B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

FIRST SEMESTER B.E. (CS, CS-DS, AI-ML, AI-DS, CS-IOT, CS-BS, BT)

Course Title	Mathematical Foundation for Computer Science Stream -1	Course Code	25MA1BSMCS
Credits	4	L – T – P	3-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus and Matrix theory in Engineering applications.
- **Acquire the knowledge** of Calculus and Matrix theory concepts to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

UNIT – 1: Matrices and System of Linear Equations	**[10 hours]**

Prerequisites: Operations on matrices and determinants. Elementary row transformation of a matrix.

Echelon form, rank of a matrix, consistency and solution of system of linear equations - Gauss-elimination method, approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector.
Applications: Balancing chemical equations, Traffic flow.
Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

UNIT – 2: Multivariable Calculus	**[10 hours]**

Prerequisites: Calculus of one variable

Partial differentiation, total derivatives - differentiation of composite functions, Jacobian, Taylor's and Maclaurin's series expansion for two variables (statement only) – problems.
Applications: Maxima and minima for a function of two variables.
Self-study: Indeterminate forms-L'Hospital's rule, Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 3: Vector Calculus	**[10 hours]**
Prerequisites: Scalars, vectors and its operations, multivariable calculus, basic integration.	
Scalar and vector fields. Gradient, divergence and curl – physical interpretation, solenoidal vector fields, irrotational vector fields. **Curvilinear coordinates:** Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. **Applications:** Directional derivatives and scalar potential. **Self – study:** Expression for gradient, divergence and curl in curvilinear systems.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
UNIT – 4: Ordinary Differential Equations (ODEs) of First Order	**[09 hours]**
Prerequisites: Basic integration, linear ODE, solution by separation of variables.	
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 $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. **Applications**: Orthogonal trajectories, Newton's law of cooling. **Self-Study:** Nonlinear differential equations - Introduction to general and singular solutions, solvable for p, for x and y. Clairaut's equations.	
Unit – 5: Ordinary Differential Equations of Higher Order	**[09 hours]**
Prerequisites: Roots of a polynomial.	
Higher-order linear ordinary differential equations with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's differential equations. **Applications:** Solution of differential equation in fundamental forms (homogeneous equations). **Self-Study:** Method of undetermined coefficients.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA1BSMCS	CO 1	Apply the concepts of Calculus and Matrix theory in solving problems.	1	3
	CO 2	Relate the importance of Calculus and Matrix theory in computer science stream.	1	1
	CO 3	Demonstrate the understanding of Calculus and Matrix theory through programming skills using modern tool.	1,5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
- The best two scores out of three tests will be considered for CIE.

Semester End Examination:

- Two complete questions will be given from each unit.
- One complete question from each unit to be answered.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024.

Reference Books

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2. **S. Pal and S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
5. **J. Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
6. **G. Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
7. **D.G. Zill and W.S.Wright:** "Advanced Engineering Mathematics", Jones Bartlett Publishers Inc.,7th Ed., 2020.

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/
- Vector Calculus: https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroomand https://www.classcentral.com/course/vector-calculus-engineers-17387

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

FIRST SEMESTER B. E. (CV, EEE, ECE, ME, IEM, CH)

Course Title	Mathematical Foundation for Civil, Electrical and Mechanical Streams– 1	Course Code	25MA1BSCEM
Credits	04	L – T – P	3-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus and Matrix theory in Engineering applications.
- **Acquire the knowledge** of Calculus and Matrix theory concepts to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

UNIT – 1: Matrices and System of equations	**[10 hours]**

Pre-requisites: Operations on matrices and determinants, elementary row transformations of a matrix.

Echelon form, rank, consistency and solution of system of linear equations - Gauss-elimination method, approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector.

Applications: Balancing chemical equations, Traffic flow.

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

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

UNIT – 2: Calculus of One Variable	**[10 hours]**
Pre-requisites: Trigonometric functions and identities, differentiation and its rules.	
Introduction to polar coordinates, polar curves, angle between radius vector and tangent, angle between two curves. Length of perpendicular from pole to the tangent, pedal equations. **Applications**: Curvature and Radius of curvature – cartesian and polar forms. **Self-study:** Taylor's and Maclaurin's series expansion for one variable, radius of curvature in parametric form.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
UNIT – 3: Multivariable Calculus	**[10 hours]**
Pre-requisites: Higher-order derivatives, chain rule and determinants.	
Partial differentiation, total derivatives - differentiation of composite functions, Jacobian, Taylor's and Maclaurin's series expansion for two variables (statement only) – problems. **Applications:** Maxima and minima for a function of two variables. **Self-study:** Indeterminate forms-L'Hospital's rule, Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. Errors and approximations.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
UNIT – 4: Ordinary Differential Equations (ODEs) of First Order	**[09 hours]**
Pre-requisites: Basic integration, linear ODE, solution by separation of variables.	
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 $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. **Applications**: Orthogonal trajectories, Newton's law of cooling. **Self-Study:** Nonlinear differential equations - Introduction to general and singular solutions, solvable for p, for x and y. Clairaut's equations.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
UNIT – 5: Ordinary Differential Equations of Higher Order	**[9 hours]**
Pre-requisites: Roots of a polynomial.	
Higher-order linear ordinary differential equations with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's differential equations. **Applications:** Spring-Mass system and L-R-C series circuits **Self-Study:** Method of undetermined coefficients.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)
After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA1BSCEM	**CO 1**	Apply the concepts of Calculus and Matrix theory in solving problems.	1	3
	CO 2	Relate the importance of Calculus and Matrix theory concepts to Civil, Electrical & Mechanical Streams.	1	1
	CO 3	Demonstrate the understanding of Calculus and Matrix theory concepts through programming skills using modern tool.	1,5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
- The best two scores out of three tests will be considered for CIE.

Semester End Examination:
- Two complete questions will be given from each unit.
- One complete question from each unit to be answered.

Suggested Learning Resources:

Text Books
1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
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- https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
- https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

SECOND SEMESTER B.E. (CV, EEE, ECE, ME, IEM & CH)

Course Title	Mathematical foundation for Civil, Electrical and Mechanical Streams -2	Course Code	25MA2BSCEM
Credits	4	L – T – P	3-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of calculus, partial differential equations (PDE) and numerical methods in engineering applications.
- **Acquire the knowledge** of calculus, PDE and numerical methods to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

UNIT -1: INTEGRAL CALCULUS	**[11 hours]**

Prerequisites: Definite and indefinite integrals of single-variable functions, basic conic sections and polar coordinates.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates.

Applications: Area by double integral (polar curves), Volume by triple integral.

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

Self-Study: Moment of Inertia along a particular direction, Duplication formula.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 2: VECTOR CALCULUS	**[10 hours]**
Prerequisites: Scalars, vectors and its operations, multivariable calculus, basic integration.	
Scalar and vector fields. Gradient, divergence and curl - physical interpretation, solenoidal vector fields, irrotational vector fields and scalar potential. Vector Integration: Line integrals, Green's theorem and Stokes' theorem (statement only): problems. **Applications:** Directional derivative and work done by a force. **Self-study:** Velocity, acceleration of a moving particle and Gauss divergence theorem.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 3: PARTIAL DIFFERENTIAL EQUATIONS (PDEs)	**[10 hours]**
Prerequisites: Basics of differential equations.	
Formation of PDEs by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration, homogeneous PDE by the method of Separation of variables. **Applications**: Mathematical modelling of one-dimensional heat and wave equations. **Self-study:** Solution of one-dimensional heat and wave equations by the method of separation of variables.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit - 4: NUMERICAL METHODS -1	**[09 hours]**
Prerequisites: Algebraic and transcendental functions, roots of an equation.	
Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. N**umerical integration:** Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule. **Applications:** Estimating the velocity, acceleration, area, volume. **Self-Study:** Regula-Falsi method and Newton's divided difference formula.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 5: NUMERICAL METHODS -2	**[08 hours]**
Prerequisites: Basic differentiation and integration, analytical solutions for initial value problem.	
Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Picard's method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. **Applications:** Finding approximate solution of ODEs related to engineering field. **Self-Study:** Adam-Bashforth method and Numerical solution of higher order ODEs.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA2BSCEM	CO 1	Apply the concepts of Calculus, Partial differential equations and Numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Partial differential equations and Numerical methods in Civil, Electrical and Mechanical streams.	1	1
	CO 3	Demonstrate the understanding of Calculus and Numerical methods through programming skills using modern tool.	1, 5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
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	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
- The best two scores out of three tests will be considered for CIE.

Semester End Examination:

- Two complete questions will be given from each unit.
- One complete question from each unit to be answered.

Suggested Learning Resources:

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3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. R. Wylie, L. C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.

5. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
6. **D.G. Zill and W. S. Wright:** "Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020.

Web links and Video Lectures (e-Resources):

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- VTU EDUSAT Program
- https://nptel.ac.in/courses/111105160
- https://nptel.ac.in/courses/127106019
- https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/
- https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/pages/syllabus/

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

SECOND SEMESTER B.E. (CS, CS-DS, AI-ML, AI-DS, CS-IOT, CS-BS, BT)

Course Title	Mathematical Foundation for Computer Science Stream-2	Course Code	25MA2BSMCS
Credits	4	L – T – P	3-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Linear algebra and Numerical methods in Engineering applications.
- **Acquire the knowledge** of Calculus, Linear algebra and Numerical methods to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

UNIT -1: INTEGRAL CALCULUS	**[11 hours]**

Prerequisites: Definite and indefinite integrals of single-variable functions, basic conic sections and polar coordinates.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates.

Applications: Area by double integral (polar curves), Volume by triple integral.

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

Self-Study: Moment of Inertia along a particular direction, Duplication formula.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 2: Vector Space	**[10 hours]**
Prerequisites: Binary operations, groups, matrices and system of equations.	
Definition and examples, subspace, linear combinations, linear span, linearly independent and dependent sets, row space, column space and null space of a matrix, basis and dimension. **Applications:** Coordinate vector. **Self-study:** Verification of vector spaces.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 3: Linear Transformations	**[10 hours]**
Prerequisites: Functions, matrix algebra, system of linear equations and their solutions.	
Definition and examples, Matrix of a linear transformation. Rank and nullity of a linear operator, rank-nullity theorem and eigen spaces of a linear transformation. **Applications:** Singular, non-singular and onto linear transformations, invertible linear transformation **Self-study:** Geometric linear transformation in R^2 for image processing.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 4: Numerical Methods -1	**[09 hours]**
Prerequisites: Algebraic and transcendental functions, roots of an equation.	
Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. N**umerical integration:** Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule. **Applications:** Estimating the velocity, acceleration, area, volume. **Self-Study:** Regula-Falsi method and Newton's divided difference formula.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
UNIT – 5: Numerical Methods -2	**[08 hours]**
Prerequisites: Basic differentiation and integration, analytical solutions for initial value problem.	
Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Picard's method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. **Applications:** Finding approximate solution of ODEs related to engineering field. **Self-Study:** Adam-Bashforth method and Numerical solution of higher order ODEs.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA2BSMCS	CO 1	Apply the concepts of Calculus, Linear Algebra and Numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Linear Algebra and Numerical methods in Computer science stream.	1	1
	CO 3	Demonstrate the understanding of Calculus, Linear Algebra and Numerical methods through programming skills using modern tool.	1, 5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
- The best two scores out of three tests will be considered for CIE.

Semester End Examination:

- Two complete questions will be given from each unit.
- One complete question from each unit to be answered.

Suggested Learning Resources:

Text Books

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2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024.

Reference Books

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2. **S. Pal & S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.

5. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
6. **D.G. Zill and W.S.Wright:** " Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020.

Web links and Video Lectures (e-Resources):

- VTU e-shikshana Program
- Integral Calculus: https://www.classcentral.com/course/youtube-integral-calculus-90616b and https://www.edx.org/course/mathtrackx-integral-calculus
- Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
- Vector Calculus: https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroomand https://www.classcentral.com/course/vector-calculus-engineers-17387
- Vector spaces and Linear Transformations: https://nptel.ac.in/courses/111104137, https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ and https://www.classcentral.com/subject/linear-algebra
- Numerical Methods: https://www.classcentral.com/course/numerical-methods-engineers-32822,
- https://nptel.ac.in/courses/111107105 and https://ocw.mit.edu/courses/18-335j-introduction-to numerical-methods-spring-2019/

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

THIRD SEMESTER B. E.

(COMMON TO ALL BRANCHES EXCEPT CIVIL ENGG. & CS-STREAM)

Course Title	TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES	**Course Code**	**23MA3BSTFN**
Credits	**03**	**L – T – P**	**2-1-0**
Contact Hours	**39**		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Series, Transforms and Numerical Techniques in Engineering Problems.
- Acquire the knowledge of Series, Transforms and Numerical Techniques to apply them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

LAPLACE TRANSFORMS: **[08 hours]**

Definition and Laplace transform of standard functions (statements only). Problems on Laplace transform of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of derivatives and integrals. Laplace Transform of periodic functions (statement only) and unit-step function – Problems.

