SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

I Semester

22MATC11	Mathematics-I for Civil Engineering stream	(2:2:2:0)4

Contact Hours:40

Course objectives:

- To familiarize the importance of calculus associated with one variable and two variables for civil engineering.
- To analyze Civil engineering problems applying Ordinary Differential equations.
- To develop the knowledge of Linear Algebra refereeing to matrices.

Course outcome

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Apply the knowledge of calculus to solve problems related to polar curves.			1,2,12
CO-2	Learn the notion of partial differentiation to compute rate of change of multivariate functions.			1,2,12
CO-3	Analyze the solution of linear and nonlinear ordinary differential equations.			1,2,12
CO-4	Make use of matrix theory for solving for system of linear equations and compute eigen values and eigenvectors.			1,2,12
CO-5	Familiarize with modern mathematical tools namely Mathematica/Matlab/ Python/Scilab			1,2,12

Pos	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	1	1										1

UNIT-1: Calculus

Introduction to polar coordinates and curvature relating to Civil engineering. Polar coordinates, Polar curves, angle between the radius vector and the tangent, and angle between two curves. Pedal equations. Curvature and Radius of curvature- Cartesian, Parametric, Polar and Pedal forms. Problems.

Self-study: Center and circle of curvature, evolutes and involutes.

Applications: Structural design and paths, Strength of materials, Elasticity. **(8hours)**

UNIT-2: Series Expansion and Multivariable Calculus

Introduction to series expansion and partial differentiation in the field of Civil engineering applications.

Taylor's and Maclaurin's series expansion for one variable (Statement only)–problems. Indeterminate forms-L Hospital's rule, problems.

Partial differentiation, total derivative-differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables- Problems.

Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Applications: Computation of stress and strain, Errors and approximations, Estimating the critical points and extreme values. **(8hours)**

UNIT-3 Ordinary Differential Equations (ODEs) of first order

Introduction to first-order ordinary differential equations pertaining to the applications for Civil engineering.

Linear and Bernoulli's differential equations. Exact and reducible to exact differential

equations - Integrating factors on $\frac{1}{M}\left(\frac{\partial M}{\partial y}-\frac{\partial M}{\partial x}\right)$ and $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial M}{\partial x}\right)$ Orthogonal trajectories and Newton's law of cooling. Nonlinear differential equations: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations -Problems.

Self-Study: Applications of ODEs in Civil Engineering problems like bending of the beam, whirling of shaft, solution of non-linear ODE by the method of solvable for x and y.

Applications: Rate of Growth or Decay, Conduction of heat. **(8hours)**

UNIT-4 Ordinary Differential Equations of higher order

Importance of higher-order ordinary differential equations in Civil Engineering applications. Higher-order linear ODEs with constant coefficients-Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations-Problems.

Self-Study: Formulation and solution of Cantilever beam. Finding the solution by the method of undetermined coefficients.

Applications: Oscillations of a spring, Transmission lines, Highway engineering. **(8hours)**

UNIT-5 Linear Algebra

Introduction of linear algebra related to Civil Engineering applications. Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations-Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigen value and Eigenvector.

Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.

Applications: Structural Analysis, Balancing equations. **(8hours)**

List of Laboratory experiments (2hours/week per batch/batch strength 15)

10 lab sessions + 1 repetition class + 1 Lab Assessment

- 2D plots for Cartesian and polar curves
- Finding angle between polar curves, curvature and radius of curvature of a given curve
- Finding partial derivatives, Jacobian and plotting the graph
- Applications to Maxima and Minima of two variables
- Solution of first order differential equation and plotting the graphs
- Solutions of Second-order ordinary differential equations with initial/boundary conditions
- Solution of a differential equation of oscillations of a spring/deflection of a beam with different loads
- Numerical solution of system of linear equations, test for consistency and graphical representation
- Solution of system of linear equations using Gauss-Seidel iteration
- Compute eigenvalues and eigen vectors and find the largest and smallest eigenvalue by
- Rayleigh power method.

Suggested software's: Mathematica/MatLab/Python/Scilab

Reference Books:

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education,11th Ed., 2017.

2. Srimanta Pal & Subodh C. Bhunia: “Engineering Mathematics” Oxford University Press, 3rdEd., 2016.

3. N. P Bali and Manish Goyal: “A textbook of Engineering Mathematics” LaxmiPublications,10th Ed., 2022.

4. C. Ray Wylie, Louis C. Barrett: “Advanced Engineering Mathematics” McGraw–Hill Book Co., Newyork, 6thEd., 2017.

5. Gupta C. B, Sing S.R and Mukesh Kumar: “Engineering Mathematic for Semester I and Mc-Graw Hill Education (India) Pvt. Ltd 2015.

6. H. K. Dass and Er. Rajnish Verma: “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.

7. James Stewart: “Calculus” Cengage Publications, 7th Ed., 2019.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

I Semester

22MATE11	Mathematics-I for Electrical & Electronics Stream	(2:2:2)4

Contact Hours:40

Course objectives: The goal of the course

Mathematics-I for Electrical & Electronics Engineering Stream (**22MATE11**) is to

- **Familiarize** the importance of calculus associated with one variable and multivariable for Electrical & Electronics Engineering.
- **Analyze** Electrical & Electronics engineering problems by applying Ordinary Differential Equations.
- **Apply** the knowledge of modular arithmetic to computer algorithms.
- **Develop** the knowledge of Linear Algebra to solve the system of equations.

Course outcomes (COs):

Description of the Course Outcome:		Mapping to Pos(1-12)/PSOs (1,2)		
		Substantial	Moderate	Slight
CO-1	Apply the knowledge of calculus to solve problems related to polar curves and learn the notion of partial differentiation to compute rate of change of multi variate functions.	--	--	1
CO-2	Analyze the solution of linear and nonlinear ordinary differential equations.			
CO-3	Apply the concept of change of order of integration and variables to evaluate multiple Integrals and their usage in computing area and volume.	--	2	--
CO-4	Make use of matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors			
CO-5	Familiarize with modern mathematical tools namely MATHEMATICA /MATLAB /PYTHON/SCILAB			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1	2	--	---	--	--	--	--	--	--	--	--	--	--

Course Contents:

Unit–I Calculus

Introduction to polar coordinates and curvature relating to EC & EE Engineering Applications: Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature-Cartesian, Parametric, Polar and Pedal forms. Problems.

Self study: Center and circle of curvature, evolutes and involutes.

Applications: Communication signals, Manufacturing of microphones and Image Processing.

08 Hrs.

Unit–II Series Expansion and Multivariable Calculus

Introduction of series expansion and partial differentiation in EC&EE Engineering Applications. Taylor's and Maclaurin's series expansion for one variable (Statement only)– problems. Indeterminate forms-L Hospital's rule-Problems. Partial differentiation, total derivative-differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self -study: Euler's Theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Applications: Series expansion in communication signals, Errors and approximations, and vector calculus. **08 Hrs.**

Unit–III Ordinary Differential Equations (ODEs) of first order

Introduction to first-order ordinary differential equations pertaining to the applications for EC&EE engineering.

Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations-Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$,-Orthogonal trajectories, L-R and C-R circuits, Problems.

