

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, Aided by Govt. of Karnataka and Affiliated to Visvesvaraya Technological University, Belgaum)
Mallathahalli, Outer Ring Road, Bengaluru-560 056



INTERNAL BOARD OF STUDIES MEETING

Department of Mathematics

CURRICULUM & DETAILED SYLLABI of MATHEMATICS

I & II Semesters

(FOR THE ACADEMIC YEAR 2025-2026)

Submitted to

DEAN ACADEMIC

For

Seeking Approval from Academic Council (AC)

By

DEPARTMENT OF MATHEMATICS

18 August 2025



**DEPARTMENT OF MATHEMATICS
MINUTES OF INTERNAL BOARD OF STUDIES (BOS)
MEETING**

The following are the minutes of the internal Board of Studies meeting held on this day, 18 August 2025, during 10.00 am - 12.00 pm in the Department of Mathematics Dr. Ambedkar Institute of Technology, Bengaluru.

Members Present:

Sl. No.	Category	Name of the member	Designation	Signature
1	Head of the Department	Dr. R. Murali Professor, Department of Mathematics, Dr AIT, Bengaluru - 560 056	Chairman	
2.	Internal faculty members at different levels	Dr. Jayalakshmi M Professor, Department of Mathematics, Dr AIT, Bengaluru - 560 056	Member	
		Dr. Nagarathnamma H Assistant Professor, Department of Mathematics, Dr AIT, Bengaluru - 560 056	Member	
		Dr. Prabhavathi Angadi Assistant Professor, Department of Mathematics, Dr AIT, Bengaluru - 560 056	Member	
		Dr. Sunitha Kulkarni Assistant Professor, Department of Mathematics, Dr AIT, Bengaluru - 560 056	Member	

Sl. No.	Agenda
1.	To conduct internal BOS as per the new VTU scheme 2025 for first year B.E.
2.	Modification to be made upto a maximum of 20% from VTU syllabus.

RESOLUTION

At the outset, the Chairman of the BOS committee, Dr. R. Murali, welcomed all the members to the meeting.

1. The first-year syllabi are approved with minor modifications as per VTU norms and with CO and PO mappings.
2. Self-study topics are included in each module.



Department of Mathematics
Syllabus proposed for approval as per NEP Model Curriculum Guidelines
CURRICULUM AND SYLLABUS OF MATHEMATICS
(For the First-year students admitted during the AY 2025-26)

For UG: B.E. Regular Students:

Course Code	Course Title	Teaching hours per week				Credit Assigned
		L	T	P	SS	
First Semester B.E. Programmes						
1BMAU101A	Differential Calculus and Linear Algebra: CV Stream	02	02	02	–	04
1BMAU101B	Calculus and Linear Algebra: CSE Stream	02	02	02	–	04
1BMAU101C	Differential Calculus and Linear Algebra: ME Stream	02	02	02	–	04
1BMAU101D	Differential Calculus and Linear Algebra: EEE Stream	02	02	02	–	04
Second Semester B.E. Programmes						
1BMAU201A	Differential Calculus and Numerical Methods: CV Stream	02	02	02	–	04
1BMAU201B	Numerical Methods: CSE Stream	02	02	02	–	04
1BMAU201C	Multivariable Calculus and Numerical Methods: ME Stream	02	02	02	–	04
1BMAU201D	Calculus, Laplace Transform and Numerical Techniques: CSE Stream	02	02	02	–	04

Nomenclatures:

(A) Civil Engineering Stream includes B.E. in Civil Engineering course.

(B) Computer Science Engineering Stream includes B.E. in the following streams:

- (i) Computer Science and Engineering (CSE).
- (ii) Information Science and Engineering (ISE).
- (iii) Artificial Intelligence and Machine Learning (AIML).
- (iv) Computer Science and Business systems (CSBS).
- (v) Computer Science and Data Science (CSDS).

(C) Mechanical Engineering Stream includes B.E. in the following streams:

- (i) Mechanical Engineering (ME).
- (ii) Industrial Engineering and Management (IEM).
- (iii) Aeronautical Engineering (AE).

(D) Electrical and Electronics Engineering Stream includes B.E. in the following streams:

- (i) Electrical and Electronics Engineering (EEE).
- (ii) Electronics and Communication Engineering (ECE).
- (iii) Electronics and Telecommunication Engineering (ETE).
- (iv) Electronics and Instrumentation Engineering (EIE).