Inverse Laplace transforms: definition and problems. Solution of differential equations.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

FOURIER SERIES: **[08 hours]**

Introduction to trigonometric polynomial, trigonometric series. Dirichlet's conditions. Fourier series of periodic functions with period 2π and arbitrary period. Complex Fourier series. Practical harmonic analysis.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-3

FOURIER TRANSFORMS: **[08 hours]**

Definition and problems on Fourier Transform. Fourier sine and cosine transforms – Problems. Inverse Fourier transform, Inverse Fourier cosine and sine transforms - Problems. Convolution theorem (only statement) – problems.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

NUMERICAL SOLUTION OF PDE: **[07 hours]**

Classification of second-order partial differential equations, finite difference approximation of derivatives. Solution of one-dimensional heat equation by Schmidt and Bendre-Schmidt explicit formulae. Solution of one-dimensional wave equation using finite difference method.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

CALCULUS OF VARIATIONS: **[08 hours]**

Definition, Variation of a functional, Euler-Lagrange equation, variational problems.
Applications: Hanging cable problem, Brachistochrone problem.

Z-TRANSFORMS:

Definition, Standard Z-transforms, Damping rule, Shifting rule. Inverse Z-transform and applications – Solution of difference equations.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSTFN	CO 1	Techniques, Calculus of Variation and Finite Difference Apply the concepts of Series, Transform Methods to solve engineering problems.	1	3
	CO 2	Apply the concepts of Transform Techniques, Calculus of Variation and Finite Difference Methods in engineering using modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. B.V. Ramana: "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed.
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. N. P Bali and Manish Goyal: "A textbook of Engineering Mathematics", Laxmi Publications.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics", McGraw–Hill Book Co. New York, 6th Edition.
5. Gupta C.B, Sing S. R. and Mukesh Kumar: "Engineering Mathematics 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 (2014).
7. James Stewart: "Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. http://www.class-central.com/subject/math(MOOCs)
2. http://academicearth.org/
3. http://www.bookstreet.in.
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

THIRD SEMESTER B.E. COURSE (CS CLUSTER except Machine Learning)

Course Title	Statistics and Discrete Mathematics	Course Code	23MA3BSSDM
Credits	03	L – T– P	2 – 1– 0
Contact hours	39		

Prerequisites: Basic concepts of Permutations, Combinations, probability, statistics, G.C.D., L.C.D., divisors and primes.

Course Objectives: The goal of the course is to

- Appreciate the importance of Discrete Mathematics and statistics in computer and allied engineering science.
- Acquire the knowledge of Discrete Mathematics and Statistics applied in their core domain.
- Improve their Mathematical Thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

GRAPH THEORY **[08 hours]**

Basic concepts: Types of graphs, order and size of a graph, in-degree and out-degree, connected and disconnected graphs, Eulerian graphs, Hamiltonian graphs, sub-graphs, and Isomorphic graphs. Matrix representation of graphs: adjacency matrix, incidence matrix. Trees: spanning tree, minimal spanning tree: Kruskal's algorithm and shortest path-Dijkstra's algorithm

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

PROBABILITY DISTRIBUTIONS **[08 hours]**

Theoretical distributions: Discrete and continuous random variables

Discrete distributions: Poisson distribution, Geometric distributions. Continuous distributions: Exponential, Gaussian, Uniform Distribution and Gamma distributions.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-3

JOINT PROBABILITY AND MARKOV CHAIN **[08 hours]**

Joint Probability Distributions: Discrete and continuous joint random variables, Mathematical expectations, Covariance, and Correlation.

Markov Chain: Probability vector, stochastic matrix, fixed point vector, regular stochastic matrix. Higher transition probabilities, stationary distribution of regular Markov chain.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

STATISTICAL INFERENCE **[08 hours]**

Introduction, procedure for testing of hypothesis, level of significance.

Large sample: Test of significance for single mean and difference between two means.

Small sample: Test of significance for single mean, the difference between two means, paired t-test, ratio of variances (F-distribution) and Chi-Square goodness of fit.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

COMBINATORICS **[07 hours]**

Introduction, Binomial and multinomial theorems, Catalan numbers, the principle of inclusion and exclusion, Derangements, Rook Polynomials.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSSDM	CO 1	Apply the concept of Discrete Mathematics and Statistics in Computer and Allied Engineering Science.	1	3
	CO 2	Demonstrate the Importance of Discrete Mathematics and Statistics using Modern IT Tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

Text Books:

1. Graph Theory and Combinatorics, D. S. Chandrasekharaiah, 4th edition, 2011-12, Prism Engineering Education Series.
2. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.
3. Discrete Mathematics and its applications, Kenneth H. Rosen, 7th edition, McGraw Hill Publishers.

Reference Books:

1. Discrete Mathematics, Kolman, Busby Ross, 5th Edition, 2004, Prentice Hall.
2. Graph Theory with Applications to Engineering and Computer Science, Narsingh Deo, Eastern Economy Edition, PHI Learning Pvt., Ltd.
3. Mathematics for Machine Learning, Marc Peter Deisennorth, A. Aldo Faisal, Cheng Soon Ong,2020, Cambridge University Press.

E-books and online course materials:

1. http://jlmartin.faculty.ku.edu/~jlmartin/courses/math725-S16/
2. https://www.whitman.edu/mathematics/cgt_online/cgt.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/probability-intro
2. https://nptel.ac.in/courses/111104026/(DiscreteMathematics)
3. https://nptel.ac.in/courses/111106086/(Combinatorics)

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

THIRD SEMESTER B.E. COURSE

(Artificial Intelligence and Machine Learning)

Course Title	**Mathematical Foundation for Machine Learning - 1**	**Course Code**	**23MA3BSMML**
Credits	**03**	**L – T – P**	**2-0-1**
Contact hours	**26 + 0 + 13**		

Course Objectives:

The objectives of the course are to facilitate the learners to

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

LINEAR TRANSFORMATIONS -1 **[6 hours]**

Linear transformations, Matrix as a linear transformation, matrix representation of linear transformations, one-one and onto transformations, singular and non-singular transformations, Determinant of Large matrices and its complexity.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-2

LINEAR TRANSFORMATIONS -2 **[5 hours]**

Algebra of linear transformations, Geometric linear transformations, Composition of linear transformations, Affine Subspaces, Affine transformations.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-3

VECTOR NORMS AND INNER PRODUCT SPACES **[5 hours]**

Norms, Vector norms, matrix norms, L_1 norm, L_∞ norm, the Frobenius norm, condition number, Inner products, lengths and distances, angles and orthogonality, inner product of functions, orthonormal basis.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-4

APPLICATIONS OF INNER PRODUCT **[5 hours]**

Orthogonal complements, Orthogonal projections, Gram-Schmidt process, Orthogonal matrices, least square approximations, rotations, metric spaces.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-5

EIGENVALUES AND EIGENVECTORS **[5 hours]**

Eigenspaces, Spectral norm, characteristic and minimal polynomials, Eigen decompositions and diagonalizations, diagonalization of symmetric matrices.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

MATHEMATICS LAB:

2 hours/week per batch of 15 students

1 Introduction + 10 lab sessions + 1 repetition class + 1 Lab Assessment

List of Laboratory experiments:

Lab-0: Introduction

Lab-1: Finding Coordinates of vectors and Matrix of linear maps.

Lab-2: Recursive formula for finding large determinants.

Lab-3: Finding composition and inverse of linear transformations.

Lab-4: Plotting linear and affine transformations.

Lab-5: Finding L_1, L_∞ and Frobenius norms of vectors and matrices.

Lab-6: Finding angles between vectors and checking orthogonality.

Lab-7: Construction of orthonormal basis.

Lab-8: Least-Square solution of linear system of equations.

Lab-9: Finding eigenspaces and calculating spectral norms.

Lab-10: Eigen decomposition of matrices.

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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSMML	**CO 1**	Apply the concepts of Calculus and Linear Algebra to problems in Machine learning.	1	3
	CO 2	Apply the concepts of Calculus and Linear Algebra to Machine learning through modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)
- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020
2. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
3. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
4. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2. https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/linear-algebra-machine-learning
2. https://nptel.ac.in/syllabus/111106051/

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

THIRD SEMESTER B. E.

(CIVIL ENGINEERING)

Course Title	Mathematics for Civil Engineering – 3	Course Code	23MA3BSMCV
Credits	03	L – T – P	2-1-0
Contact Hours	39		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Series, Transforms and Numerical Techniques in Engineering Problems.
- Acquire the knowledge of Series, Transforms and Numerical Techniques to apply them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and provide real-life examples.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

STATISTICAL METHODS: **[08 hours]**

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = a\,x^b$) by the method of least squares.

Correlation and regression - Karl Pearson's coefficient of correlation and rank correlation. Lines of regression, angle between two regression lines.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

PROBABILITY DISTRIBUTIONS: **[08 hours]**

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Poisson and normal distributions.

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

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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DEPARTMENT OF MATHEMATICS

UNIT-3

LAPLACE TRANSFORMS: **[08 hours]**

Definition and Laplace transform of standard functions (statements only). Problems on Laplace transform of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of derivatives and integrals. Laplace Transform of periodic functions (statement only) and unit-step function – Problems.

Inverse Laplace transforms: definition and problems. Solution of differential equations.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

FOURIER SERIES: **[08 hours]**

Introduction to trigonometric polynomial, trigonometric series. Dirichlet's conditions. Fourier series of periodic functions with period 2π and arbitrary period. Practical harmonic analysis.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

NUMERICAL SOLUTION OF PDE: **[07 hours]**

Classification of second-order partial differential equations, finite difference approximation of derivatives. Solution of one-dimensional heat equation by Schmidt and Bendre-Schmidt explicit formulae. Solution of one-dimensional wave equation using finite difference method.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSMCV	CO 1	Apply the concepts of Transform, Series and Finite Difference Methods to solve engineering problems.	1	3
	CO 2	Apply the concepts of Transform, Series and Finite Difference Methods in engineering using modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed.
2. S. Pal & S. C. Bhunia, "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. N. P. Bali and M. Goyal, "A textbook of Engineering Mathematics", Laxmi Publications.
4. D. G. Zill, "Advanced Engineering Mathematics", Jones and Bartlett learning, 6th Ed, 2018.
5. C. R. Wylie, L. C. Barrett, "Advanced Engineering Mathematics", McGraw–Hill Book Co. New York, 6th Edition.
6. H. K. Dass and R. Verma, "Higher Engineering Mathematics", S. Chand Publication (2014).

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. http://www.class-central.com/subject/math(MOOCs)
2. http://academicearth.org/
3. http://www.bookstreet.in.
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

FOURTH SEMESTER B. E.

(Common to AS/ME /EEE/ECE/ET/EIE)

Course Title	Complex Analysis, Probability and Statistical Methods	Course Code	23MA4BSCPS
Credits	03	L – T – P	2-1-0
Contact Hours	40		

COURSE OBJECTIVES: The goal of the course is to:

- Appreciate the importance of Complex Analysis, Special Functions, Probability and Statistics in Engineering.
- Acquire the knowledge of Complex Analysis, Special Functions, Probability and Statistics applied in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skill.

UNIT-1

COMPLEX ANALYSIS **[08 hours]**

Review of a function of a complex variable, limits, continuity and differentiability.

Analytic functions, Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula and problems.

Conformal mapping: $w = z^2$ and $w = z + \frac{k^2}{z}\ (z \neq 0)$.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-2

SPECIAL FUNCTIONS: **[08 hours]**

Introduction, Ordinary and Singular Points, Series solution of Bessel's differential equation leading to $J_n(x)$, Bessel's function of the first kind, Properties, generating function for $J_n(x)$. Series solution of Legendre's differential equation leading to $P_n(x)$. Legendre polynomials, Rodrigue's formula (without proof) - Problems.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-3

STATISTICAL METHODS: **[08 hours]**

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = a\,x^b$) by the method of least squares.

Correlation and regression - Karl Pearson's coefficient of correlation and rank correlation. Lines of regression, angle between two regression lines.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-4

PROBABILITY DISTRIBUTIONS: **[08 hours]**

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Poisson and normal distributions.

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

Teaching-Learning Process	Chalk and Board, Problem-based learning / Presentation

UNIT-5

STATISTICAL INFERENCE: **[08 hours]**

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means (single mean and difference between two means), student's t-distribution (single mean and difference between two means), Chi-square distribution-goodness of fit.