Non-linear differentia equations: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems.

Self-Study: Applications of ODEs, Solvable for x and y.

Applications of ordinary differential equations: Rate of Growth or decay, Conduction of heat.

08 Hrs.

Unit–IV Integral Calculus

Introduction to Integral Calculus in EC & EE Engineering Applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Centre of gravity.

Applications: Antenna and wave propagation, Calculation of optimum power in electrical circuits, field theory. **08 Hrs.**

Unit-V Linear Algebra

Introduction of linear algebra related to EC & EE engineering Applications.

Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector.

Self study: Solution of system of equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.

Applications of Linear Algebra: Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution. **08 Hrs.**

List of Laboratory experiments (2 hours/week per batch/batch strength15)

10 lab sessions +1 repetition class +1 Lab Assessment

1 2D plots for Cartesian and polar curves.

2 Finding angle between polar curves, curvature and radius of curvature of a given curve.

3 Finding partial derivatives, Jacobian and plotting the graph.

4 Applications to Maxima and Minima of two variables.

5 Solution of first-order differential equation and plotting the graphs.

6 Program to compute area, volume and centre of gravity.

7 Evaluation of improper integrals

8 Numerical solution of system of linear equations, test for consistency and graphical representation.

9 Solution of system of linear equations using Gauss-Seidel iteration method.

10 Compute eigen values and eigen vectors and find the largest and smallest eigen value by Rayleigh power method.

Suggested software's: Mathematica /MatLab /Python/ Scilab

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year) Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.,2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. **V. Ramana:** "Higher Engineering Mathematics", McGraw-Hill Education,11th Ed.,2017
2. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed.,2016.
3. **N. P. Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics", McGraw–Hill Book Co., New York, 6th Ed.,2017.
5. **Gupta C. B, Sing S. R and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc- Graw Hill Education (India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics", S. Chand Publication, 3rd Ed.,2014.
7. **James Stewart: "**Calculus", Cengage Publications, 7th Ed.,2019.
8. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

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- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

I Semester

22MATM11	Mathematics-I for ME Stream	(2:2:2:0)4

Contact Hours:40

Course Learning Objectives (CLOs):

- Familiarize the importance of calculus associated with one variable and two variables for Mechanical engineering.
- Analyze Mechanical engineering problems applying Ordinary Differential Equations.
- Develop the knowledge of Linear Algebra refereeing to matrices.

Course outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to Pos (1-12)/PSOs (1,2)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply the knowledge of calculus to solve problems related to polar curves.	--	--	1
CO-2	Learn the notion of partial differentiation to computer ate of change of multivariate functions.	--	--	1
CO-3	Analyze the solution of linear and non-linear ordinary differential equations.	--	2	--
CO-4	make use of matrix theory for solving for system of linear equations and compute eigenvalues and eigenvectors	--	--	1
CO-5	familiarize with modern mathematical tools namely MATHEMATICA /MATLAB/ PYTHON/SCILAB	--	2	--

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1	2	--	---	--	--	--	--	--	--	--	--	--	--

Course Contents:

Unit-I: Calculus

Introduction to polar coordinates and curvature relating to mechanical engineering. Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems.

Self-study: Center and circle of curvature, evolutes and involutes. Applications: Applied Mechanics, Strength of Materials, Elasticity. **08 Hrs.**

Unit II: Series Expansion and Multivariable Calculus

Introduction to series expansion and partial differentiation in the field of Mechanical engineering applications. Taylor's and Maclaurin's series expansion for one variable (Statement only)– problems.
Indeterminate forms- L Hospital's rule, Problems.
Partial differentiation, total derivative-differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables- Problems.

Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with a single constraint.

Applications: Computation of stress and strain, Errors and approximations in Manufacturing process, Estimating the critical points and extreme values, vector calculus. **08 Hrs.**

Unit–III Ordinary Differential Equations (ODEs) of first order

Introduction to first-order ordinary differential equations pertaining to the applications for mechanical engineering. Linear and Bernoulli's differential equations. Exact and reducible to exact.
Differential equations-Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$.
Orthogonal trajectories, Newton's law of cooling.
Non linear differential equations: Introduction to general and singular solutions, solvable for p only, Clairaut's equations, reducible to Clairaut's equations - Problems.

Self-Study: Applications of ODEs: L-Rcircuits. Solvable for x and y.

Applications: Rate of Growth or Decay, Conduction of heat. **08 Hrs.**

Unit–IV Ordinary Differential Equations of higher order

Importance of higher-order ordinary differential equations in Mechanical Engineering applications. Higher-order linear ODEs with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre homogeneous differential equations-Problems.

Self-Study: Formulation and solution of oscillations of a spring. Finding the solution by the method of undetermined coefficients.

Applications: Applications to oscillations of a spring, Mechanical systems and Transmission lines. **08 Hrs.**

Unit-V Linear Algebra

Introduction of linear algebra related to Mechanical Engineering applications.

Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations -Gauss-elimination method, Gauss- Jordan method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector.

Self-Study: Solution of a system of equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley-Hamilton theorem. **08 Hrs.**

List of Laboratory experiments (2hours/week per batch/batch strength 15)

10 lab sessions + 1 repetition class + 1 Lab Assessment

- 2D plots for Cartesian and polar curves
- Finding angle between polar curves, curvature and radius of curvature of a given curve
- Finding partial derivatives, Jacobian and plotting the graph
- Applications to Maxima and Minima of two variables
- Solution of first order differential equation and plotting the graphs
- Solutions of Second-order ordinary differential equations with initial/boundary conditions
- Solution of a differential equation of oscillations of a spring/deflection of a beam with different loads
- Numerical solution of system of linear equations, test for consistency and graphical representation
- Solution of system of linear equations using Gauss-Seidel iteration
- Compute eigenvalues and eigen vectors and find the largest and smallest eigenvalue by
- Rayleigh power method.

Suggested software's: Mathematica/MatLab/Python/Scilab

Text Book:

1. B.S. Grewal: "Higher Engineering Mathematics", Khanna publishers,44th Ed.,2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

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HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

I Semester

22MATS11	Mathematics-1 for CSE	(2-2-2)4

Contact Hours: 40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Familiarize the importance of calculus associated with one variable and multivariable for computer science and engineering.
- Analyze computer science and engineering problems by applying Ordinary Differential Equations.
- Apply the knowledge of modular arithmetic to computer algorithms.
- Develop the knowledge of Linear Algebra to solve the system of equations.

Course Out comes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply the knowledge of calculus to solve problems related to polar curves and learn the notion of partial differentiation to compute rate of change of multivariate functions	-	-	1,2,12
CO-2	Analyze the solution of linear and nonlinear ordinary differential equations	-	-	1,2,12
CO-3	Get acquainted and apply modular arithmetic to computer algorithms	-	-	1,2,12
CO-4	Make use of matrix theory for solving system of linear equations and compute eigen values and eigenvectors	-	1,2	12
CO-5	Familiarize with modern mathematical tools namely MATHEMATICA / MATLAB / PYTHON/SCILAB	-	-	1,2,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.2	1.2	-	-	-	-	-	-	-	-	-	1.0	-	-	-	-

Pre-requisites: None

Contents

Unit-I Calculus

Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature-Cartesian, Parametric, Polar and Pedal forms- Problems.