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Civil Engineering Stream

Semester: I

Course Title	Differential Calculus and Linear Algebra							
Course Code	1BMAU101A							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06			
CIE Marks: 50	SEE Marks: 50	Total Max. marks=100			Duration of SEE: 03 Hours			

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of differential calculus, linear algebra and differential equations to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	Polar Curves and Curvature Polar coordinates, polar curves, angle between the radius vector and the tangent, angle between two polar curves. Pedal equations. Curvature and Radius of curvature- cartesian, parametric, polar and pedal forms (without proof). Self-Study: Tracing of curves (cartesian, parametric and polar). (RBT Levels: L1, L2, L3 and L4)	04	04
II	Series Expansion and Multivariable Calculus Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Partial differentiation, Euler's theorem. Total derivative – differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables. Self-Study: Extended Euler's theorem. (RBT Levels: L1, L2, L3 and L4)	04	04
III	Ordinary Differential Equations of First Order Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors: $\frac{1}{N} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right)$ and $-\frac{1}{M} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right)$ only. Orthogonal trajectories. Self-Study: Reducible to exact-IF by inspection. (RBT Levels: L1, L2, L3 and L4)	04	04

IV	<p>Ordinary Differential Equations of Higher Order Higher order linear differential equations with constant coefficients-homogeneous and non-homogeneous, inverse differential operator: e^{ax}, $\sin(ax+b)$ or $\cos(ax+b)$, x^n only. Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Solving governing differential equations of mass spring. Self-Study: Cauchy's and Legendre's non-homogeneous differential equations. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
V	<p>Linear Algebra Elementary row transformation of a matrix, echelon form, rank of a matrix. Consistency, solution of system of linear equations – Gauss elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector. Self-Study: Normal form and solution of system of linear equations by Gauss- Jordan method. (RBT Levels: L1, L2, L3 and L4)</p>	04	04

COURSE OUTCOMES: On completion of the course, students are able to:

CO1	Learn the notion of partial differentiation to compute rate of change of multivariate functions and the concept of calculus to solve the related problems.
CO2	Understand the concept of matrix theory for solving the system of linear equations, eigenvalues and eigenvectors.
CO3	Apply the knowledge of calculus, differential equations to solve the domain related problems.
CO4	Analyze the concept of differential equations, Jacobian and rank of the matrix to conclude on its solution.
CO5	Develop the modern mathematical tool-wxMAXIMA, the concept of derivatives to find extreme values, Jacobian, Orthogonal trajectories.

TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed., 2018.
3. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022.

REFERENCE BOOKS

1. B. V. Ramana, Higher Engineering Mathematics, McGraw–Hill Education, 11th Ed., 2017
2. Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
4. H.K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.

5. David C. Lay, Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018.

Weblinks 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/>

List of Laboratory experiments (2 hours/week per batch/batch strength 15): 10 lab sessions+ 1 repetition class+ 1 Lab Assessment.	
1	Analyzing standard 2D curves in polar, parametric and cartesian forms.
2	Finding angle between polar curves.
3	Evaluation of bending of curves and nature at a given point on it.
4	Determination of flow of a multivariable function along the given direction and also identify the independence of given multivariable functions.
5	Determination of the optimal values of unconstrained function of atmost two variables.
6	Determination of the primitive of first order differential equations.
7	Solution of higher order homogeneous linear differential equations.
8	Solution of higher order non-homogeneous linear differential equations.
9	Identifying the nature of given set of lines or planes using rank method.
10	Finding all the eigenvalues of a square matrix using Rayleigh power method.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	3										
CO3	3	2										
CO4	2	3										
CO5	1	1	2		2							
Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Computer Science Engineering Stream

Semester: I

Course Title	Calculus and Linear Algebra							
Course Code	1BMAU101B							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06	40	20	04
CIE Marks: 50	SEE Marks: 50		Total Max. marks=100			Duration of SEE: 03 Hours		