Teaching-Learning Process	Chalk and Board, Problem-based learning / Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSCPS	CO 1	Apply the concepts of complex variables, special functions, probability and statistics to solve engineering problems.	1	3
	CO 2	Apply the concepts of complex variables, special functions and statistical methods using modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
2. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics C. Ray Wylie, Louis C. Barrett McGraw-Hill, 6th Edition 1995.
2. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010.
3. A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014.
4. Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. http://www.bookstreet.in.
5. VTU EDUSAT PROGRAMME – 20
6. VTU e-Shikshana Program

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

FOURTH SEMESTER B.E. COURSE

(CS CLUSTER Except AIML)

Course Title	**Linear Algebra and Optimization**	**Course Code**	**23MA4BSLAO**
Credits	**03**	**L – T – P**	**2-1-0**
Contact hours	**40**		

Course Objectives:

The objectives of the course are to facilitate the learners to

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

CONTINUOUS OPTIMIZATION – 1 **[7 hours]**

Function of several variables, partial differentiation, local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-2

CONTINUOUS OPTIMIZATION-2 **[7 hours]**

Optimization using gradient descent/ascent and NR method.
Sequential search 3-point search and Fibonacci search.
Constrained Optimization, Method of Lagrange multipliers, KKT optimality conditions.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-3

INNER PRODUCT SPACES **[7 hours]**

Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt orthogonalization process, QR-factorization, least squares problem and least square error. Curve fitting – Principle of least squares, fitting a straight line and fitting a parabola.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-4

EIGENVALUES AND EIGENVECTORS **[7 hours]**

Introduction, Polynomials of Matrices, Cayley-Hamilton Theorem, eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-5

MATRIX DECOMPOSITION AND THEIR APPLICATIONS **[8 hours]**

Diagonalization, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, rank and signature of real quadratic forms, Singular value decomposition. Dimensional reduction – PCA.

Teaching-Learning Process:	Chalk and Board, Problem based learning

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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSLAO	**CO 1**	Apply the concepts of linear algebra in Computer and Allied Engineering Sciences.	1	3
	CO 2	Demonstrate the applications of computer science and Allied Engineering Science using modern ICT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
2. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
2. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020
3. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
4. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2. https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/linear-algebra-machine-learning
2. https://nptel.ac.in/syllabus/111106051/

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

FOURTH SEMESTER B. E. (Medical Electronics)

Course Title	**Mathematical Methods for Medical Electronics**	**Course Code**	**23MA4BSMMD**
Credits	**03**	**L – T – P**	**2-1-0**
Contact Hours	**40**		

COURSE OBJECTIVES: The goal of the course is to:

- Appreciate the importance of Complex Analysis, Special Functions, Probability and Statistics in Engineering.
- Acquire the knowledge of Complex Analysis, Special Functions, Probability and Statistics applied in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies, that teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skill.

UNIT-1

COMPLEX ANALYSIS **[08 hours]**

Review of a function of a complex variable, limits, continuity and differentiability.

Analytic functions, Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method-Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem, Cauchy's integral formula and problems.

Conformal mapping: $w = z^2$ and $w = z + \frac{k^2}{z}\ (z \neq 0)$.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-2

STATISTICAL METHODS: **[08 hours]**

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = a\,x^b$) by the method of least squares.

Correlation and regression - Karl Pearson's coefficient of correlation and rank correlation-problems. Lines of regression, angle between two regression lines - problems.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-3

PROBABILITY DISTRIBUTIONS: **[08 hours]**

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Poisson and normal distributions- problems - Illustrative examples.

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

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-4

STATISTICAL INFERENCE-1: **[08 hours]**

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means (single mean and difference between two means), student's t-distribution (single mean and difference between two means), paired t- test.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation

UNIT-5

STATISTICAL INFERENCE -2: **[08 hours]**

Test of significance for single proportion [Large sample], difference between two proportions [Large sample], ratio of variances (F- distribution), Chi -Square distribution-goodness of fit. Analysis of variance (one-way).

Teaching-Learning Process	Chalk and Board, Problem based-learning / Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSMMD	CO 1	Apply the concepts of complex variables, probability and statistics to solve engineering problems.	1	3
	CO 2	Apply the concepts of complex variables, and statistical methods using modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXTBOOKS:

1. Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
2. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995.
2. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010.
3. A Text-Book of Engineering Mathematics, N. P. Bali and Manish Goyal Laxmi Publications 2014.
4. Advanced Engineering Mathematics, Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. http://www.bookstreet.in.
5. VTU EDUSAT PROGRAMME – 20
6. VTU e-Shikshana Program

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

FOURTH SEMESTER B.E. COURSE

(Artificial Intelligence and Machine Learning)

Course Title	**Mathematical Foundation for Machine Learning – 2**	**Course Code**	**23MA4BSMML**
Credits	**03**	**L – T – P**	**2- 0 - 1**
Contact hours	**26 + 0 + 13**		

Course Objectives:

The objectives of the course are to facilitate the learners to:

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

MATRIX OPERATION IN MACHINE LEARNING **[6 hours]**

Matrix decompositions – LU and Cholesky decomposition, singular value decomposition, Data compression with SVD, Dimensionality reduction - Principal Component Analysis, the Moore-Penrose pseudoinverse.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-2

VECTOR CALCULUS **[5 hours]**

Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-3

APPLICATIONS OF VECTOR CALCULUS **[5 hours]**

Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-4

UNIVARIATE OPTIMIZATION **[5 hours]**

Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent and NR method, Legendre-Fenchel Transform and convex conjugates.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-5

MULTIVARIABLE OPTIMIZATION **[5 hours]**

Sequential search 3-point search and Fibonacci search, constrained optimization using Lagrange multipliers, KKT optimality conditions.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

MATHEMATICS LAB:

2 hours/week per batch of 15 students

1 Introduction + 10 lab sessions + 1 repetition class + 1 Lab Assessment

List of Laboratory experiments:

Lab-0: Introduction**.**

Lab-1: Finding LU and Cholesky decomposition.

Lab-2: Finding Singular value decomposition and PCA.

Lab-3: Automatic Differentiation and Backpropagation.

Lab-4: Computing gradients of vector-valued function and matrices.

Lab-5: Computing Hessian Matrices and their eigenvalues.

Lab-6: Computing minimum of quadratic functions using the Gradient descent method.

Lab-7: Finding minimum using NR method.

Lab-8: Lagrange's multiplier method for finding extremum values.

Lab-9: Sequential search 3-point search method.

Lab-10: Fibonacci search method.

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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSMML	**CO 1**	Apply the concepts of Calculus and Linear Algebra to problems in Machine learning.	1	3
	CO 2	Apply the concepts of Calculus and Linear Algebra to Machine learning through modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
3. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
4. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2. https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/linear-algebra-machine-learning
2. https://nptel.ac.in/syllabus/111106051/

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

FOURTH SEMESTER B. E. COURSE - (CHEMICAL ENGINEERING)

Course Title	Statistics and Probability	Course Code	23MA4BSSAP
Credits	03	L – T – P	2 – 1 – 0
Contact hours	40 hours		

Prerequisites: Basic concepts of Statistics and Probability, addition theorem, conditional probability, Bayes' theorem, discrete random variable, Binomial distribution. Basic concepts of statistics. Matrices.

Course Objectives:

- To get acquainted with the procedure of collecting, designing, analyzing, and drawing inferences about the data
- To have insight into Statistical methods, Correlation, and Regression analysis.
- To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in design engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and Provide real-life examples.
- Support and guide the students for self–study.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

STATISTICS AND PROBABILITY **[08 hours]**

Curve fitting – Principle of least squares, fitting a straight line, fitting of a parabola, fitting of the exponential curve of the $y = ab^x$. Correlation and Regression.

Probability distributions: Discrete distribution - Poisson distribution. Continuous distribution-Normal distribution.

Pedagogy:	Chalk and Board, Problem based learning.

UNIT-2

JOINT PROBABILITY AND MARKOV CHAIN **[08 hours]**

Joint Probability Distributions: Discrete random variables, Mathematical expectations, Covariance and Correlation.

Markov Chain: Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochasticmatrices. Higher transition probabilities, stationary distribution of regular Markov chain.

Pedagogy:	Chalk and Board, Problem-based learning.

UNIT-3

STATISTICAL INFERENCE – I **[08 hours]**

Introduction, estimation – point, interval; procedure for testing of hypothesis, level of significance, construction of confidence interval.

[Large sample] Test of significance for single mean, difference between two means, single proportion,difference between two proportions, and difference of two Standard deviations.

Pedagogy:	Chalk and Board, Problem-based learning.

UNIT-4

STATISTICAL INFERENCE – II **[08 hours]**

[Small sample] Test of significance for single mean, difference between two means, paired t-test, ratio of variances (F - distribution), Chi-Square distribution-goodness of fit, independence of attributes. Analysis of variance (one-way and two-way classifications).

Pedagogy:	Chalk and Board, Problem-based learning.

UNIT-5

DESIGN OF EXPERIMENTS **[08 hours]**

Principles of experimental design – Randomization, Replication, Local Control.
Randomized block design, Completely Randomized block design, Latin Square Design– Problems.

Pedagogy:	Chalk and Board, Problem-based learning.

On Completion of the course, student will have the ability to:

Course Code	CO #	COURSE OUTCOME (CO)	PO	Strength
23MA4BSSAP	CO 1	Apply the basic principles of statistics and probability, Markov chain, and design of experiments to the problems in Engineering.	1	3
	CO 2	Apply the concepts of Sampling distributions to Analyze and interpret the data from real-world examples.	1	3
	CO 3	Demonstrate an understanding of sampling distributions and principles of experimental design.	1, 6, 9, 10	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

Text Books:

1. Fundamentals of Biostatistics, Khirfan A. Khan, Atiya Khanum, 3rd edition, 2012, Ukaaz Publications.
2. An Introduction to Biostatistics, P. S. S. Sundar Rao and J. Richard, 4th edition, 2006, Prentice Hall of India.

Reference Books:

1. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 6th edition, Wiley.
2. Biostatistics, P. N. Arora, P. K. Malhan, 2nd edition, 2013, Himalaya Publishing House

E-books and online course materials:

1. https://www.coursera.org/learn/basic-statistics
2. https://www.coursera.org/learn/probability-intro
3. https://www.classcentral.com/course/udacity-intro-to-statistics-361
4. http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook

Online Courses and Video Lectures:

1. http://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring- 2014/
2. http://nptel.ac.in/courses/*111105041/1* NPTEL >> Mathematics >> Probability and Statistics
3. https:// www.khanacademy.org/Math
4. https:// www.class-central.com/subject/math (MOOCS).

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)
FOURTH SEMESTER B.E. COURSE (BT)

Course Title	**Biostatistics and Design of Experiments**	**Course Code**	**23MA4BSBDE**
Credits	**3**	**L – T – P**	**2-1-0**
Contact hours	**40**		

Pre-requisites:

- Basic concepts of Statistics,
- Basic concepts of Probability- addition theorem, conditional probability, Bayes' theorem, discrete random variable - Binomial distribution.

Course Objectives:

- Students will get acquainted with the procedure of collecting, designing, analyzing, and drawing inferences about the data.
- To understand the fundamentals of design and the methods of optimization.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

- Explanation via real-life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
- Instructions with interactions in classroom lectures (physical/hybrid).
- Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
- Flipped classroom sessions (~10% of the classes).
- Industrial visits, Guest talks, and competitions for learning beyond the syllabus.
- Students' participation through audio-video-based content creation for the syllabus (as assignments).
- Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- Students' seminars (in solo or group) /oral presentations.

UNIT-1

STATISTICS & PROBABILITY DISTRIBUTIONS **[08 hours]**

Curve fitting: $y = a + bx$, $y = a + bx + cx^2$, $y = ab^x$; Correlation and regression; Introduction to Probability; Discrete distribution - Poisson; Continuous distributions - Normal.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

STATISTICAL INFERENCE – I **[08 hours]**

Introduction - Sampling**,** Estimation – point, interval; Construction of confidence interval; Procedure for testing of hypothesis- level of significance. Test of significance for single proportion [Large sample], difference between two proportions [Large sample], ratio of variances (F- distribution), Chi -Square distribution-goodness of fit.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-3

STATISTICAL INFERENCE – II [COMPARISON OF MEANS] **[08 hours]**

Parametric test - Test of significance for single mean & difference of two means [Small & large sample], paired t- test, Analysis of variance (one-way).

Non-parametric test - Kruskal Wallis One Way Analysis of Variance by Ranks, Wilcoxon Signed Rank Test, Wilcoxon Mann-Whitney Test.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

DESCRIPTIVE STATISTICS **[08 hours]**

Types of variables, measure of spread, logarithmic transformations, multivariate data. Basics of study design, cohort studies, model fitting.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

DESIGN AND ANALYSIS OF EXPERIMENTS **[08 hours]**

Principles of experimental design, Randomized block design, Completely Randomized block design, Latin Square Design, Factorial Experiments with case studies.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

On completion of the course, student will have the ability to:

Course Code	CO#	Course Outcomes	PO	Strength
23MA4BSBDE	CO1	Analyze and interpret the statistical data for bioscience and allied engineering.	1, 2	3
	CO2	Design and demonstrate the use of Statistical tools to analyze the real-world examples of bioscience and allied engineering as a team.	5, 9, 10	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

Text Books:

- Alvin E. Lewis, Biostatistics, McGraw-Hill Professional Publishing 2013.
- T. P. Chapman, Statistical Analysis of Gene Expression Microarray Data CRC 2003.
- John F. Monahan, Numerical Methods of Statistics (Cambridge Series in Statistical and Probabilistic Mathematics), Cambridge University Press, 2011.
- Warren J. Ewens, Gregory Grant, Statistical Methods in Bioinformatics: An Introduction (Statistics for Biology and Health), Springer. 2010.
- P. S. S. Sundar Rao and J. Richard, An introduction to Biostatistics, 4th edition, 2006, Prentice Hall of India.