Self-study: Centre and circle of curvature, evolutes and involutes.

Applications: Computer graphics, Image processing. **8 Hrs.**

Unit-II Series Expansion and Multi variable Calculus

Taylor's and Maclaurin's series expansion for one variable (Statement only)– problems. Indeterminate forms- L 'Hospital's rule-Problems. Partial differentiation, total derivative –differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Applications: Series expansion in computer programming, Errors and approximations, calculators. **8 Hrs.**

Unit-III Ordinary Differential Equations (ODE) of first Order

Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations-Integrating factors on $\frac{1}{N}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$ *and* $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$- Orthogonal trajectories, Problems Non-linear differential equations: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems.

Self-Study: Applications of Odes, Solvable for x and y.

Applications of ordinary differential equations: Rate of Growth or Decay, Conduction of heat-R L&C-R circuits. **8 Hrs.**

Unit-IV Modular Arithmetic:

Introduction to Congruences, Linear Congruences, the remainder theorem, Solving Polynomials, Linear Diophantine Equation, System of linear Congruences, Euler's Theorem, Wilson Theorem and Fermat's little theorem. Applications of Congruences-RS Algorithm.

Self-Study: Divisibility, GCD, Properties of Prime Numbers, Fundamental theorem of Arithmetic.

Applications: Cryptography, encoding and decoding, RS Applications in public key encryption. **8 Hrs.**

Unit-V Linear Algebra

Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations-Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigenvectors, Raleigh's power method to find the dominant Eigen value and Eigen vector. Problems.

Self-Study: Solution of system of equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley Hamilton Theorem.

Applications: Boolean matrix, Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution. **8 Hrs.**

List of Laboratory experiments (2 hours/ week per batch/ batch strength 15)
10 lab sessions+ 1repetitionclass+1 Lab Assessment

1 2D plots for Cartesian and Polar curves
2 Finding angle between polar curves, curvature and radius of curvature of a given curve
3 Finding partial derivatives, Jacobian and plotting the graph
4 Applications to Maxima and Minima of two variables
5 Solution of first-order differential equation and plotting the graphs
6 Finding GCD using Euclid's Algorithm
7 Applications of Wilson's theorem
8 Numerical solution of system of linear equations, test for consistency and graphical representation
9 Solution of system of line are equations using Gauss- Seidel iteration
10 Compute eigen values and eigen vectors and find the largest and smallest eigen value by Rayleigh power method.

Suggested software's: Mathematica/ MatLab/ Python/ Scilab

Reference Books:

1 B. S. Grewal: "Higher Engineering Mathematics", Hanna publishers, 44th Ed., 2021.

2 E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons,10th Ed.,2018.
3 V. Ramana: "Higher Engineering Mathematics" McGraw- Hill Education, 11th Ed.2017.
4 Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press,3rd Ed., 2016.
5 N.P Bali and Manish Goyal: "A text book of Engineering Mathematics Laxmi Publications, 10th Ed.,2022.
6 C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" Mc Graw–Hill Book Co., New York, 6th Ed., 2017.
7 Gupta C. B. Sing S. R and Mukesh Kumar: "Engineering Mathematic.

Web links and Video Lectures (e-Resources):

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- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

II semester

22MATC21	Mathematics-2 for Civil	(2-2-2)4

Contact Hours:40 Theory + 12 Lab Sessions

Course objectives:

- Familiarize the importance of Integral calculus and Vector calculus essential for civil engineering.
- Analyze Civil engineering problems by applying Partial Differential Equations.
- Develop the knowledge of solving civil engineering problems numerically.

Course outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Apply the knowledge of multiple integrals to compute area and volume.			1,2,12
CO-2	Understand the applications of vector calculus refer to solenoidal, irrotational vectors, line.			1,2,12
CO-3	Demonstrate partial differential Equations and their solutions for physical interpretations.			1,2,12
CO-4	Apply the knowledge of numerical methods in solving physical and engineering phenomena.			1,2,12
CO-5	Get familiarize with modern mathematical tools namely Mathematica/MatLab/Python/Scilab.			1,2,12

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	1	1										1

Pre-requisites: Knowledge of fundamentals of calculus.

Unit-1 (Integral Calculus)

Introduction to Integral Calculus in Civil Engineering applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Centre of gravity.

Applications: Applications to mathematical quantities (Area, Surface area, Volume), Analysis of probabilistic models. **8 hours**

Unit-2 (Vector Calculus)

Introduction to Vector Calculus in Civil Engineering applications.

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence- physical interpretation, solenoidal and irrotational vector fields. Problems.

Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems.

Self-Study: Volume integral and Gauss divergence theorem.

Applications: Heat and mass transfer, oil refinery problems, environmental engineering. Analysis of streamlines, velocity and acceleration of a moving particle. **8 hours**

Unit-3 (Partial Differential Equations) (PDEs)

Importance of partial differential equations for Civil Engineering applications.

Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation.

Self-Study: Solution of one-dimensional heat equation and wave equation by the method of separation of variables.

Applications: Design of structures (vibration of rod/membrane) **8 hours**

Unit-4 (Numerical Methods-1)

Importance of numerical methods for discrete data in the field of Civil Engineering.

Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods (only formulae). Problems.
Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

Numerical integration: Trapezoidal, Simpson's (1/3)rd and(3/8)th rules(without proof). Problems.

Self-Study: Bisection method, Lagrange's inverse Interpolation.

Applications: Estimating the approximate roots, extremum values, Area, volume, and surface area. Finding approximate solutions to civil engineering problems. **8 hours**

Unit-5 (Numerical Methods-2)

Introduction to various numerical techniques for handling Civil Engineering applications.

Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree-Taylor's series method,
Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems.

Self-Study: Adam-Bash forth method.
Applications: Finding approximate solutions to ODE related to civil engineering fields.
8 hours

List of Laboratory experiments (2hours/week per batch/batchstrength15)
10 lab sessions + 1repetitionclass + 1LabAssessment

1 Program to compute surface area, volume and centre of gravity.
2 Evaluation of improper integrals.
3 Finding gradient, divergent, curl and their geometrical interpretation.
4 Verification of Green's theorem.
5 Solution of one-dimensional heat equation and wave equation.
6 Solution of algebraic and transcendental equations by Regula-Falsi and Newton- Raphson method.
7 Interpolation/Extrapolation using Newton's forward and backward difference formula.
8 Computation of area under the curve using Trapezoidal, Simpson's (1/3)rd and (3/8)th rule Solution of ODE of first order and first degree by Taylor's series and Modified Euler's method.
9 Solution of ODE of first order and first degree by Runge-Kutta 4th order and Milne's predictor-corrector method.