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of differential calculus, linear algebra, and vector calculus to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	Polar Curves and Curvature Polar coordinates, polar curves, angle between the radius vector and the tangent, angle between two polar curves. Pedal equations. Curvature and Radius of curvature- cartesian, parametric, polar and pedal forms (without proof). Self-Study: Tracing of curves (cartesian, parametric and polar). (RBT Levels: L1, L2, L3 and L4)	04	04
II	Calculus Partial differentiation, Euler's theorem, total derivative, differentiation of composite functions. Jacobian, statements of Taylor's and Maclaurin's series expansion for two variables. Maxima and minima for the function of two variables. Self-Study: Extended Euler's theorem. (RBT Levels: L1, L2, L3 and L4)	04	04
III	Vector Calculus Scalar and vector fields, gradient, directional derivatives, divergence and curl, solenoidal vector fields, irrotational vector fields and scalar potential. Curvilinear coordinates: Scale factors, base vectors, Cylindrical polar coordinates, Spherical polar coordinates, transformation between cartesian and curvilinear systems, orthogonality. Self-Study: Vector Identities. (RBT Levels: L1, L2, L3 and L4)	04	04

IV	<p>Linear Algebra Elementary row transformation of a matrix, Echelon form, rank of a matrix. Consistency and solution of system of linear equations: Gauss elimination method, Gauss-Jordan method. Applications: Traffic flow. Eigenvalues and Eigenvectors, diagonalization of the matrix, modal matrix. Self-Study: Normal form of the matrix. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
V	<p>Vector Space Vector spaces- definition and examples, subspace- definition and examples. Linear Combinations, linear span, linearly independent and dependent sets, basis and dimension, row space and column space of a matrix, coordinate vector, inner products and orthogonality. Self-Study: Rank-Nullity theorem. (RBT Levels: L1, L2, L3 and L4)</p>	04	04

COURSE OUTCOMES: On completion of the course, students are able to:

CO1	Learn the notion of partial differentiation to compute rate of change of multivariate functions and the concept of vector calculus and vector space to solve the related problems.
CO2	Understand the concept of matrix theory for solving the system of linear equations, eigenvalues and eigenvectors.
CO3	Apply the knowledge of differential calculus, vector calculus and vector space to solve domain related problems.
CO4	Analyze the concept of partial differentiation, rank of the matrix to conclude on its solution.
CO5	Develop the modern mathematical tool-wxMAXIMA, the concept of derivatives to find extreme values, Jacobian, Orthogonal trajectories.

TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Publications, 4th Ed., 2022.
3. Seymour Lipschutz and Marc Lipson, Linear Algebra, Schaum’s outlines series, 4th Ed., 2008.

REFERENCE BOOKS

1. B. V. Ramana, Higher Engineering Mathematics” McGraw-Hill Education, 11th Ed., 2017.
2. N. P Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
3. James Stewart, Calculus, Cengage Publications, 7th Ed., 2019.
4. David Poole, Linear Algebra, a modern introduction, Cengage publishers, 4th Ed., 2014.
5. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 4th Ed., 2018.
6. Gareth Williams, Linear Algebra with applications, Jones Bartlett Publishers Inc., 6th Ed., 2017.

Weblinks 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/>

List of Laboratory experiments (2 hours/week per batch/batch strength 15): 10 lab sessions + 1 repetition class + 1 Lab Assessment.	
1	Analyzing standard 2D curves in polar, parametric and Cartesian forms.
2	Finding angle between polar curves.
3	Evaluation of bending of curves and nature at a given point on it.
4	Determination of flow of a multivariable function along the given direction and also identify the independence of given multivariable functions.
5	Determination of the optimal values of unconstrained function of atmost two variables.
6	Vector differential operator applied on scalar and vector point functions.
7	Application problems on vector differential operator and vector identities.
8	Finding all the eigenvalues of a square matrix.
9	Linearly independent and dependent set of vectors.
10	Basis and dimension of a vector space.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	3										
CO3	2	2										
CO4	2	3										
CO5	1	1	2		2							
Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Mechanical Engineering Stream

Semester: I

Course Title	Differential Calculus and Linear Algebra							
Course Code	1BMAU101C							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06	40	20	04
CIE Marks: 50	SEE Marks: 50		Total Max. marks=100			Duration of SEE: 03 Hours		

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of differential calculus, linear algebra and differential equations to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	Polar Curves and Curvature Polar coordinates, polar curves, angle between the radius vector and the tangent, angle between two polar curves. Pedal equations. Curvature and Radius of curvature- cartesian, parametric, polar and pedal forms (without proof). Self-Study: Tracing of curves (cartesian, parametric and polar). (RBT Levels: L1, L2, L3 and L4)	04	04
II	Series Expansion and Multivariable Calculus Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Partial differentiation, Euler's theorem, total derivative – differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables. Self-Study: Extended Euler's theorem. (RBT Levels: L1, L2, L3 and L4)	04	04
III	Ordinary Differential Equations of First Order Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors: $\frac{1}{N} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right)$ and $-\frac{1}{M} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right)$ only. Orthogonal trajectories. Law of natural growth and decay. Self-Study: Reducible to exact-IF by inspection. (RBT Levels: L1, L2, L3 and L4)	04	04