E-books and online course materials:

1. VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
2. https://www.youtube.com/watch?v=1Q6_LRZwZrc
3. https://www.youtube.com/watch?v=gPt2DubVJQM
4. https://www.coursera.org/courses?query=biostatistics
5. https://www.edx.org/learn/biostatistics
6. https://www.classcentral.com/subject/biostatistics.

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2024-2025)

THIRD SEMESTER B. E.

(Computer Science & Business Systems)

Course Title	Discrete Mathematics for Business Systems	Course Code	24MA3BSDBS
Credits	03	L – T – P	2-1-0
Contact Hours	39		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Discrete Mathematics and Mathematical logic in computer and business systems
- Acquire the knowledge of Discrete Mathematics applied in their core domain.
- Improve their Mathematical Thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and provide real-life examples.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

MATHEMATICAL LOGIC: **[07 hours]**

Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

COUNTING TECHNIQUES: **[08 hours]**

Basic counting, generating functions, recurrence relations (first order and higher order homogeneous relations). Principle of mathematical induction, pigeonhole principle.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-3

BOOLEAN ALGEBRA: **[08 hours]**

Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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DEPARTMENT OF MATHEMATICS

UNIT-4

GRAPH THEORY -1: **[08 hours]**

Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, Shortest path – Dijkstra's algorithm.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

GRAPH THEORY -2: **[08 hours]**

Planar graphs, Euler's formula, dual of a planar graph, independence number and clique number, chromatic number, statement of Four-color theorem, Trees, minimal spanning tree – Kruskal's algorithm.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

COURSE OUTCOMES (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
24MA3BSDBS	CO 1	Apply the concept of Discrete mathematical structures in Computer Science and Business systems	1	3
	CO 2	Analyse the concept of Discrete mathematical structures in Computer Science and Business systems	1	3
	CO 3	Demonstrate the use of modern IT tools in solving Computer Science and Business systems applications through Discrete mathematical structures.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. M. M. Mano, "Digital Logic & Computer Design", Pearson.
2. C. L. Liu, "Elements of Discrete Mathematics", (Second Edition) McGraw Hill Computer Science Series.
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, Englewood Cliffs.
4. L. Zhongwan, "Mathematical Logic for Computer Science", World Scientific, Singapore.

REFERENCE BOOKS:

1. R. A. Brualdi, "Introductory Combinatorics", North-Holland, New York.
2. J. A. Bondy and U. S. R. Murty, "Graph Theory with Applications", Macmillan Press, London.
3. E. Mendelson, "Introduction to Mathematical Logic", (Sixth Edition), CRC Press.
4. K. H. Rosen, "Discrete Mathematics and its applications", (Seventh Edition), McGraw Hill.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. https://nptel.ac.in/courses/111104026/(DiscreteMathematics)
2. https://nptel.ac.in/courses/111106086/(Combinatorics)
3. https://nptel.ac.in/courses/111106050/(Graphtheory)

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2024-2025)

THIRD SEMESTER B. E.

(Computer Science & Business Systems)

Course Title	PROBABILITY THEORY FOR BUSINESS SYSTEMS	Course Code	24MA3BSPBS
Credits	03	L – T – P	2-1-0
Contact Hours	39		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of continuous and discrete probability distributions in Engineering Problems.
- Acquire the knowledge of probability distributions to apply them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and provide real-life examples.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

INTRODUCTION TO PROBABILITY: [08 hours]

Introduction, Probability: Random Experiment: Sample point and sample space, event, operation of events, concepts of mutually exclusive and exhaustive events. Classical and relative frequency approach, axiomatic approach of probability. Independence of events, conditional probability, Bayes' theorem and its applications, Bayes' optimal classifiers and Naive Classifiers.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

DISCRETE PROBABILITY DISTRIBUTIONS: [08 hours]

Discrete Random variables, probability mass function, cumulative distribution function, Mathematical expectation, mean and variance, moments and their properties, Moment generating function. Poisson and Geometric distributions.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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DEPARTMENT OF MATHEMATICS

UNIT-3

CONTINUOUS PROBABILITY DISTRIBUTIONS: **[08 hours]**

Continuous Random variables, probability density functions, cumulative distribution function, Mathematical expectation, mean and variance, moments and their properties, Moment generating function. Exponential, Erlang and normal (Gaussian) distributions.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

JOINT PROBABILITY: **[07 hours]**

Introduction - Joint Probability distribution for two discrete and continuous random variables, Joint probability mass and density function, Joint probability Cumulative distribution function, Mathematical expectations, conditional distribution and independence, Covariance and Correlation.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

MARKOV CHAINS: **[08 hours]**

Introduction to stochastic process, probability vectors, Stochastic matrices, regular stochastic matrices, Markov chains, higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states. Markov processes: Chapman - Kolmogorov equations, Mean time spent in transient states.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
24MA3BSPBS	CO 1	Apply the concepts of Probability distributions to solve engineering problems.	1	3
	CO 2	Analyze the problems in business system using probability theory.	1	3
	CO 3	Demonstrate the use of modern tools for solving problems in computer Science and Business systems using probability theory.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. S. M. Ross, "Introduction of Probability Models", Academic Press, N.Y.
2. A. Goon, M. Gupta and B. Dasgupta, "Fundamentals of Statistics", vol. I & II, World Press.
3. M. Baron, "Probability and Statistics for Computer Scientists", Taylor and Francis.
4. T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, 3rd edition, 2017.
5. Murray R Spiegel , Ray Meddis, "Schaum's Outline of Theory and Problems of Probability, Schaum Outline Series publication

REFERENCE BOOKS:

1. S. M. Ross, "A first course in Probability", Prentice Hall.
2. I. R. Miller, J.E. Freund and R. Johnson, "Probability and Statistics for Engineers", (Fourth Edition), PHI.
3. A. M. Mood, F. A. Graybill and D. C. Boes, "Introduction to the Theory of Statistics", McGraw Hill Education.
4. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.
5. R. E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi, 9th edition, 2012.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc19_ma30/preview
2. https://archive.nptel.ac.in/courses/111/102/111102111/
3. https://onlinecourses.nptel.ac.in/noc22_ee123/preview
4. http://www.digimat.in/nptel/courses/video/111104146/L19.html
5. http://acl.digimat.in/nptel/courses/video/106101224/L46.html
6. http://www.digimat.in/nptel/courses/video/111102111/L38.html
7. https://www.almabetter.com/bytes/tutorials/applied-statistics/moment-generating-functions-and-expected-values

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2024-2025)

FOURTH SEMESTER B.E.

(Computer Science & Business Systems)

Course Title	**FOUNDATIONS OF ALGEBRA FOR BUSINESS SYSTEMS**	**Course Code**	**24MA4BSABS**
Credits	**03**	**L – T – P**	**2-1-0**
Contact Hours	**39**		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- To introduce basic concept of abstract algebra.
- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and provide real-life examples.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

Groups, Rings and Fields: **[09 hours]**

Definition and some examples of groups, Klein 4-group, Additive and multiplicative modulo group of integers, subgroups. Definition and examples of Rings, some special classes of Rings. Definition of field and some examples.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

Linear Transformation: **[08 hours]**

Review of vector space, Linear Transformation. Geometric Linear Transformation, change of basis, linear functional, Dual Spaces, ~~Homeomorphism,~~ $L(V,W)$, Composition of linear transformations, Affine Subspaces, Affine transformations,

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-3

Inner Product Spaces: **[08 hours]**

Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt orthogonalization process, QR-factorization. Method of least squares for inconsistent systems and least square error.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

Eigenvalues and Eigenvectors: **[07 hours]**

Introduction, Polynomials of Matrices, Cayley-Hamilton Theorem, eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

Matrix Decomposition and Their Applications: **[07 hours]**

Diagonalization, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Singular value decomposition. Dimensional reduction and image compression – PCA.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
24MA4BSABS	CO 1	Apply the concepts of algebra and linear algebra in Computer and Business System	1	3
	CO 2	Analyse the concept of linear algebra applied to computer science and business system.	1	3
	CO3	Demonstrate the use of modern tools for solving computer science and business system problem using algebra.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. I. N. Herstein, "Topics in Algebra", 2nd Ed., John Wiley & Sons
2. G. Strang, “Introduction to Linear Algebra”, Wellesley-Cambridge Press, 5th Edition, 2016.
3. D. C. Lay, Steven R. Lay, Judi J. McDonald, Linear Algebra and Its Applications Loose Leaf, Pearson College Div, 5th edition, 2015.
4. S. Boyd and L. Vandenberghe, Introduction to Applied Linear Algebra, Cambridge University Press, 2018

REFERENCE BOOKS:

1. J. B. Fraleigh, "A First Course in Abstract Algebra", 7th Ed., Pearson Education 2
2. S Lipschutz, “Schaum's Outline of Linear Algebra”, McGraw Hill Education, 3rd edition, 2017.
3. R. Bronson and G. Costa, “Linear Algebra: An Introduction”, Elsevier, 2007.
4. K. Singh, “Linear Algebra: Step by Step”, Oxford University Press, 1st Edition, 2013.
5. S. H. Friedberg, A J. Insel and L. E. Spence, Linear Algebra, Pearson, 2019, Fifth Edition.
6. K. Hoffman, R. Kunze, “Linear Algebra”, 2nd edition, Pearson.

E-books and online course materials:

1. https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2. https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures:

1. https://archive.nptel.ac.in/courses/111/105/111105112/
2. https://www.coursera.org/learn/linear-algebra-machine-learning
3. https://nptel.ac.in/syllabus/111106051/

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

SYLLABUS (2024-2025)

FOURTH SEMESTER B. E.

(COMPUTER SCIENCE & BUSINESS SYSTEMS)

Course Title	STATISTICAL MODELING FOR BUSINESS SYSTEMS	Course Code	24MA4BSSBS
Credits	03	L – T – P	2-1-0
Contact Hours	39		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Statistical methods, Probability and Inference in Business systems.
- Acquire the knowledge of Statistical methods, Probability and Inference in Business systems to apply them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample strategies; that teacher can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and provide real-life examples.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

STATISTICAL METHODS: **[08 hours]**

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = a\,x^b$) by the method of least squares. Correlation and regression - Karl Pearson's coefficient of correlation and Spearman's rank correlation. Lines of regression, angle between two regression lines. Multiple correlation and multiple regression - Problems.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-2

SAMPLING TECHNIQUES AND ESTIMATION: **[8 hours]**

Random sampling - Sampling from finite and infinite populations (sampling with replacement and sampling without replacement), Sampling distribution of sample mean - Stratified random sampling.

Point estimation - Criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation: Concept and Examples, Complete sufficiency and its application in estimation.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-3

PARAMETRIC INFERENCE: [08 hours]

Test of hypothesis: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Z test: Single mean, difference of means, t: Single mean, difference of means, Paired t-test, F test, Analysis of variance (one way with as well as without interaction).

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-4

NON-PARAMETRIC INFERENCE: [08 hours]

Comparison with parametric inference, use of order statistics, Sign test, Chi square test- Goodness of fit, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test, Spearman's and Kendall's test.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT-5

TIME SERIES ANALYSIS & FORECASTING: [07 hours]

Basics: Trend lines, Stationary, ARIMA Models, identification, estimation and forecasting.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
24MA4BSSBS	CO 1	Apply the concepts of Statistical methods, sampling techniques and inference to solve problems in Computer & Business systems.	1	3
	CO 2	Analyze problems in Computer & Business systems through statistical methods, sampling techniques and inferences.	1	3
	CO 3	Apply modern IT tools to solve Business systems using statistical methods, sampling techniques and inferences.	2,3,5,9	1,2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. R. E. Walpole, R. H. Myers, S. L. Myers and K.Ye, "Probability & Statistics for Engineers & Scientists", International Edition, 9th Edition.
2. D.C. Montgomery, G. C. Runger, "Applied Statistics and Probability for Engineers", Wiley Edition, 6th Edition.
3. S. C. Gupta, V. K. Kapoor, " Fundamentals Of Mathematical Statistics", Sultan Chand & Sons Publication.