Textbook

1. B.S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", JohnWiley&Sons,10th Ed., 2018.

Reference Books

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education,11th Ed., 2017.
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw–Hill Book Co., New York, 6th Ed.,2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd. 2015.
6. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication,3rd Ed., 2014.
7. James Stewart: "Calculus" Cengage Publications, 7th Ed., 2019.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

II semester

22MATM21	Mathematics-2 for Mechanical Stream	(2-2-2)4

Contact Hours:40 Theory + 12 Lab Sessions

Course objectives:

- Familiarize the importance of Integral calculus and Vector calculus essential for Mechanical engineering.
- Analyze Mechanical engineering problems by applying Partial Differential Equations.
- Develop the knowledge of solving mechanical engineering problems numerically.

Course outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Apply the knowledge of multiple integrals to compute area and volume.			1,2,12
CO-2	Understand the applications of vector calculus refer to solenoidal, irrotational vectors, line.			1,2,12
CO-3	Demonstrate partial differential Equations and their solutions for physical interpretations.			1,2,12
CO-4	Apply the knowledge of numerical methods in solving physical and engineering phenomena.			1,2,12
CO-5	Get familiarize with modern mathematical tools namely Mathematica/MatLab/Python/Scilab.			1,2,12

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	1	1	1									

Pre-requisites: Knowledge of fundamentals of calculus.

Course content:

Unit-1 (Integral Calculus)

Introduction to Integral Calculus in Mechanical Engineering applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Centre of gravity.

Applications: Applications to mathematical quantities (Area, Surface area, Volume), Analysis of probabilistic models. **8 hours**

Unit-2 (Vector Calculus)

Introduction to Vector Calculus in Mechanical Engineering applications.

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence- physical interpretation, solenoidal and irrotational vector fields. Problems.

Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems.

Self-Study: Volume integral and Gauss divergence theorem.

Applications: Heat and mass transfer, oil refinery problems, environmental engineering. Analysis of streamlines, velocity and acceleration of a moving particle. **8 hours**

Unit-3 (Partial Differential Equations) (PDEs)

Importance of partial differential equations for Mechanical Engineering applications.

Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation.

Self-Study: Solution of one-dimensional heat equation and wave equation by the method of separation of variables.

Applications: Design of structures (vibration of rod/membrane) **8 hours**

Unit-4 (Numerical Methods-1)

Importance of numerical methods for discrete data in the field of Mechanical Engineering. Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods (only formulae). Problems.

Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

Numerical integration: Trapezoidal, Simpson's (1/3)rd and (3/8)th rules (without proof). Problems.

Self-Study: Bisection method, Lagrange's inverse Interpolation.

Applications: Estimating the approximate roots, extremum values, Area, volume, and surface area. Finding approximate solutions to Mechanical Engineering problems. **8 hours**

Unit-5 (Numerical Methods-2)

Introduction to various numerical techniques for handling Mechanical Engineering applications.

Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree-Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems.

Self-Study: Adam-Bash forth method.

Applications: Finding approximate solutions to ODE related to mechanical engineering fields.

8 hours

List of Laboratory experiments (2hours/week per batch/batchstrength15)

10 lab sessions + 1repetitionclass + 1LabAssessment

1. Program to compute surface area, volume and centre of gravity.
2. Evaluation of improper integrals.
3. Finding gradient, divergent, curl and their geometrical interpretation.
4. Verification of Green's theorem.
5. Solution of one-dimensional heat equation and wave equation.
6. Solution of algebraic and transcendental equations by Regula-Falsi and Newton-Raphson method.
7. Interpolation/Extrapolation using Newton's forward and backward difference formula.
8. Computation of area under the curve using Trapezoidal, Simpson's(1/3)rd and (3/8)th rule Solution of ODE of first order and first degree by Taylor's series and Modified Euler's method.

9 Solution of ODE of first order and first degree by Runge-Kutta 4th order and Milne's predictor-corrector method.

Textbook

1. B.S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44thEd., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", JohnWiley&Sons,10th Ed., 2018.

Reference Books

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2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rdEd.,2016.
3. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed.,2022.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw–Hill Book Co., New york,6th Ed.,2017.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I And II", Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication,3rd Ed., 2014.
7. James Stewart: "Calculus" Cengage Publications, 7th Ed.,2019.

Jennifer K

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

II Semester

22MATE21	Mathematics-2 for Electrical & Electronic Stream	(2-2-2)4

Contact Hours:40 Theory + 12 Lab Sessions

Course Objectives: The goal of the course

Mathematics-II for Electrical & Electronics Engineering Stream (**22MATE21**) is to

- **Familiarize** the importance of Integral calculus and Vector calculus essential for electronics and electrical engineering.
- **Analyse** Electronics and Electrical Engineering problems by applying Partial Differential Equations.
- **Develop** the knowledge of solving electronics and electrical engineering problems numerically.

Course outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO1	Understand the applications of vector calculus refer to solenoidal, irrotational vectors, line Integral and surface integral.			1,2,12
CO2	Demonstrate the idea of Linear dependence and independence of sets in the vector space, And linear transformation			1,2,12
CO3	To understand the concept of Laplace transform and to solve initial value problems.			1,2,12
CO4	Apply the knowledge of numerical methods in solving physical and engineering phenomena.			1,2,12
CO5	Get familiarize with modern mathematical tools namely SCILAB/**PYTHON**/MATLAB			1,2,12

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	1	1										1

Pre-requisites: Knowledge of fundamentals of calculus.

Unit-1 (Vector Calculus)

Introduction to Vector Calculus in EC&EE Engineering Applications.

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence-physical interpretation, solenoidal and irrotational vector fields. Problems.

Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems.

Self-Study: Volume integral and Gauss divergence theorem.

Applications: Conservation of laws, Electrostatics, Analysis of streamlines and electric potentials. **8 hours**

Unit-2 (Vector Space and Linear Transformations)

Importance of Vector Space and Linear Transformations in the field of EC&EE Engineering Applications.

Vector spaces: Definition and examples, subspace, linear span, linearly independent and dependent sets, Basis and dimension.

Linear Transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation. Change of coordinates, Rank and nullity of a linear operator, Rank-Nullity theorem. Inner product spaces and orthogonality.

Self-study: Angles and Projections. Rotation, reflection, contraction and expansion. **Applications:** Image processing, AI & ML, Graphs and networks, computer graphics. **8 hours**

Unit-3 (Laplace Transform)

Importance of Laplace Transform for EC &EE Engineering Applications.

Existence and Uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence, Properties–Linearity, Scaling, t-shift property, s-domain shift, differentiation in the s-domain, division by t, differentiation and integration in the time domain, LT of special functions- periodic functions(square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside Unit step function, Unit impulse function.

Inverse Laplace Transforms:

Definition, properties, evaluation using different methods, convolution theorem (without proof), problems, and Applications to solve ordinary differential equations.

Self-Study: Verification of convolution theorem.

Applications: Signals and systems, Control systems, LR, CR & LCR circuits. **8 hours**

Unit-4 (Numerical methods -1)

Importance of numerical methods for discrete data in the field of EC&EE Engineering Applications.

Solution of algebraic and transcendental equations: Regula-Falsi method and Newton-Raphson method (only formulae). Problems. Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

N**umerical integration**: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.

S**elf-Study:** Bisection method, Lagrange's inverse Interpolation, Weddle's rule.

