of matrices using direct methods and the Cayley-Hamilton theorem.	20
CO-2	Demonstrate understanding of vector spaces, subspaces, basis, linear dependence/independence, and dimension.	20
CO-3	Learn different notions of vector and scalar fields with their properties. Understanding the major theorems (Green's, Stokes', Gauss') and some applications of these theorems	30
CO-4	Apply methods such as Bernoulli's Equation, Exact Equations, and Clairaut's Equation to model and solve first-order differential equations.	10
CO-5	To find solution of higher-order linear differential equations of constant coefficients by using different methods.	20

Curriculum Revision:

Version:	Choose an item.
Drafted on (Month-Year):	Click or tap to enter a date.
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	Click or tap to enter a date.