REFERENCE BOOKS:

1. R. A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education India (2015) 8th ed.
2. A. M. Goon, M. K. Gupta and B. Dasgupta, "Fundamentals of Statistics," Vol. I & II, The World Press (2002), 8th ed.
3. C. Chatfield, "The Analysis of Time Series: An Introduction", Chapman & Hall/CRC (2003) 6th ed.
4. G. G. Vining, E. A. Peck and D. C. Montgomery, "Introduction to Linear Regression Analysis", Wiley- Interscience (2006), 6th ed.
5. A. M. Mood, F. A. Graybill and D. C. Boes, "Introduction to the Theory of Statistics", McGraw Hill (2017), 4th ed.
6. N. R. Draper and H. Smith, "Applied Regression Analysis", Wiley-Interscience (1998), 3rd ed.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. http://www.class-central.com/subject/math(MOOCs)
2. http://academicearth.org/
3. http://www.bookstreet.in.
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU, Belagavi
DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)
SIXTH SEMESTER – INSTITUTIONAL ELECTIVE

Course Name	**MATHEMATICAL STATISTICS FOR ENGINEERS**	**Course Code**	**23MA6OESFE**
Credits	**03**	**L – T - P**	**2-1-0**
Contact hours	**36 Hours**		

Prerequisites: Basic concepts of Permutations, Combinations, Probability and Statistics

Course Objectives: The goal of the course is to

- Appreciate the importance of probability and statistics in engineering science.
- Acquire the knowledge of probability and statistics applied in their core domain.
- Improve their Mathematical Thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions):

- These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.
- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

DESCRIPTIVE STATISTICS: Introduction to Statistics and Data Analysis - Measure of Central Tendency, Measure of Dispersion and Measure of .

[07 hours]

UNIT-2

PROBABILITY DISTRIBUTIONS:
Theoretical distributions: Discrete and continuous random variables: Discrete distributions: Geometric distributions, Hypergeometric distribution and Uniform distribution.
Continuous distributions: **[08 hours]**

UNIT-3

INFERENTIAL STATISTICS: Sampling distribution, central limit theorem, weak law for large numbers, Chebyshev's inequality, Markovian inequality, Moment of generating function.

[07 hours]

UNIT-4

ESTIMATION: Parameter estimation-Point and interval; Estimation error-bias, variance and risk, Method of moments, Estimator design approach- Maximum Likelihood, confidence interval.

[07 hours]

UNIT-5

HYPOTHESIS TESTING: Introduction, parametric testing: Proportion, one way and 2-way ANOVA. Non-parametric test: Chi-square-Independence of attribute, Homogeneity data, Mann-Whitney test and Wilcoxon-signed Rank test.

[07 hours]

COURSE OUTCOMES

At the end of the course, the student will have the ability to

CO No	COURSE OUTCOMES	PO
1	Understanding the fundamentals of statistics.	1
2	Analyze and interpret the statistical data for engineering.	1,2
3	Demonstrate the use of statistical tools to analyze the real-world examples of engineering as a team.	5,9,10

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

Text books:	
1	Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M. Ross, 5th edition, Elsevier.
2	Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Gupta, Sultan Chand and Sons publishers.
Reference Book:	
1	Basic Statistical Methods for Engineers and Scientists, Kennedy, J. B., and Neville, A. M., (1986), 3rd edition, Harper and Row.
2	Basic Statistical Methods for Engineers and Scientists Miller, I. R., Freund, J. E., and Johnson, R., (1990x, 4th edition, Prentice-Hall.

E-books and online course materials:	
1	https://minerva.it.manchester.ac.uk/~saralees/statbook3.pdf
2	http://vfu.bg/en/e-Learning/Math--Soong_Fundamentals_of_probability_and_statistics_for_engineers.pdf

Online Courses and Video Lectures:	
1	https://nptel.ac.in/courses/111105041
2	https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2014/

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS

Proposed SYLLABUS (2023-2024)

SIXTH SEMESTER B.E. COURSE

Course Title	Numerical Methods for Engineers	Course Code	23MA6OENME
Credits	03	L – T – P	3 - 0 – 0
Contact hours	36		

Pre-requisites: Matrix theory, Differential and Integral Calculus, Differential Equations.

Course Objectives:

The purpose of the course is to encourage and train the students:

- To apply numerical techniques.
- To enhance computational skills for solving mathematical equations.
- To solve the complex engineering problems in their respective domain.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

Iterative Methods for System of Equations and Eigenvalues problems (7 hours)

Fixed iteration methods, Newton's method for solving nonlinear systems, Thomas' algorithm for tri-diagonal systems, Jacobi's and Given's Method for finding eigenvalues.

UNIT-2

Interpolation, Numerical Differentiation and Integration (8 hours)

Linear interpolation, Piecewise polynomial interpolation: Cubic-spline interpolation. Stirling's formula and Bessel's formula. Richardson extrapolation.

Boole's and Romberg integration. Evaluation of Double Integrals using Numerical Methods – Trapezoidal Rule - Simpson's Rule.

UNIT-3

Methods for initial value problems **(7 hours)**

Uniqueness and existence of solution of initial value problems, Autonomous and non-autonomous System of Ordinary Differential Equations (ODEs), Solution of autonomous systems, Solution of Eigenvalue Problems (ODE). Solving system of ODE using Runge-Kutta 2^{nd} and 4^{th} order methods.

UNIT-4

Methods for boundary value problems **(7 hours)**

Introduction to boundary value problem (BVP): Solving BVP using the Shooting method, Finite difference method, Cubic-Spline method. Solution of integral equations using finite difference method.

UNIT-5

Finite Difference Methods for Partial Differential Equations (PDEs) **(7 hours)**

Classification of PDEs, Finite difference approximation of partial derivatives, Existence of solution, Weak form of solutions of PDE, Solution of Heat and Wave equation by finite difference method equations, Solution of 2D-Laplace and 2D-Poisson equations by Finite difference method.

Course Outcomes

On completion of the course, the student will have the ability to:

Course Code	CO #	COURSE OUTCOME (CO)	PO	Strength
23MA6IENME	CO 1	Apply numerical techniques to solve mathematical model that arises in Engineering applications.	1	3
	CO 2	Demonstrate the numerical solution of Engineering problems through modern IT tools.	1& 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	AAT	10	100	05	50
	Quiz	10		05	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

Two best scores out of the three tests will be considered for CIE

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination: (QP PATTERN)

- Each unit has an internal choice.
- One complete question from each unit to be answered.

Text Books:

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computations, 6^{th} edition, 2007, New Age International Publishers.
2. S. S. Sastry, Introductory methods of numerical analysis, Fifth Edition, 2012, PHI Publishers

Reference Books:

1. Steven V. Chapra, Applied Numerical Methods with Matlab for Engineers and Scientists, Third Edition, 2011, McGraw-Hill.
2. Richard L. Burden, Douglas J. Faires, A. M. Burden, Numerical Analysis, 10th Edition., 2010, Cengage Publishers.
3. M. D. Raisinganiah, Integral Equations and Boundary Value Problems, S.Chand Publishers.

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU

DEPARTMENT OF MATHEMATICS

SYLLABUS (2021 - 2022)

SEVENTH SEMESTER – INSTITUTIONAL ELECTIVE

Course Name	**Computational Graph Theory**	**Course Code**	**21MA7IECGT**
Credits	**03**	**L – T - P**	**3 - 0 - 0**
Contact hours	**39 hours**		

Course Objectives: The objective of the course is to introduce the concepts in graph Theory, with a sense of algorithms and some modern applications. They will be able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.

UNIT-1

GRAPHS AND DIGRAPHS **[8 hours]**

Fundamentals of graphs and digraphs, modelling using graphs and digraphs, graph search – BFS, DFS. The shortest path algorithms: Dijkstra algorithm, Bellman Ford algorithm. Minimum weight spanning tree: Kruskal's algorithm and Prim's algorithms. Applications: Job sequencing problems, designing an efficient computer drum, making a road system one-way.

UNIT-2

EULERIAN AND HAMILTONIAN GRAPHS **[7 hours]**

Transportation Problems: Eulerian graphs, Fleury's algorithm, Chinese Postman Problem, Hamiltonian cycles, Travelling Salesman Problem, applications.

UNIT-3

CONNECTIVITY **[8 hours]**

Vertex and edge connectivity, separable graphs, block graphs, k-connected graphs, maximum flow Problem, Ford-Fulkerson algorithm, Min Cut - Max Flow theorem, Maximum Flow of Minimum Cost, feasible flows. Construction of reliable communication networks-The minimum connector problem, enumeration of chemical molecules and electrical networks.

UNIT-4

COVERING AND MATCHING **[8 hours]**

Vertex and edge covering, vertex and edge independence, matchings, perfect matchings, maximum matching, Hall's theorem, augmenting path, Edmond's algorithm, maximal independent sets, König's Min-Max theorem, Gale-Shapley Algorithm, Minimum path cover**,** Friend's strangers problem.

UNIT-5

COLORABILITY **[8 hours]**

Vertex colouring, Chromatic Number, Bi-chromatic, Edge coloring and its applications to timetabling and sport scheduling, Vizing's theorem, Sequential coloring algorithm, map coloring, Four Color problem, chromatic polynomial. König's theorem, Applications: Scheduling examinations, Frequency assignments, Index registers.

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Text Books

1. Narsing Deo, Graph Theory, PHI, 2014.
2. Geir Agnarsson & Raymond Greenlaw Pearson, Graph Theory, modelling, applications and algorithms, Prentice Hall, 2007.

Reference Books

1. Frank Harary, Graph Theory, Addison Wesley, Reading, Massachussets, 1969.
2. Jonathan L. Gross, Jay Yellen, Graph Theory and its Applications, 2nd Edition, CRC Press LLC, Florida, 2000.
3. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, McGraw Hill, 2005.

At the end of the course the students will be able to

CO	Course Outcomes	PO's
CO-1	Demonstrate an understanding of the fundamental concepts of graph theory, digraphs, trees, finding Paths and cycles, weighted graphs matching and graph coloring.	**1,2**
CO-2	Apply appropriate graph algorithms to solve problems involving transportation, connection, social networking and scheduling.	**1,2**
CO-3	Analyse the algorithms to find the shortest path, maximum flow of minimum cost, maximum matching and minimum path cover.	**2**
CO-4	Use of MATLAB to find the shortest path, minimum weighted spanning tree, maximum flow.	**5**

Question Paper Pattern

- Each unit consists of one full question.
- Five full question to be answered.
- Internal choice in Unit 1 and Unit 5.

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SYLLABUS (2025 - 2026)
SEVENTH SEMESTER – INSTITUTIONAL ELECTIVE

Course Name	**NUMBER THEORY**	**Course Code**	**25MA7OENMT**
Credits	**3**	**L – T - P**	**3-0-0**
Contact hours	**39 Hours**		

Course Objectives: The course is a graduate level introduction Number Theory in which, it will cover fundamentals of the subject. It has contributed to many practical problems such as Coding Theory, Cryptography in modern information technology.

UNIT-1

CONGRUENCE APPLICATIONS: Introduction, Congruences and Equivalence Relations, The Pollard Rho Factoring Method, Divisibility Tests, Modular Designs, Check Digits, The p-Queen Puzzle, Round-Robin Tournaments, The Perpetual Calendar Linear Congruences.

[09 hours]

UNIT-2

ARITHMETIC FUNCTIONS: Introduction, Sigma Function, Tau Function, Dirichlet Product, Dirichlet Inverse, Moebius Function, Euler's Function, Euler's Theorem, An application to Algebra.

[07 hours]

UNIT-3

PRIMITIVE ROOTS AND INDICES: The order of a positive integer, primality tests, primitive roots for primes, the algebra of indices.

[07 hours]

UNIT-4

QUADRATIC CONGRUENCE AND CONTINUED FRACTION: Legendre symbol, Quadratic reciprocity, the Jacobi symbol, finite continued fractions, infinite continued fractions.

[09 hours]

UNIT-5

NON LINER DIOPHANTINE EQUATIONS: Pythagorean triangles, Fermat's last theorem, Sum of Squares, Pell's equation, Mordell's equation.

[07 hours]

Text books:	
1	Elementary number theory with Applications-2nd Edition-Thomas Koshy 2009.
	Beginning Number Theory by Neville Robbins-2nd Edition-Jones and Barlett Publ.-2006.
Reference Book:	
1.	Elementary Number Theory by David M Burton - Tata McGraw Hill Publ.-6th Edition 2006.
2.	Elementary Number Theory by Gareth A. Jones and Josephine Mary Jones - Springer-1998.

COURSE OUTCOMES

At the end of the course, the student will have the ability to

CO No	COURSE OUTCOMES	PO
1	Apply the concept of congruence and its practical uses in real-world scenarios.	1
2	Demonstrate an understanding towards the nature of different functions	1
3	Demonstrate an understanding primitive roots and indices	1
4	Apply concept of quadratic congruence to evaluate quadratic residues and understand continued fractions.	1
5	Demonstrate an understanding with some important non-linear Diophantine equation.	1

Question Paper Pattern:

1. Each unit consists of one full question.
2. Each full question consists of two, three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in all units.

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SYLLABUS (2025 - 2026)
EIGHT SEMESTER – INSTITUTIONAL ELECTIVE

Course Name	**Operations Research (Open Elective)**	**Course Code**	**25MA8OEOPR**
Credits	**03**	**L – T - P**	**3 -0- 0**
Contact hours	**39 hours**		

Course Objectives: Operations research is an interdisciplinary branch of mathematics which uses mathematical methods to arrive at optimal decisions to problems in various disciplines including Engineering. It is recommended for study by Engineering students as at the end of the course, they would be able to apply the techniques of optimal decision making and for maximizing performance of a process at minimal cost. They would also arrive at justifications for their decision making.

