FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Computer Engineering)**

Semester: **II**

Course Code: **202000211**

Course Title: **Linear Algebra, Vector Calculus and ODE**

Course Group: **Basic Science Courses**

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)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	2	0	4	50 / 18	50 / 17	25 / 9	25 / 9	150 / 53

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

Detailed Syllabus:

Sr.	Contents	Hours
1	**Applications of Matrices:** Matrices and Elementary Row Operations, 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, Eigenvalues and Eigenvectors of a Matrix, Caley-Hamilton Theorem, Diagonalization	10
2	**Linear Algebra:** Vector Spaces, Subspaces of a Vector Space, Linear Independence and Dependence of Vectors, Span of a Set of Vectors, Basis and Dimension	08
3	**Vector Calculus:** Vector and Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Line Integrals, Line Integrals Independent of Path, Green's Theorem in the Plane (Without Proof), Surface Integrals, Divergence Theorem of Gauss (Without Proof), Stoke's Theorem (Without Proof)	12

4	**Differential Equations of First Order:** Bernoulli's Equation, Exact Differential Equations, Equations Reducible to Exact Equations, Clairaut's Equation	**05**
5	**Higher Order Ordinary Differential Equations:** Linear Differential Equations with Constant Coefficients, Inverse Operator, Rules for Finding Particular Integral when X=eax, sin(ax + b), cos(ax+b), xm, eaxV, V being a function of x. Method of Variation of Parameters, Method of Undetermined Coefficients, Euler – Cauchy differential equations, Legender's Linear Equation	**12**
	TOTAL	**47**

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	Diagonalization of a matrix.
5	Vector Spaces and Sub Spaces
6	Linear independence and linear independence. Span of a vector space and Basis, Dimension
7	Gradient, directional derivative, divergence, curl
8	Line integral. Green's Theorem, Gauss Divergence Theorem and Stoke's Theorem
9	First Order differential equations- Bernoulli's Equation, Exact, Clairaut's
10	Higher order differential equations with constant coefficients having standard functions as X given in the syllabus
11	Method of Variation of Parameters, Method of Undetermined Coefficients, Legender's Linear Equation

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
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:

- Direct Classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment (Tutorials)
- Interactive methods
- Seminar/Poster presentation

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**	
20%	40%	30%	10%	0%	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	Use the matrix methods and certain techniques to solve the system of linear equations and to find eigen values, eigen vectors of a matrix to check whether it is diagonalizable.	**20**
CO-2	Understand the abstract notions of vector space and the dimensionality of it.	**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 some methods of differential equations like Bernoulli's Equation, Exact, Clairaut's which remains to study at their plus two level.	**10**
CO-5	To find solution of higher-order linear differential equations of constant coefficients by using different methods.	**20**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025