|| Jai Sri Gurudev ||
Sri Adichunchanagiri Shikshana Trust (R)
SJB Institute of Technology
BGS Health and Education City, Dr. Vishnuvardhana Road, Kengeri, Bengaluru-560060
Approved by AICTE, New Delhi.
Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	I	**Course Type:**	ASC		
Course Title: Differential Calculus, Equations and Linear Algebra					
Course Code:	25MAT11C			**Credits:**	4
Teaching Hours/Week (L: T:P:S)			3:2:0:1	**Total Hours:**	50
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives

1. To facilitate the students with a foundation of differential calculus.
2. Apply differential equations to model and solve real-world problems in science and engineering
3. Develop the knowledge of Linear Algebra referring to matrices.

II. Teaching-Learning Process (General Instructions)

1. In addition to the traditional lecture method, innovative teaching methods shall be adopted.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Grading assignments, presentations, practical implementation of the problem, quizzes and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

Pre-requisites

1. Trigonometric formulae.
2. Differentiation, Integration and properties.

III. COURSE CONTENT

Module-1: Polar Curves and Curvature — 10 Hours

Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, and pedal forms. Implementation using MAT LAB.

Self study: Radius of curvature in polar form and parametric form.

RBT Levels: L1, L2 and L3

Module-2: Series Expansion, Indeterminate Forms and Multivariable Calculus — 10 Hours

Statement and problems on Maclaurin's series expansion for one variable. Indeterminate forms - (1^{∞}, 0^0 *and* ∞^0), L'Hospital's rulePartial differentiation: Definition total derivative - differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables. Implementation using MAT LAB.

Self-Study: Statement and problems on Taylor's series expansion for one variable.

RBT Levels: L1, L2 and L3

Module-3: Ordinary Differential Equations of First Order first degree	10 Hours
Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors $1/N\left(\partial M/\partial y - \partial N/\partial x\right)$ and $1/M\left(\partial N/\partial x - \partial M/\partial y\right)$.Orthogonal trajectories (cartesian), Study of Law of natural growth and decay. Implementation using MAT LAB.	
Self-study:. Linear differential equation, Orthogonal trajectories in polar form	
RBT Levels: L1, L2 and L3	
Module-4: Ordinary Differential Equations of Higher Order	10 Hours
Higher-order linear ordinary differential equations with constant coefficients, homogeneous and non-homogeneous equations (e^{ax}, sin(ax+b), cos(ax+b), x^n only), Cauchy's and Legendre's homogeneous differential equations. Applications: Solving governing differential equations of Mass Spring. Implementation using MAT LAB.	
Self-study: Method of variation of parameters	
RBT Levels: L1, L2 and L3	
Module-5: Linear Algebra	10 Hours
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations -Approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Traffic flow. Implementation using MAT LAB	
Self-study: Gauss-elimination method.	
RBT Levels: L1, L2 and L3	

IV. COURSE OUTCOMES

CO1	Apply the knowledge of single and multivariable calculus to evaluate the problems arising in engineering discipline
CO2	Apply methods to solve ordinary differential equations of first and higher order arising in engineering problems.
CO3	Apply the principles of linear algebra to solve systems of linear equations, eigenvalues and eigenvectors, real-world problems such as traffic flow.
CO4	Employ MATLAB techniques for analytical solutions, and graphical visualization of differential calculus and linear algebra concepts in engineering.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	S1	S2	S3	S4
CO1	3	2			1				1		1				
CO2	3	2			1				1		1				
CO3	3	2			1				1		1				
CO4	3	2			1				1		1				

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Name of the publisher	Edition and Year
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Ed., 2018.
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Ed., 2018

3	Linear Algebra and its Applications	Gilbert Strang	Cengage Publications	4th Ed., 2022
VII(b): Reference Books:				
1	Higher Engineering Mathematics	B.V. Ramana	McGraw-Hill Education	11th Ed., 2017
2	Engineering Mathematics	Srimanta Pal & Subodh C.Bhunia	Oxford University	3rd Ed., 2016
3	A Textbook of Engineering Mathematics	N. P. Bali and Manish Goyal	Laxmi Publications	10th Ed., 2022.
4	Higher Engineering Mathematics	H. K. Dass and Er. Rajnish Verma	S. Chand Publication	3rd Ed., 2014
5	Linear Algebra and its Applications	David C Lay	Pearson Publishers	4th Ed., 2018
VII(c): Web links and Video Lectures (e-Resources):				
• http://academicearth.org/ • VTU e-Shikshana Program • VTU EDUSAT Program • https://nptel.ac.in/courses/111106135 • https://nptel.ac.in/courses/111105160 • https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ • https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/				
VIII: Activity Based Learning				
Assignments, quiz and presentation.				