UNIT-1

INTRODUCTION: Evolution, definition, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, Linear Programming Problems (LPP) - Formulation and solution by graphical method. Use of slack, surplus and artificial variables, Canonical and Standard forms, Solution of LPPs using Simplex method, Big- M method.

[9 hours]

UNIT-2

TRANSPORTATION PROBLEM: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner method, least cost method, Vogel approximation method. Optimal solutions by MODI method, degeneracy in transportation problems.

[7 hours]

UNIT-3

ASSIGNMENT PROBLEM -Formulation, types, Hungarian method for assignment problem, unbalanced assignment problem, application to maximization cases and travelling salesmen problem.

[7 hours]

UNIT-4

PERT-CPM TECHNIQUES: Introduction, network construction-AON & AOA diagrams, Fulkerson's rule for numbering the events, Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project. Predicting the completion time of project; crashing of simple projects.

[9 hours]

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UNIT-5

GAME THEORY: Formulation of games, types, solution of games with saddle point, Solution of games without saddle point, 2x2 games without saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

[7 hours]

Text books:	
1	"Operations Research"- S.D.Sharma, Published by Kedar Nath Ram Nath.
2	"R. Panneerselvam-Operations Research, Eastern Economy Edition.
Reference Book:	
1.	"Operations Research" Kanti Swarup, P. K. Gupta, Man Mohan, Sultan Chand & Sons,
2.	"Operations Research", Manohar Mahajan. Dhanpat Rai & Co.2010 edition.

e-books	
1.	https://books.google.co.in/books?isbn=8131711048 , Taha – 2008.
2.	https://books.google.co.in/books?isbn=8121902819 D S Hira – 2008.
3.	https://books.google.co.in/books?isbn=8131700003,A. M. Natarajan, P. Balasubramani – 2006.

COURSE OUTCOMES

At the end of the course, the student will have the ability to

CO No	COURSE OUTCOMES	PO
1	Formulate a real-world problem as a Mathematical programming model.	1,5
2	Formulate and solve transportation models to analyse the appropriate cost cutting strategies.	2
3	Apply and develop Operation Research Techniques to solve assignment models in the field of Engineering.	2
4	Ability to demonstrate the knowledge of planning, scheduling, and optimal solutions for implementation in project management.	1
5	Employ game theory for strategic decision making.	

Question Paper Pattern:

1. Each unit consists of one full question.
2. Each full question consists of two, three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in all units.

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SYLLABUS (2025 - 2026)
EIGHTH SEMESTER – INSTITUTIONAL ELECTIVE - (Except CSE/ISE Branch)

Course Name	Linear Algebra & Optimization	Course Code	25MA8OELAO
Credits	03	L – T - P	3 – 0 – 0
Contact hours	39 hours		

Prerequisites: Vector Algebra, Matrix theory, Calculus, Geometry, Group Theory.

Course Objectives: To provide the students with a foundation of concepts in linear algebra that is essential to engineers of computer and information science.

UNIT-1

VECTOR SPACES: Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates.

[8 hours]

UNIT-2

LINEAR TRANSFORMATIONS: Introduction, Linear Mappings, Geometric linear transformation of ¡ ^{2}, 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.

[8 hours]

UNIT-3

EIGENVALUES 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.

[8 hours]

UNIT-4

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.

[8 hours]

UNIT-5

SYMMETRIC MATRICES AND QUADRATIC FORMS: Diagonalization of real symmetric matrices, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Singular value decomposition.

[7 hours]

Text books:	
1	David C. lay, Steven R. lay and Judi J Mc. Donald, Linear Algebra and its applications, 5th edition, Pearson Education, 2015.
2	Seymour Lipschutz, Schaum's outline series-Theory and problems of linear algebra, 5th edition, McGraw-Hill Education, 2012.
Reference Book:	
1.	Gilbert Strang, Linear Algebra and its applications, 4th edition, Brooks Cole, 2005.
2.	Richard Bronson and Gabriel B. Costa, Linear Algebra: An Introduction, 2nd edition, Academic press, 2007

e-books	
1.	https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2.	https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures	
1.	https://www.coursera.org/learn/linear-algebra-machine-learning
2.	https://www.coursera.org/learn/linear-algebra-machine-learning

COURSE OUTCOMES

At the end of the course, the student will have the ability to

CO No	COURSE OUTCOMES	PO
1	Apply the concepts of vectors spaces.	1
2	Relate the concepts of Eigenvalues, Eigenvectors & functions to linear algebra.	1
3	Apply the concepts of inner products.	1

Question Paper Pattern:

1. Each unit consists of one full question.
2. Each full question consists of two, three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in all units.

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SYLLABUS (2025 - 2026)

THIRD SEMESTER B.E. (CS, CS-DS, AI-ML, AI-DS, CS-IOT, CS-BS)

Course Title	Additional Mathematics for Computer Science Stream- 1	Course Code	25MA3BSACS
Credits	0	L – T – P	2-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Probability and Matrix theory in Engineering applications.
- **Acquire the knowledge** of Calculus, Probability and Matrix theory concepts to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

Unit – 1: Fundamentals of Probability	**[8 hours]**
Definition, basic terminologies, Addition theorem and Multiplication theorem on probability, independent events, Conditional probability, Random variable, Probability distribution, Bernoulli trials and Binomial Distribution-Problems.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 2: Matrix and System of Linear Equations	**[8 hours]**
Definition, Basic operations, Elementary row operations, Echelon form, Rank. Consistency and Solution of system of linear equations: Gauss-elimination method and approximate solution by Gauss Seidel method. Eigenvalues and Eigenvectors.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 3: Calculus of One Variable	**[8 hours]**
Introduction to differentiation-problems. Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Polar curves, angle between the radius vector and the tangent, angle between two curves (No proof).	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 4: Multivariate Calculus	**[8 hours]**
Partial differentiation, total derivative-differentiation of composite functions. Jacobian-problems. Vector Differentiation: Scalar and vector fields. Gradient, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 5: Integral Calculus	**[08 hours]**
Integration – properties, integration by parts, definite integrals-problems, Evaluation of double and triple integrals-Problems. Beta and Gamma functions: Definitions, properties,	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA3BSACS	**CO 1**	Apply the concepts of Calculus, Probability Matrix theory in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Probability Matrix theory in computer science stream.	1	3

Assessment Details

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz-1	10	100	5	50
	Quiz-2	10		5	
	Test 1	40		20	
	Test 2	40		20	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024.

Reference Books

1. **B. V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal and S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
5. **J. Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.

6. **G. Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
7. **D.G. Zill and W.S.Wright:** "Advanced Engineering Mathematics", Jones Bartlett Publishers Inc.,7th Ed., 2020.

Web links and Video Lectures (e-Resources):

1. Calculus of one and multivariable: https://nptel.ac.in/courses/111104092
2. https://fossee.in
3. Matrices and System of Equations: https://www.classcentral.com/course/matrix-algebra-engineers-11986 and https://nptel.ac.in/courses/111106051

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

THIRD SEMESTER B.E. (CV, EEE, ECE, ME, IEM and CH)

Course Title	Additional Mathematics for Civil, Electrical and Mechanical Streams- 1	Course Code	25MA3BSANC
Credits	0	L – T – P	2-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus and Numerical Methods in Engineering applications.
- **Acquire the knowledge** of Calculus and Numerical Methods concepts to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

Unit – 1: Calculus of one variable	**[8 hours]**
Introduction to differentiation-problems. Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Polar curves, angle between the radius vector and the tangent, angle between two curves (No proof).	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 2: Multivariate Calculus	**[8 hours]**
Partial differentiation, total derivative-differentiation of composite functions. Jacobian-problems. Vector Differentiation: Scalar and vector fields. Gradient, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 3: Integral Calculus	**[8 hours]**
Integration, integration by parts, definite integrals - properties and problems. Beta and Gamma functions: Definitions, properties, problems. Vector Integration: Line integrals.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 4: Ordinary Differential Equations (ODEs) of First Order	**[8 hours]**
Introduction to Differential equations, variable separable method, homogeneous differential equations, Linear differential equations, Exact differential equations.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 5: Numerical Methods	**[8 hours]**
Solution of algebraic and transcendental equations: Newton-Raphson method (only formulae)- problems. Finite differences, Interpolation using Newton's forward and backward difference formulae. Numerical Integration: Simpson's $1/3$ and $3/8$ rules.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA3BSANC	CO 1	Apply the concepts of Calculus and Numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus and Numerical methods in their core areas of specialization.	1	3

Assessment Details

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz-1	10	100	5	50
	Quiz-2	10		5	
	Test 1	40		20	
	Test 2	40		20	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. **B. V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal and S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
5. **J. Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.

6. **G. Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
7. **D.G. Zill and W.S.Wright:** "Advanced Engineering Mathematics", Jones Bartlett Publishers Inc.,7th Ed., 2020.

Web links and Video Lectures (e-Resources):

1. http://academicearth.org/
2. VTU e-Shikshana Program
3. VTU EDUSAT Program
4. Calculus of one and multivariable: https://nptel.ac.in/courses/111104092
5. Numerical Methods: https://www.classcentral.com/course/numerical-methods-engineers-32822.

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

THIRD SEMESTER B.E. (CS, CS-DS, AI-ML, AI-DS, CS-IOT, CS-BS)

Course Title	Additional Mathematics for Computer Science Stream-2	Course Code	25MA4BSACS
Credits	0	L – T – P	2-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Linear algebra and Numerical methods in Engineering applications.
- **Acquire the knowledge** of Calculus, Linear algebra and Numerical methods to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

Unit -1: Vector Spaces	**[8 hours]**
Definition and examples of vector spaces, Subspace, Linear combination, Linear span, Linearly independent and dependent sets, Basis and dimension.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 2: Linear Transformations	**[8 hours]**
Definition and examples of linear transformation, Null space and Range space of a linear transformation, Matrix representation of a linear transformation, Rank-nullity theorem.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 3: Ordinary Differential Equations (ODEs) Of First Order	**[8 hours]**
Introduction to Differential equations, variable separable method, homogeneous differential equations, Linear differential equations, Exact differential equations.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 4: Numerical Methods - 1	**[8 hours]**
Algebraic and transcendental functions, Approximate root of an equation, Solution of algebraic and transcendental equations: Newton-Raphson method (only formula)- Problems. Finite differences, Interpolation using Newton's forward and backward difference formula.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
UNIT – 5: Numerical Methods - 2	**[8 hours]**
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 - Problems.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA4BSACS	**CO 1**	Apply the concepts of Calculus, Linear algebra and Numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Linear algebra and Numerical methods in computer science stream.	1	3

Assessment Details

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz-1	10	100	5	50
	Quiz-2	10		5	
	Test 1	40		20	
	Test 2	40		20	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024.

Reference Books

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal & S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.

5. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
6. **D.G. Zill and W.S.Wright:** " Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020.

Web links and Video Lectures (e-Resources):

1. VTU e-shikshana Program
2. https://fossee.in
3. Integral Calculus: https://www.classcentral.com/course/youtube-integral-calculus-90616b and https://www.edx.org/course/mathtrackx-integral-calculus
4. Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
5. Vector spaces and Linear Transformations: https://nptel.ac.in/courses/111104137, https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/ and https://www.classcentral.com/subject/linear-algebra
6. Numerical Methods: https://www.classcentral.com/course/numerical-methods-engineers-32822, https://nptel.ac.in/courses/111107105 and https://ocw.mit.edu/courses/18-335j-introduction-to numerical-methods-spring-2019/

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

FOURTH SEMESTER B.E. (CV, EEE, ECE, ME, IEM and CH)

Course Title	Additional Mathematics for Civil, Electrical and Mechanical Streams - 2	Course Code	25MA4BSANC
Credits	0	L – T – P	2-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Matrix algebra, Probability and Numerical methods in Engineering applications.
- **Acquire the knowledge** of Calculus, Matrix algebra, Probability and Numerical methods to implement them effectively within their core areas of specialization.
- Strengthen their **mathematical reasoning** and **develop competencies** essential for continuous lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) includes diverse pedagogical approaches beyond traditional instruction to support outcome-based learning.
- Utilize multimedia tools such as videos and animations to enhance conceptual understanding, complemented by collaborative group learning to encourage peer interaction and knowledge sharing.
- Pose at least three Higher Order Thinking (HOT) questions in the class to stimulate critical thinking and deeper analysis.
- Implement Problem Based Learning (PBL) approaches to engage students in real-world scenarios that require application of concepts, thereby developing critical and creative thinking.
- Present the topics using multiple representations and encourage students to develop their own creative solutions, while highlighting real-world applications to enhance understanding and relevance.