Applications: Estimating the approximate roots, extremum values, Area, volume, and surface area. **8 hours**

Unit-5 (Numerical Methods -2)

Introduction to various numerical techniques for handling EC& EE Applications. Numerical Solution of Ordinary Differential Equations (ODEs):

Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor- corrector formula (No derivations of formulae). Problems.

Self-Study: Adam-Bashforth method.

Applications: Estimating the approximate solutions of ODE for electric circuits. **8 hours**

List of Laboratory experiments (2hours/week per batch/batchstrength15)
10 lab sessions + 1repetition class + 1Lab Assessment

1. Finding gradient, divergent, curl and their geometrical interpretation. Verification of Green's theorem.
2. Computation of basic and dimension for a vector space and Graphical representation of linear transformation.
3. Visualization in time and frequency domain of standard functions.
4. Computing inverse Laplace transform of standard functions.
5. Laplace transform of convolution of two functions.
6. Solution of algebraic and transcendental equations by Regula-Falsi and Newton-Raphson method.
7. Interpolation/Extrapolation using Newton's forward and backward difference formula.
8. Computation of area under the curve using Trapezoidal, Simpson's (1/3)rd and (3/8)th rule
9. Solution of ODE of first order and first degree by Taylor's series and Modified Euler's method.
10. Solution of ODE of first order and first degree by Runge-Kutta 4th order and Milne's predictor-corrector method.

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44^{th} Ed., 2021.

2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

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2. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed.,2016.
3. **N.P Bali and Manish Goyal**: "A text book of Engineering Mathematics" L axmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett: "**Advanced Engineering Mathematics" McGraw–Hill Book Co., New York, 6th Ed., 2017.
5. **Gupta C.B, Sing S. Rand Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc- Graw Hill Education (India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
7. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
8. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed.,2017.

Jennifer K

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

II semester

22MATS21	Mathematics-2 for CSE	(2-2-2)4

Contact Hours:40 Theory + 12 Lab Sessions

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Familiarize the importance of Integral calculus and Vector calculus.
- Learn vector spaces and linear transformations.
- Develop the knowledge of numerical methods and apply them to solve transcendental and differential equations.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.	-	-	1,2,12
CO-2	Understand the applications of vector calculus refer to solenoidal, and irrotational vectors, Orthogonal curvilinear coordinates.	-	-	1,2,12
CO-3	Demonstrate the idea of Linear dependence and independence of sets in the vector space, and linear transformation	-	-	1,2,12
CO-4	Apply the knowledge of numerical methods in analysing the discrete data and solving the physical and engineering problems.	-	-	1,2,12
CO-5	Get familiarize with modern mathematical tools namely MATHEMATICA/MATLAB/PYTHON/ SCILAB	-	-	1,2,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	1.4	1.4	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-

Pre-requisites: Knowledge of fundamentals of calculus.

Course Contents:

Unit I (Integral Calculus)

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Center of gravity, Duplication formula.

Applications: Antenna and wave propagation, Calculation of optimum value in various geometries. Analysis of probabilistic models. **8 Hrs.**

Unit II (Vector Calculus)

Introduction to Vector Calculus in Computer Science & Engineering: Scalar and vector fields. Gradient, directional derivative, curl and divergence – physical interpretation, solenoidal and irrotational vector fields. Problems.

Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. Problems.

Self-Study: Volume integral.

Applications: Conservation of laws, Electrostatics, Analysis of streamlines **8 Hrs.**

Unit III (Vector Spaces and Linear Transformations)

Vector spaces: Definition and examples, subspace, linear span, linearly independent and dependent sets, Basis and dimension. Problems.

Linear transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation. Change of coordinates, Rank and nullity of a linear operator, rank-nullity theorem. Inner-product spaces and orthogonality. Problems.

Self-study: Angles and Projections. Rotation, reflection, contraction and expansion.

Applications: Image processing, AI&ML, Graphs and networks, computer graphics. **8 Hrs.**

Unit IV (Numerical Methods–1)

Numerical methods: Solution of algebraic and transcendental equations-Regula- Falsi and Newton-Raphson methods (only formulae). Problems. Finite differences, Interpolation using Newton's forward and backward difference formulae, Newtons divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

Numerical integration: Trapezoidal, Simpson's (1/3)rd and (3/8)th rules (without proof). Problems.

Self study: Bisection method, Lagrange's inverse interpolation.

Applications: Estimating the approximate roots, extremum values, Area, volume, and surface area. Errors infinite precision. **8 Hrs.**

Unit V (Numerical Methods–2)

Numerical Solution of Ordinary Differential Equations (ODE's): Numerical solution of ordinary differential equations of first order and first degree – Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems.

Self-Study: Adam-Bashforth method.

Applications: Estimating the approximate solutions of ODE **8 Hrs**.

List of Laboratory experiments (2hours/week per batch/ batch strength 15) 10 lab sessions + 1 repetition class + 1 Lab Assessment

1 Program to compute area, surface area, volume and centre of gravity
2 Evaluation of improper integrals
3 Finding gradient, divergent, curl and their geometrical interpretation
4 Computation of basis and dimension for a vector space and Graphical representation of linear transformation
5 Computing the inner product and orthogonality
6 Solution of algebraic and transcendental equations by Ramanujan's, Regula- Falsi and Newton-Raphson method.
7 Interpolation/Extrapolation using Newton's forward and back ward difference Formula.
8 Computation of area under the curve using Trapezoidal, Simpson's(1/3)rd and(3/8)th rule.
9 Solution of ODE of first order and first degree by Taylor's series and Modified Euler's method.
10 Solution of ODE of first order and first degree by Runge-Kutta 4th order and Milne's predictor-corrector method.

Suggested software's: Mathematica /MatLab/Python/Scilab .

Reference Books:

1 B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2 E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons,10th Ed., 2018.
3 V. Ramana: "Higher Engineering Mathematics" McGraw-Hil Education, 11th Ed.2017

4 Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
5 N.P Bali and Manish Goyal: "A text book of Engineering Mathematics" Laxmi Publications,10th Ed.,2022.
6 C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw–Hill Book Co., Newyork, 6th Ed.,2017.
7 Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd 2015.
8 H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S. Chand Publication,3rd Ed.,2014.
9 James Stewart: "Calculus" Cengage Publications, 7th Ed., 2019.
10 David C Lay: "Linear Algebra and its Applications", Pearson Publishers,4th Ed.,2018.
11 Gareth Williams: "Linear Algebra with applications", Jones Bartlett Publishers Inc.,6th Ed.,2017.
12 William Stallings: "Cryptography and Network Security" Pearson Prentice Hall, 6th Ed., 2013.
13 David M Burton: "Elementary Number Theory" McGraw-Hill, 7th Ed., 2010.