Unit -1: Matrices and System of Linear Equations	**[8 hours]**
Definition, basic operations, Elementary row operations, Echelon form, Rank. Consistency and Solution of system of linear equations; Gauss-elimination method and approximate solution by Gauss Seidel method. Eigenvalues and Eigenvectors.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 2: Partial Differential Equations (PDE)	**[8 hours]**
Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration, homogeneous PDE by the method of separation of variables.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Unit – 3: Fundamentals of Probability	**[8 hours]**
Definition, Basic terminologies, Addition theorem and Multiplication theorem on probability, independent events, Conditional probability, Random variable, Probability distribution, Bernoulli trials and Binomial Distribution-Problems.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 4: Numerical Solution of Ordinary Differential Equations (ODEs)	**[8 hours]**
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.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation
Unit – 5: Multiple Integrals	**[8 hours]**
Evaluation of double integrals, evaluation of double integrals by changing into polar coordinates. Evaluation of triple integrals.	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, students will be able to:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA4BSANC	**CO 1**	Apply the concepts of Calculus, Matrix algebra, Probability and Numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Matrix algebra, Probability and Numerical methods in computer science stream.	1	3

Assessment Details

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz-1	10	100	5	50
	Quiz-2	10		5	
	Test 1	40		20	
	Test 2	40		20	

- CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 45th Ed., 2024.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 5th Ed., 2024.

Reference Books

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal & S. C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
5. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
6. **D.G. Zill and W.S.Wright:** " Advanced Engineering Mathematics", Jones Bartlett Publishers Inc., 7th Ed., 2020.

Web links and Video Lectures (e-Resources):

1. VTU e-shikshana Program
2. https://fossee.in
3. Integral Calculus: https://www.classcentral.com/course/youtube-integral-calculus-90616b and https://www.edx.org/course/mathtrackx-integral-calculus
4. Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
5. Vector Calculus: https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroomand https://www.classcentral.com/course/vector-calculus-engineers-17387
6. Numerical Methods: https://www.classcentral.com/course/numerical-methods-engineers-32822, https://nptel.ac.in/courses/111107105 and https://ocw.mit.edu/courses/18-335j-introduction-to numerical-methods-spring-2019/

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU

DEPARTMENT OF MATHEMATICS & HUMANITIES

Course Code :	25MA1AECEN/ 25MA2AECEN	Course Title:	**COMMUNICATION SKILLS**
Credits:	1	**L – T – P**	1-0-0

Course Objectives:

- To understand the nuances of phonetics, accent, intonation and improve the pronunciation and communication skills
- To learn the basic English grammar and understand all types of English vocabulary and acquire professional communication skills

Perform as a member of a team and engage in group discussion and oral presentation.

Teaching-Learning Process (General Instructions):

The strategies teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective:

Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.

(i) Direct instructional method (Low/Old Technology), (ii) Flipped classrooms (High/advanced Technological tools), (iii) Blended learning (Combination of both), (iv) Enquiry and evaluation-based learning, (v) Personalized learning, (vi) Problems based learning through discussion, (vii) Following the method of expeditionary learning Tools and techniques, (viii) Use of audio-visual methods through language Labs in teaching of LSRW skills.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can progress the students in theoretical applied and practical skills in teaching of communicative skills in general.

UNIT-1	**[03 hours]**

COMMUNICATION SKILLS: Glimpses of Essential English for Engineers (General Overview). Communication Skills: Process, Verbal and Non-Verbal, Proxemics, Chronemics and Barriers. **Writing**: Word Classification – Parts of Speech, Sentence structures. **Speaking & Listening:** Listening to English Pronunciation – English Phonemes – Intelligible Accent – Speech Organs- Syllable Structures, Stress, Intonation, and Practice.

Teaching Methodology	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	ALL 44 sounds of English in 75 minutes - https://www.youtube.com/watch?v=QxQUapA2w4&t=51s. AI-based grammar and writing tools (e.g., Grammarly, ChatGPT, Quillbot) to analyze and classify parts of speech. AI-based pronunciation tools (Google Speech-to-Text) for real-time feedback
Reading Material	"**The Chimney Sweeper"** **by William Blake** Martin Luther King Jr's "I Have a Dream" Speech
Assessment Techniques and Tools	**Role Play**: Formal/informal scenarios, **Group Discussion (GD), Case Studies Analysis**: Identify barriers and suggest solutions, **Mini- Presentation**: Focused on proxemics. Observation Rubric (for body language, tone, time cues), (Sample Rubric, please refer the annexure), Video Recording + Self-evaluation Sheet.

UNIT-2	[03 hours]

INTERPERSONAL SKILLS : **Speaking**: Role Play Exercises Based on Workplace Contexts, Introducing Oneself - PEP Talks- Personal Empowerment, Participating in Group Discussion and Debates, Giving Technical Presentation. **Reading:** Reading the Interview of an Achiever (Skimming and Scanning) (Case Studies). **Writing:** Writing a Short Biography of an Achiever Based on given reflections, **Grammar:** Sentence patterns. **Vocabulary** Development: Idioms and Phrases.

Teaching Methodology	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	Google Meet / Zoom + AI Transcription- Practice group discussions with live transcription. Grammarly - Highlights grammar issues with explanations. **Oxford Learner's Dictionaries** (https://www.oxfordlearnersdictionaries.com/) - Includes etymology, pronunciation, synonyms/antonyms.
Assessment Techniques and Tools	Group discussion performance (listening, turn-taking, clarity) Technical resentations (confidence, structure, clarity) Role plays (relevance, tone, spontaneity) Case studies Oral communication rubric (clarity, relevance, tone, confidence, non-verbal cues), **Activity**: Read a short **interview of an achiever** (e.g., A. P. J. Abdul Kalam, Sudha Murthy) **LMS (Learning Management Systems)**: Moodle or Google Classroom for submissions and reflections. **Video Submissions**: Students submit videos of role plays or presentations for asynchronous review.

UNIT-3	[03 hours]

ENGLISH FOR EMPLOYABILTY: **Writing:** Formal Letter writing (Enquiry, Order, and Complaint). Tenses – Reported Speech- Voice - Email Etiquettes, Structure, Writing and Responding to Emails. Paragraph Writing (Descriptive, Argumentative, Expository, Short Story, and Narrative), Blog Writing. **Reading**: Proof Reading (Spelling, Punctuation, Grammar). Error Identification Exercises. **Speaking:** Questions & Requests (non-Wh questions and Question tags).

Pedagogy	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Digital Tools	Grammarly – Check grammar, tone, spelling Canva – Free templates to create posters, ads, infographics Adobe Express – Visual storytelling and ad design
Assessment Techniques and Tools	**Paragraph Writing -** Descriptive, Argumentative, Expository, Short Story, Narrative - Paragraph rubric (structure, logic, vocabulary, grammar) Writing - **Tool**: Digital submission + rubric for content originality, reader engagement, clarity. **Speaking Skills -** Oral assessment rubric (intonation, clarity, accuracy) Email simulator (Google Forms/Canvas/Docs template)

UNIT-4	**[03 hours]**

ENGLISH IN DIGITAL WORLD: Writing: Framing of search terms / keywords in search engines/ Commands for search on open AIs - Tools to support synchronous communication such as webinar platforms, and asynchronous communication such as forums and social media - Online communication - Types – pros and cons of online communication. Acceptable online roles and behaviours – Netiquettes - Etiquettes of social media. Problems and opportunities in handling digital resources -Tools to check grammar. Writing: Citing information accurately from source material - Plagiarism – Infringement, Importance of academic integrity.

Pedagogy	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	Quiklrn.com
Digital Tools	Google Meet - Integrated with Gmail, free for students Google Classroom - Forum, assignments, comments
Assessment Techniques and Tools	Write a short essay (150–200 words) on the problems and opportunities. Evaluation rubric (structure, coherence, grammar). Grammar assessment rubric (before vs after comparison, understanding of corrections).

UNIT-5	**[03 hours]**

APPLYING FOR JOBS : Listening: TED Talks. Speaking: Mock Interview, Telephone Interviews. Reading: Reading a Job Interview- language used in formal professional settings, formal vs. informal tone, non- verbal communication cues, Statement of Purpose, Company Profile and Completing Comprehension Exercises Writing: Job Applications and Resumes Grammar: Conditional Clauses, Modal verbs Vocabulary Development: Technical Vocabulary, Purpose Statement.

Pedagogy **Language Lab**	TBTL (Task-Based Teaching Learning) & Eclectic Approach
Language Lab	**Quiklrn.com**
Assessment Techniques and Tools	Listening to professional talks, analyzing tone and structure - https://www.ted.com/talks Non-verbal cues in professional reading - https://www.youtube.com/c/Mindsight Grammar AI practice - https://quillbot.com/grammar-check
Assessment Techniques and Tools	TED Talk worksheet - Listening rubric (comprehension, inference, note-taking), Reading comprehension tests, Resume & Application rubric (content, layout, tone, language), Grammar MCQs / Editing worksheet, Scenario-based MCQs or roleplay, Vocabulary worksheet

Course outcomes (Course Skills Set)

Course Code	CO	COURSE OUTCOME (CO)	PO
25MA1AECEN/ 25MA2AECEN	CO 1	Build essential verbal, non-verbal, and phonetic communication skills for clarity and effectiveness.	9
	CO 2	Use interpersonal skills in group discussions, presentations, and professional interactions.	9
	CO 3	Apply formal writing, email etiquette, and creative content development for employability.	9
	CO 4	Communicate effectively in digital platforms, following netiquette and academic integrity.	10
	CO 5	Prepare job applications, resumes, and perform confidently in interviews.	10

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

Extra Reading

1. Kumar, A. R. (2008). *English for engineers and technologists*. Orient BlackSwan.
2. Raman, M., & Sharma, S. (2015). *Technical communication: Principles and practice* (3rd ed.). Oxford University Press.
3. Floyd, K., & Cardon, P. W. (2019). *Business and professional communication* (3rd ed.). Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 | Published: December 23, 2024
4. Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 | Published: September 12, 2024
5. Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications.

Learning Resources:

- Oxford Advance Learners Dictionary
- Cambridge English Skills Real Listening and Speaking by Miles Craven
- Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar

Other Digital Resources

- Google Docs + Voice Typing - https://docs.google.com
- LearnEnglish – https://learnenglish.britishcouncil.org/
- TakeIELTS - https://www.britishcouncil.in/exam/ielts
- British Council Apps-**bbcLearnEnglishonline Grammar**

LearnEnglish Podcasts IELTS Word Power

Bbclearningenglishgrammer online Sounds Right (Phonemic C

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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DEPARTMENT OF MATHEMATICS & HUMANITIES

SYLLABUS (2025 - 2026)

ಬಳಕೆ ಕನ್ನಡ			
ವಿಷಯ ಸಂಕೇತ (Course Code)	25MA1HSBAK / 25MA2HSBAK	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯ ಮಾಪನ ಅಂಕಗಳು.	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / week (L:T:P:S)	1-0-0	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01		

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
2. To enable learners to Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To train the learners for correct and polite conservation.
5. To know about Karnataka state and its language, literature and General information about this state.

ಭೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching – Learning Process – General Instructions):

These are sample Strategies; which teacher can use to accelerate the attainment of the course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ಸ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿ ಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧ ಪಟ್ಟ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.
4. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚಿಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚುರ್ಚಿಸಲು ಕ್ರಮ ಕೈಗೊಳ್ಳುವುದು . ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
5. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯ ಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

UNIT – 1	**3 Hours**
1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language. 2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities. 3. Key to Transcription. Kannada Language Script. 4. ವ್ಯಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯ ಸೂಚಕ / ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words.	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.
UNIT – 2	**3 Hours**
1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತುಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು – Possesive forms of nouns, dubitive question and Relative nouns. 2. ಗುಣ ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ ಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and colour Adjectives, Numerals. 3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು –ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) -Predictive Forms, Locative Case.	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.
UNIT – 3	**3 Hours**
1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative cases, and numerals. 2. ಸಂಖ್ಯಾವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers. 3. ನ್ಯೂನ/ ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು & ವರ್ಣ ಗುಣವಾಚಕಗಳು -Defective/Negative Verbs & Colour Adjectives.	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.
UNIT – 4	**3 Hours**
1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು. Permission, Commands, encouraging and Urging words (Imperative words and sentences) 2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು. Accusative Cases and Potential Forms used in General Communication. 3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯ ಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು. – Helping verbs “iru and iralla”, corresponding Future and negation verbs.	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.

UNIT – 5	**3 Hours**
1 ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ, ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ. Comparitive, Relationship, Identification and Negation Words. 2 Kannada Vocabulary List: ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು.	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA1HSBAK / 25MA2HSBAK	**CO 1**	To create an awareness regarding the necessity of learning local language for a comfortable living and to know more about Kannada culture and literature.	PO10	3
	CO 2	To develop proper speaking, reading and writing skills in Kannada.	PO10	3
	CO 3	To engage as a member of a team and enhance the skill in group communication and presentation.	PO9	1

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

ಪಠ್ಯ ಪುಸ್ತಕ:

ಬಳಕೆ ಕನ್ನಡ: ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous Institute, Affiliated to VTU, Belagavi
DEPARTMENT OF MATHEMATICS & HUMANITIES

SYLLABUS (2025 - 2026)

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ			
ವಿಷಯ ಸಂಕೇತ (Course Code)	25MA1HSSAK / 25MA2HSSAK	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯ ಮಾಪನ ಅಂಕಗಳು.	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / week (L:T:P:S)	1-0-0	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01		

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು :

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾದಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು. ಕನ್ನಡ ಶಬ್ದ ಸಂಪತ್ತಿನ ಪರಿಚಯ.

ಭೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching – Learning Process – General Instructions):

These are sample Strategies; which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ಸ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇವತ್ತಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ - ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂದಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು. ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶನಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಕಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸುವುದು.

ಘಟಕ - 1	**3 Hours**

ಲೇಖನಗಳು:

1. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ.
2. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ.

ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಟ್ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ - 2	**4 Hours**
ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ: 1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕ ಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಜೇಡರದಾಸಿಮಯ್ಯ , ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ. 2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಟ್ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು .
ಘಟಕ - 3	**3 Hours**
ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ: 1. ಡಿ. ವಿ. ಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲ ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ. ರಾ. ಬೇಂದ್ರೆ . 3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಟ್ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು .
ಘಟಕ - 4	**3 Hours**
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ 2. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಟ್ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ - 5	**2 Hours**
1. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ ಚಿ ಬೋರಲಿಂಗಯ್ಯ	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಟ್ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO
25MA1HSSAK / 25MA2HSSAK	**CO 1**	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.	PO10
	CO 2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಹಾಗೂ ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುತ್ತದೆ.	PO10
	CO 3	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ, ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.	PO9

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

ಪಠ್ಯ ಪುಸ್ತಕ:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಡಾ. ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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Autonomous Institute, Affiliated to VTU

DEPARTMENT OF MATHEMATICS & HUMANITIES

Course Code :	25MA1HSSSK / 25MA2HSSSK /	Course Title:	**SOFT SKILLS**
Credits:	1	**L – T – P**	1-0-0

UNIT-1 [03 hours]

Social Skills:

- **Communication:** Principles of clear and effective exchange of ideas in professional and social contexts.
- **Persuasion:** Techniques to influence and convince through logical, emotional, and ethical appeals.
- **Self-Awareness:** Identifying personal strengths, weaknesses, opportunities, and challenges (SWOC analysis).
- **Active Listening:** Paraphrasing, questioning techniques, and demonstrating attentiveness.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during sessions build both conceptual understanding and real- world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	To embed skills, participants get hands-on through: Guided reflections and explainers to connect concepts with relatable real-life situations Guided visualization to prompt reflection and self-discovery Role-plays and activities to practice behaviours in context
	Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

UNIT-2 [03 hours]

Emotional Skills I :

- Emotional Intelligence (EI): Recognizing and managing emotions, empathy, relationship management, and conflict resolution.
- Stress Management: Identifying stress triggers, relaxation techniques, work-life balance strategies, and mindfulness practices.
- Time Management: Prioritization (Eisenhower Matrix), setting SMART goals, avoiding procrastination, and effective scheduling.
- Adaptability & Resilience: Handling change, bouncing back from setbacks, and developing a growth mindset.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	• To embed skills, participants get hands-on through: • Guided reflections and explainers to connect concepts with relatable real-life situations • Guided visualization to prompt reflection and self-discovery • Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem- solving exercises.

UNIT-3	**[03 hours]**

Emotional Skills II:

- Ambition & Goal Setting: Defining personal and professional aspirations, creating SMART goals, and aligning actions with long-term vision.
- Sympathy & Empathy: Understanding emotional perspectives, differentiating between the two, and applying them in workplace and social interactions.
- Creativity & Innovation: Generating original ideas, problem-solving, and applying creative thinking techniques (mind-mapping, SCAMPER).

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	• To embed skills, participants get hands-on through: • Guided reflections and explainers to connect concepts with relatable real-life situations • Guided visualization to prompt reflection and self-discovery • Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	Formative: Role-plays, activities, group discussions, peer feedback. Summative: Presentations, written reflections, problem-solving exercises.

UNIT-4	**[03 hours]**

Professional Skills I:

- **Problem Solving:** Identifying root causes, analysing options, and implementing solutions using methods like 5 Whys and Fishbone Diagram.
- **Discipline:** Building consistency, accountability, and professional habits.
- **Time Management:** Prioritizing tasks (Eisenhower Matrix), scheduling, avoiding procrastination.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, activities, peer feedback. Eclectic Approach.
Language Lab	Quicklrn.com
Experiential Learning Methods	To embed skills, participants get hands-on through: Guided reflections and explainers to connect concepts with relatable real-life situations Guided visualization to prompt reflection and self-discovery Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, activities, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

UNIT-5	**[03 hours]**

Professional Skills II:

- Collaboration & Teamwork: Working effectively in diverse teams, fostering trust, and achieving shared goals.
- Negotiation & Conflict Resolution: Strategies to resolve differences and reach win– win outcomes.
- Critical Thinking: The ability to analyze, evaluate, and synthesize information to make well-reasoned decisions.

Instructional Design	Each competency is taught and assessed through guided visualisations, reflections, explainers and hands on activities conducted during lab sessions those build both conceptual understanding and real-world application.
Teaching Methodology	TBTL (Task-Based Teaching Learning) – interactive workshops, simulations, peer feedback. Eclectic Approach
Language Lab	Quicklrn.com
Experiential Learning Methods	To embed skills, participants get hands-on through: Guided reflections and explainers to connect concepts with relatable real- life situations Guided visualization to prompt reflection and self-discovery Role-plays and activities to practice behaviours in context Peer discussions to gain diverse perspectives.
Assessment Methods	**Formative:** Role-plays, group discussions, peer feedback. **Summative:** Presentations, written reflections, problem-solving exercises.

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Course outcomes (Course Skills Set)

Course Code	CO	COURSE OUTCOME (CO)	PO
25MA1HSSSK / 25MA2HSSSK /	**CO 1**	Apply social skills for clear communication, persuasion, self-awareness, and active listening.	9
	CO 2	Use emotional skills to build confidence, manage stress, and adapt to change.	9
	CO 3	Set ambitious goals, practice empathy, and apply creativity for problem-solving.	9
	CO 4	Demonstrate discipline, time management, and structured problem-solving.	10
	CO 5	Work in teams, negotiate, resolve conflicts, and think critically.	10

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	CIE 1	25	100
	CIE 2	25	
SEE	End Exam	50	

Two CIEs will be conducted for 25 Marks each. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

Extra Reading

1. Principles of Scientific and Technical Writing, 1e, By Pratap K. J. Mohapatra, Sanjib Moulick, © 2025 | Published: December 23, 2024
2. Soft Skills, 1e, By Soma Mahesh Kumar © 2024 | Published: June 8, 2023
3. Effective Technical Communication, 3e, By Ashraf M. Rizvi, Priyadarshi Patnaik, © 2024 | Published: September 12, 2024
4. Yadav, D. P. (2022). *A course in English pronunciation*. Notion Publications.

Learning Resources:

- Oxford Advance Learners Dictionary
- Cambridge English Skills Real Listening and Speaking by Miles Craven
- Communicative English for Professionals by Nitin Bhatnagar and Mamta Bhatnagar

Other Digital Resources

- Google Docs + Voice Typing - https://docs.google.com
- LearnEnglish – https://learnenglish.britishcouncil.org/
- TakeIELTS - https://www.britishcouncil.in/exam/ielts
- British Council Apps - **bbcLearnEnglishonline Grammar**
  LearnEnglish Podcasts IELTS
  Word Power
  Bbclearningenglishgrammer online
  Sounds Right (Phonemic Chart)

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B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU, Belagavi

DEPARTMENT OF MATHEMATICS AND HUMANITIES

SYLLABUS (2025 - 2026)

FIRST & SECOND SEMESTER B.E.

Course Title	Indian Constitution and Engineering Ethics	Course Code	25MA1HSICE /25MA2HSICE
Credits	0	L – T – P	1-0-0

Course Objectives:

The objectives of the course are to facilitate the learners.

- To introduce the origin, key principles, and framework of the Indian Constitution.
- To study the importance of the Union and State Executives, elections, constitutional amendments, and emergency provisions in maintaining and strengthening the democratic governance in India.
- To discuss ethical responsibility through the study of engineering ethics and the impact of technology on society.

Teaching-Learning Process (General Instructions):

The strategies teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective:

Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools like (i) Direct instructional method (Low/Old Technology), (ii) Flipped classrooms (High/advanced Technological tools), (iii) Blended learning (Combination of both), (iv) Enquiry and evaluation-based learning, (v) Personalized learning, (vi) Learning through discussion on Case studies.

UNIT -1	[03 hours]

Introduction to the Indian Constitution:

The Importance of the Constitution. Introduction to the Indian Constitution, The Making of the Constitution, The Role of the Constituent Assembly. The Preamble of the Indian Constitution. Salient features of the India Constitution.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT - 2	[03 hours]

FR's, FD's, and DPSP's:

Fundamental Rights and their reasonable restrictions in various complex scenarios.
Directive Principles of State Policy (DPSP).
Fundamental Duties: Their Role and Importance in Nation-Building.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT - 3	[03 hours]

Union Executive & State Executive:

Union Executive - President, Vice President, Prime Minister, Parliament, Supreme Court of India.
State Executive - Governor, Chief Minister, State Legislative Assembly, and High Courts.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

UNIT - 4	[03 hours]

Elections, Amendments, and Emergency Provisions:

Election Commission, Elections & Electoral Process.
Constitutional Amendments: Importance and Key Changes in India. Emergency Provisions.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
UNIT - 5	**[03 hours]**
Professional Ethics: Ethics & Values. Types of Ethics. Scope & Aims of Professional & Engineering Ethics. Clash of Ethics. Moral Development. The impediments to Responsibility. Trust & Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety, and Liability in Engineering.	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcomes (Course Skills Set)
After completing the course successfully, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
25MA1HSICE/ 25MA2HSICE	**CO 1**	Understand the Constitution's origin, structure, principles, and its role in ensuring dignity and equal rights.	6	3
	CO 2	Analyze the government structure, the election process, the amendments, and the emergency provisions in the Indian democracy	6	3
	CO 3	Develop an understanding of ethical responsibility through the principles of engineering ethics.	7	2

Assessment Details (CIE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Test 1	25	50	25	50
	Test 2	25		25	

Question Paper Pattern:
CIE Multiple Choice Questions

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Textbook:

1. "An Introduction to Constitution of India and Professional Ethics" by Merunandan K.B. and B.R. Venkatesh, Meragu Publications, 3rd edition, 2011.
2. "Constitution of India & Professional Ethics & Human Rights" by Phaneesh K. R., Sudha Publications, 10th edition, 2016.
3. "Engineering Ethics", M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall, 2004.

Reference Books:

1. "Samvidhana Odu" - for Students & Youths by Justice HN Nagamohan Dhas, Sahayana, kerekon.
2. "Constitution of India, Professional Ethics and Human Rights" by Shubham Singles, Charles E. Haries, and et al, published by Cengage Learning India, Latest Edition – 2019.

3. "Introduction to the Constitution of India", (Students Edition.) by Durga Das Basu (DD Basu): Prentice–Hall, 2008.
4. "Constitution of India" (for Competitive Exams) - Published by Naidhruva Edutech Learning Solutions, Bengaluru. – 2022.

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DEPARTMENT OF MATHEMATICS

SYLLABUS (2025 - 2026)

Course Name	**INDIAN KNOWLEDGE SYSTEMS (Common to All UG Programs)**	**Course Code**	**25MA7HSIKL**
Credits	**4**	**L – T - P**	**1-0-0**
Contact hours	**15**		

Course Learning Objectives: The students will be able to

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To make the students understand the traditional knowledge and analyze it and apply it to their day-to-day life.

UNIT-1

Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.

[5 Hours]

UNIT-2

Traditional Knowledge in Humanities and Sciences: Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.

[5 Hours]

UNIT-3

Traditional Knowledge in Professional domain: Town planning and architecture-Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

[5 Hours]

Reference Book:

1. **Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
2. **Traditional Knowledge System in India**, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
3. **Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

Suggested Links	
1.	https://www.youtube.com/watch?v=LZP1StpYEPM
2.	http://nptel.ac.in/courses/121106003/
3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7.	https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMInp-Jtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE

COURSE OUTCOMES

At the end of the course, the student will have the ability to

CO	COURSE OUTCOMES
1	Provide an overview of the concept of the Indian Knowledge System and its importance.
2	Appreciate the need and importance of protecting traditional knowledge.
3	Recognize the relevance of Traditional knowledge in different domains.
4	Establish the significance of Indian Knowledge systems in the contemporary world.

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	Test 1	25	100
	Test 2	25	
SEE	End Exam	50	

Only two CIE shall be conducted. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

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

High-3 : Medium-2 : Low-1

Question Paper Pattern:

1. Each unit consists of one full question.
2. Each full question consists of two, three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in all units.

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