Jennifer K

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UCSM300	**Engineering Mathematics – III**	**(2-2-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- The basic terminologies of mathematical and logical reasoning, functions, and relations associated with its properties and corresponding practical examples.
- Various counting principle methods to solve complex problems in combinatorics.
- Demonstration with examples, the basic terminologies of graphs and its types.
- Identify the applications of mathematical structures in other fields of computer science such as data structures and algorithms, databases, networks, operating systems etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Verify** the correctness of an argument using various techniques and strategies.	1	2	4,15
CO-2	**Solve** problems using counting techniques and combinatorics.	1	2	4,15
CO-3	**Solve** the problems on different types of functions, relations, and Generating functions.	1	2	4,13
CO-4	**Solve** the problems pertaining to graphs and related discrete structures.	1	2	4,13
CO-5	**Explain** the concepts and properties of algebraic structures such as groups and coding theory.	1	2	4,15

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-

Pre-requisites: None

Contents:

Unit-I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference, The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems **8L + 1T**

Unit-II

Fundamental Counting: The Rules of Sum and Product, Permutations and Combinations, The Binomial coefficients, The Pigeon-hole Principle.
Relations: Cartesian Products and Relations, Properties of Relations, Equivalence Relations and Partitions **8L + 1T**

Unit-III

Functions: Definition, Plain and One-to-One, Onto Functions, Function Composition, Inverse Functions, Directed Graphs, Hasse Diagrams. 6**L + 1T**

Unit-IV

Generating Functions: Definitions and examples, Exponential Generating Functions.
Recurrence Relations: Recursive definitions. First Order Linear Recurrence Relations, Second order linear homogeneous recurrence relation with constant coefficients. **6L + 1T**

Unit-V

Graphs: Elements of graph theory, Graphs and its properties, Directed graphs, Sub-graph, Complements, Planar graphs, Euler Graph, Hamiltonian Graphs, Graph Colouring, Representation of graphs, Trees. Application to engineering. **6L + 1T**

Reference Books:

1) Ralph P Grimaldi & B.V. Ramana “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education, 2006.
2) Kenneth H Rosen, “Discrete Mathematics and its Applications”, 7th Edition, McGraw Hill, 2012.
3) Kolman B & Busby R C, “Discrete and Mathematical Structures for Computer Science”, 5th Edition, Prentice Hall of India 2004.
4) Thomas Kosay, “Discrete Mathematics with Applications”, Elsevier, 2005, Reprint 2008.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UISM300	**Engineering Mathematics-III**	**(2- 2 - 0)3**

Contact Hours:39

Course Learning Objectives (CLOs):

To have an insight into Fourier transforms, Z-transforms. Use statistical methods for analyzing, interpreting and presenting data. To transform given data into meaningful information to help in decision-making. Investigate a sequence of repeated trails of an experiment through Markov process.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12)/ PSO (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate the principles of counting and fundamentals of logic to solve elementary counting and logic arguments.			1,2
CO-2	Design different practical models for estimation and prediction.		1,2	
CO-3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.		1,2	
CO-4	Explain Markov chains and describe stochastic process.			1,2
CO-5	Apply Fourier transforms for series of mathematical conversion and Solve difference equations			1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	1.4	1.4										

Pre-requisites: 1. Basic probability theory 2. Statistical averages.
3. Differentiation, partial differentiation and integration of functions.

Contents:

Unit-I

COMBINATORICS: Principles of counting: The rules of sum and product, permutations. Combinations, Catalan numbers, the principle of inclusion and exclusion. Derangements.
Fundamentals of Logic: Basic connectives, Tautologies, Logical equivalence, Quantifiers and its use**.** **6L+1T**

Unit-II

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems **Curve Fitting**: Curve fitting by the method of least squares.
Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **7L+1T**

Unit-III

Probability Distributions: Review of basic probability theory, Random variables, (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions-problems (No derivation for mean and standard deviation)-Illustrative examples.
Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation. **7L+1T**

Unit –IV

MARKOV CHAIN AND QUEUING THEORY: Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chains. Queuing Models: Concept of Queue, M/M/1 queuing system. **7L+1T**

Unit – V

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Z-Transforms and Difference Equations: **Z-transform**- Definition, Standard Z transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems. Inverse Z-transform. Difference equations-basic definition. Application of Z-transform to solve Difference equation. **7L+1T**

Reference Books:

1. Ralph Grimaldi and B.V. Ramana, "Discrete and Combinatorial Mathematics (An applied introduction) ", 5th edition,2004.
2. B.S. Grewal, "Higher Engineering Mathematics", KhannaPublishers,44th edition.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UECM300 Engineering Mathematics – III (2-2-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on learning mathematical model for a signal, properties of a signals and systems, representation of a signal in different domains. Also, the course emphasizes on relation between Fourier representations, sampling and reconstruction of a signal.

Course Outcomes (Cos):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to Pos(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** different types of signals. Systems and its properties.	1	2	
CO-2	**Analyze** the time domain signals and solve for the system response.	1,2		13
CO-3	**Analyze** the frequency domain signals	1	2	
CO-4	**Relate** different Fourier representations and apply it for various applications.	1	2	3, 13
CO-5	**Apply** the Z- transform to analyze discrete-time signals and systems	1	2	

Pos/PSOs	**1**	**2**	**3**	**4**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	**3**	**2.2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

Pre-requisites: Calculus

Unit-I

Introduction: Definitions of signals and systems, classification of signals, basic operations on signals, elementary signals, Properties of systems.

6L + 1T

Unit-II

Time Domain Representation: Convolution, Interconnection of LTI systems, Relations between LTI system properties and impulse Response, Solving Differential and Difference Equations, Block diagram representation. **7L + 1T**

Unit-III

Fourier Representations: Complex Sinusoids and Frequency response of LTI Systems, Fourier Representations for four classes of signals: Discrete Time Fourier Series (DTFS), Continuous Time Fourier series (FS), Discrete Time Fourier Transform(DTFT), Continuous Time Fourier Transform(FT).

7L + 1T

Unit-IV

Properties of Fourier Representations: Linearity and Symmetry Properties, Convolution Property, Differentiation Property, Integration Property, Time, and Frequency Shift Property, Multiplication **Property**, Scaling Property, Parseval's Relationships, Frequency response of LTI systems.

Applications of Fourier Representations: Relating FT to FS, Relating DTFT to DTFS, FT to DTFT, FT to DTFS. **7L + 1T**

Unit-V

Z-Transforms: Z-transform, properties of Region of Convergence, Properties of z transform, Inverse Z -transform: Partial Fraction Expansion, Power Series Expansion, Unilateral Z -transform, Transfer function. **7L + 1T**

Reference Books:

1. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons 10th edition, 2016.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
3. Simon Haykin, Barry Van Veen, "Signals and Systems", 2/e, Wiley Publications, reprint 2009.
4. H. P Hsu and R. Ranjan, "Signals and Systems", Schaum's outlines, TMH, 2006.

Jennifer K

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UCSM400	**Engineering Mathematics – IV**	**(2-2-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To have an insight into Fourier series, Fourier transforms, Difference equations and Z-transforms.
- Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Express** periodic function as a Fourier series and **obtain** the various harmonics of the Fourier series expansion for the given numerical data.	-	-	1
CO-2	**Transform** the given function using Fourier transforms depending on the nature of engineering applications. Solve difference equations using Z-transform.	-	-	1
CO-3	Make **Use** of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	-	1,2	-
CO-4	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	-	1,2	-
CO-5	Estimate the correlation, covariance using joint probability distributions. Also use student's t-distribution, Chi-square distribution as a test of goodness of it.	-	1,2	-

Pre-requisites: (1) Differentiation of function.
(2) Integration of function.
(3) Basic Probability theory.
(4) Statistical averages

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0	-

Contents:

Unit-I

Fourier Series: Periodic functions, Dirichlet's condition, Fourier series of periodic functions of period 2π and arbitrary period. Half-range Fourier series, Practical harmonic analysis, Examples from engineering field. **7L + 1T**

Unit-II

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms, Simple problems.

Z-Transforms and Difference equations: Z-transform – definition, Standard Z – transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems, Inverse Z-transform, Simple Problems, Difference equations – Basic definition, Application of Z-transform to solve Difference equation. **7L + 1T**

Unit-III

Statistical Methods: Correlation and regression- Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression– problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form= $\boldsymbol{ax+b; y=ax^2+bx+c; y=ax^b}$. **7L + 1T**

Unit-IV

Probability Distributions: Review of basic probability theory, Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples. **7L + 1T**

Unit-V

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **6L + 1T**

Reference Books:

1) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed. (Reprint) 2016.
2) B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
3) Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UECM400 Engineering Mathematics – IV (2-2-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

To provide an insight into curvilinear coordinates system. Study statistical methods, probability distribution and application of probability distributions in Engineering.

Course Out comes (Cos):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to Pos (1-12)/PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level(1)**
CO-1	**Understand** the significance of vectors and solve problems in various co-ordinate systems.	1	2	
CO-2	**Use** correlation and regression analysis to fit a suitable mathematical model for the statistical data.		1,2	
CO-3	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.		1,2	
CO-4	Recite Markov chains and describe stochastic process.		1,2	
CO-5	Determine Type-I and Type-II errors and test for goodness of fit using different methods.			

Pos/PSOs	1	2	3	4	6	7	8	9	10	11	12	13	14
Mapping Level	2.2	2	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: (1) Differentiatin of function.

(2) Integration of function.

(3) Basic Probability theory.

(4) Vector Algebra.

Unit-I

Curvilinear coordinates system: Vector Field, Dot product, Cross product of vectors, other coordinate systems: Circular Cylindrical and Spherical coordinate systems. Laplace's and Poisson's equations. **7L + 1T**

Unit-II

Statistical Methods: Correlation and regression, Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form $= ax + b;\ y = ax^2 + bx + c;\ y = ax^b$ **.** **6L + 1T**

Unit-III

Probability Distributions: Review of basic probability theory, Random variables (discrete and continuous), probability mass/density functions – Uniform, Binomial, Poisson, exponential and normal (Gaussian) distributions, problems (No derivation for mean and standard deviation) - Illustrative examples, Distribution of several random variables. **7L + 1T**

Unit-IV

Joint probability distributions: Joint Probability distribution for two discrete random variables, expectation and covariance.

Markov chains – Introduction, probability vectors, Stochastic Matrices, Fixed points and Regular stochastic matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states. **7L + 1T**

Unit-V

Sampling Theory: Introduction to sampling, estimations of parameters, Confidence intervals, Testing of Hypotheses, Decisions, Standard error, Type-I and Type-II errors, Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **7L + 1T**

Reference Books:

1. Erwin Kreyszig: Advanced Engineering Mathematics, John Wiley & Son 10th edition, 2016.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
3. Hayt & Buck, “Engineering Electromagnetics”, Tata McGraw-Hill, 8th edition, 2010.
4. Edminister, “Electromagnetics”, Schaum Outline Series, McGraw Hill, 2nd edition, 2006.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UISM400	**Engineering Mathematics-IV**	**(2-2-0)3**

Contact Hours:39

Course Learning Objectives (CLOs):

To visualize combination, spaces, rotation, reflection and projection of vectors. To compute orthogonal vectors, Eigen values to solve differential and difference equation. Obtain least square solution to solve system of equations.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12)/ PSO (1 to 2)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe the concept of vector spaces, subspaces, basis, dimension and their properties.			1,2
CO-2	Explain various matrix transformation such as linear transformation, orthogonal transformation and similarity transformation.			1,2
CO-3	Illustrate the concepts of symmetric matrices and quadratic forms.			1,2
CO-4	Apply characteristic polynomials to compute Eigen values and Eigen vectors and use Eigen spaces of matrix to diagonalizable a matrix.			1,2
CO-5	Apply the concepts of inner products to matrix decomposition.			1,2

PO's	**PO1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
Mapping Level	1.0	1.0	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: 1. Properties of determinants 2. Algebra of Matrices

Contents:

UNIT-I

VECTOR SPACES– Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates. **6L+1T**

UNIT-II

LINEAR TRANSFORMATIONS: Introduction, Linear Mappings, Geometric linear transformation of, Kernel and Image of a linear transformations, Matrix representation of linear transformations, Rank-Nullity Theorem (No proof), Singular and Nonsingular linear transformations, Invertible linear transformations.

7L+1T

UNIT-III

SYMMETRIC MATRICES AND QUADRATIC FORMS: Diagonalization of real symmetric matrices, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Singular value decomposition. **7L+1T**

UNIT-IV

EIGEN VALUES AND EIGENVECTORS: Introduction, Polynomials of Matrices, Characteristic polynomial, Cayley-Hamilton Theorem, eigenvalues and eigenvectors, eigen spaces of a linear transformation, Diagonalization, Minimal Polynomial, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form, Solving differential equations in Fundamental form. **7L+1T**

UNIT-V

INNER PRODUCT SPACES: Inner product, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error. **7L+1T**

Reference Books:

1) Linear Algebra and its applications, David C. lay, Steven R. lay, Judi J Mc. Donald, 5th edition, 2015, Pearson Education.
2) Linear Algebra and its applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.

Jennifer K

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

18UMAO675	**Applied Mathematics**	**(2 - 2 - 0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn about mathematical modelling, use of numerical techniques to deal with engineering systems. Further, they need to learn LPP and statistical tools for interpretation. They are also expected to carry out sampling distribution analysis and use of graph theory for engineering problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Obtain Mathematical model of Engineering Systems using different domains.		1,2	
CO-2	Formulate LPP and obtain optimal solutions using different tools.		1,2	
CO-3	Apply statistical tools to Interpret the data using different tools.		1,2	
CO-4	Determine Type-I and Type-II errors and test for goodness of fit using different methods.		1,2	
CO-5	Use graph theory to obtain solution for engineering problems.		1,2	

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	2	2	-	-	-	-	-	-		-	-	-

Pre-requisites:

A basic course on the concepts of algebra, geometry, calculus, trigonometry and laws of physics, Statistical averages and probability theory.

Contents:

Unit I

Introduction to Mathematical Modelling and Numerical Techniques: Introduction, Modelling technique, classification and characteristics. Mathematical modelling through algebra, geometry, calculus, trigonometry. Mathematical model of engineering system. **7L+1T**

Unit II

Linear and Non-Linear programming

Introduction, Mathematical formulation of a L.P.P, basic solution. Geometric (or graphical) method, Simplex method. Assignment problem. Non-Linear Programming – Constrained extremal problems-Lagrange's multiplier method- Kuhn- Tucker conditions and solutions. **7L+1T**

Unit III

Statistical Techniques

Co-efficient of Variation, Skewness, Karl Pearson's co-efficient of Skewness, Moments, Pearson's Beta and Gamma co-efficient, Kurtosis. Time series and Forecasting. **6L+1T**

Unit IV

Sampling distribution: Introduction, population and samples. Type-I and Type- II errors. Test of hypothesis for means, student's t-distribution, Chi-square Distribution as a test of goodness of fit. **7L+1T**

Unit V

Graph Theory:

Definition of a graph theory, incidence and degree, walks, paths, circuits, Connectedness, Eulerian and Hamiltonian graphs, Trees, basic properties of trees, Binary trees, Preorder and post order traversals, Spanning and Minimal spanning trees, Connectivity and Separability, fundamental circuits and cut sets Isomorphism of graphs, Matrix representation of graphs, adjacency and incidence matrix Graph theoretical algorithms: Dijkstra, Prims and Kruskal. **7L+1T**

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th edition,2017.
2. E. Kreyszig Advanced Engineering Mathematics John Wiley & Sons,10 edition, 2016.
3. Srimanta Pal et al, Engineering Mathematics, Oxford University Press, 3rd edition, 2016.
4. Dougas B. West, Introduction to Graph theory, second edition, PH Learning Private Limited, 2009.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UMBA301	**Mathematics(Bridge Course)**	**(3 - 0 - 0)**

Contact Hours: 39 Hrs.

Course Learning Objectives (CLOs):

This course will enable students to master the basic tools of differential & integral calculus, differential equations and partial differential equations. and become skilled to formulate, solve and analyze science and engineering problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** the knowledge of calculus to solve problems related to polar curves, curvature and its applications in determining the bentness of a curve.	-	-	1,2
CO-2	**Solve** multiple integration and use Beta and Gamma function to solve definite integrals	-	1,2	
CO-3	**Solve** first order linear differential equations analytically using standard methods.	-	1,2	
CO-4	**Solve** higher order differential equations with constant co-efficienst and variable co-efficients.	-	1,2	-
CO-5	**Learn** partial differentiation to calculate rates of change of multivariate functions. Solve problems related to composite functions and Jacobians. **Solve** problems on partial differential equations by method of separation of variables.	-		1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	1.6	1.6	-	-	-	-	-	-		-	-	-

Pre-requisites:

1. Differentiation of function
2. Integration of function.

Course Content:

Unit I

Differential Calculus:

n^{th} order differentiation of standard functions. Leibnitz theorem (Statement only & illustrative examples), Taylor's series for single variable (Statement only & illustrative examples), Maclaurin's series for single variable (Statement only & illustrative examples).

Polar curves-angle between the radius vector and tangent (Formula & illustrative examples), angle between two curves (Formula & illustrative examples). Definition of Curvature and radius of curvature. -Radius of curvature for Cartesian and polar curves (Formulas & illustrative examples). **10 hrs.**

Unit II

Integral Calculus:

Reduction formula for $\int_0^{\pi/2} sin^n x\, dx$, $\int_0^{\pi/2} cos^n x\, dx$ and $\int_0^{\pi/2} sin^n x\, cos^m x\, dx$ (Formula & illustrative examples). Definition of Beta and Gamma functions (illustrative examples). Relation between Beta and Gamma functions (No Proof) (illustrative examples). Evaluation of Double integral (direct and region given), Change of variables. Evaluation of Triple integral (direct examples). **10 hrs.**

Unit III

Ordinary Differential Equations of first order:-

Libnitz's Linear differential equation, Bernoulli's differential equation, Exact differential equations. Orthogonal trajectories. **5 hrs**.

Unit IV

Differential Equations of higher order

Solution of Second order Linear ordinary differential equation with constant coefficients. Method of variation of parameters. Legendre's homogeneous equations. **8 hrs.**

Unit V

Partial Differentiation:

Definition of Partial derivative (illustrative examples), Total differentiation (illustrative examples), Differentiation of Composite functions (illustrative examples). Jacobians and its properties (No Proof) (illustrative examples).

Partial Differential Equations (PDE's):

Formation of PDE's by elimination of arbitrary constants / functions. Solution of PDE by variable separable method. **6 hrs.**

Text Books

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **H.K. Dass & Rajnish Verma**, Higher Engineering Mathematics, 3rd edition, 2014.

Note: 1. Grades (i) PP (ii) NP
2. No semester End Examination
3. Audit (Bridge course).

1. The mandatory non – credit courses Mathematics for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.

2. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

HoD Mathematics

SDM COLLEGE OF ENGINEERING & TECHNOLOGY, DHARWAD

Department of Mathematics

21UMBA401	**Mathematics (Bridge Course)**	**(3 - 0 - 0)**

Contact Hours: 39 Hrs.

Course Learning Objectives (CLOs):

This course will enable students to use Laplace transform to solve differential equations. Analyze and Solve system of linear equation. Understand the concept of vector differentiation and vector integration.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Transform** the given function using Laplace transforms and study their properties.	-	-	1,2
CO-2	**Apply** Laplace transform to solve differential equations.	-	-	1,2
CO-3	**Compute** the solution of system of equations. **Evaluate** Eigen values and Eigen vectors for a matrix.	-	1,2	
CO-4	**Study** vector calculus and **compute** gradient, divergence, curl of a single valued function**.**	-		1,2
CO-5	**Study** vector integration **and evaluate** Line integrals, Surface integrals and Volume integrals	-		1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	1.2	1.2	-	-	-	-	-	-		-	-	-

Pre-requisites:

1. Differentiation of function
2. Integration of function.
3. Elementary row transformation of matrix.
4. Vector algebra.

Course Content:

Unit-I

Laplace Transforms:

Definition and Properties. Laplace transform of elementary functions. Laplace transform of $e^{at}f(t)$ Laplace transform of $t^n f(t)$, Laplace transform of $\frac{f(t)}{t}$,Laplace transforms of Periodic functions and unit-step function–problems. **8 hrs.**

Unit-II

Inverse Laplace Transforms

Inverse Laplace transform -problems with standard, Convolution theorem (without proof) to find the inverse Laplace transform and problems. Solution of linear differential equations using Laplace transform. **8 hrs.**

Unit-III

Elementary Linear Algebra:

Rank of a matrix - Row Echelon form. Test for consistency for system of linear equations. Solution of system of linear equations – Gauss-elimination method(consistency), Gauss-Seidel iterative method. Eigen values and Eigen vectors- Rayleigh's power method. **8 hrs.**

Unit-IV

Vector Calculus: -

Vector Differentiation: Scalar point function and vector point functions. Gradient, Directional Derivative; Curl and Divergence-physical interpretation. Solenoidal and irrotational vectors. Illustrative problems. **8 hrs.**

Unit- V

Vector Integration:

Line integrals, Surface integrals and Volume integrals. Green's theorem, Gauss divergence theorem and Stoke's theorem (only statements). **7 hrs.**

Text Books

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Rajesh Verma & H.K. Dass,** Higher Engineering Mathematics,3rd edition. 2014.

Note: 1. Grades (i) PP (ii) NP
2. No semester End Examination
3. Audit (Bridge course)

1.The mandatory non–credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE.

2.These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

HoD Mathematics