IV	Ordinary Differential Equations of Higher Order Higher order linear differential equations with constant coefficients-homogeneous and non-homogeneous, inverse differential operator: e^{ax} , $\sin(ax+b)$ or $\cos(ax+b)$, x^n only. Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Self-Study: Cauchy's and Legendre's non-homogeneous differential equations. (RBT Levels: L1, L2, L3 and L4)	04	04
V	Linear Algebra Elementary row transformation of a matrix, echelon form, rank of a matrix. Consistency, solution of system of linear equations – Gauss elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector. Self-Study: Normal form and solution of system of linear equations by Gauss- Jordan method. (RBT Levels: L1, L2, L3 and L4)	04	04

COURSE OUTCOMES: On completion of the course, students are able to:

CO1	Learn the notion of partial differentiation to compute rate of change of multivariate functions and the concept of calculus to solve the related problems.
CO2	Understand the concept of matrix theory for solving the system of linear equations, eigenvalues and eigenvectors.
CO3	Apply the knowledge of calculus, differential equations to solve the domain related problems.
CO4	Analyze the concept of differential equations, Jacobian and rank of the matrix to conclude on its solution.
CO5	Develop the modern mathematical tool-wxMAXIMA, the concept of derivatives to find extreme values, Jacobian, Orthogonal trajectories.

TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

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3. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
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5. Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, McGraw Hill Book

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4	Determination of flow of a multivariable function along the given direction and also identify the independence of given multivariable functions.
5	Determination of the optimal values of unconstrained function of atmost two variables.
6	Determination of the primitive of first order differential equations.
7	Solution of higher order homogeneous linear differential equations.
8	Solution of higher order non-homogeneous linear differential equations.
9	Identifying the nature of given set of lines or planes using rank method.
10	Finding all the eigenvalues of a square matrix using Rayleigh power method.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	3										
CO3	2	2										
CO4	2	3										
CO5	1	1	2		2							
Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Electrical and Electronics Engineering Stream

Semester: I

Course Title	Differential Calculus and Linear Algebra							
Course Code	1BMAU101D							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06	40	20	04
CIE Marks: 50	SEE Marks: 50		Total Max. marks=100			Duration of SEE: 03Hours		

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of differential calculus, linear algebra, multiple integrals and differential equations to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	Polar Curves and Curvature Polar coordinates, polar curves, angle between the radius vector and the tangent, angle between two polar curves. Pedal equations. Curvature and Radius of curvature- cartesian, parametric, polar and pedal forms (without proof). Self-Study: Tracing of curves (cartesian, parametric and polar). (RBT Levels: L1, L2, L3 and L4)	04	04
II	Series Expansion and Multivariable Calculus Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Partial differentiation, Euler's theorem. Total derivative – differentiation of composite functions, Jacobian, Maxima and minima for the function of two variables. Self-Study: Extended Euler's theorem. (RBT Levels: L1, L2, L3 and L4)	04	04
III	Ordinary Differential Equations (ODE) of First Order and First Degree and Nonlinear ODE Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors: $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ and $-\frac{1}{M}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ only. Orthogonal trajectories, L-R and C-R circuits. Nonlinear differential equations: Introduction to general and singular solutions, solvable for p only, Clairaut's equations. Self-Study: Reducible to exact-IF by inspection. (RBT Levels: L1, L2, L3 and L4)	04	04

IV	Ordinary Differential Equations of Higher Order Higher order linear differential equations with constant coefficients-homogeneous and non-homogeneous, inverse differential operator: e^{ax} , $\sin(ax+b)$ or $\cos(ax+b)$, x^n only. Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. L-C-R circuits. Self-Study: Cauchy's and Legendre's non-homogeneous differential equations. (RBT Levels: L1, L2, L3 and L4)	04	04
V	Linear Algebra Elementary row transformation of a matrix, echelon form, rank of a matrix. Consistency, solution of system of linear equations – Gauss elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant eigenvalue and eigenvector. Self-Study: Normal form and solution of system of linear equations by Gauss-Jordan method. (RBT Levels: L1, L2, L3 and L4)	04	04

COURSE OUTCOMES: On completion of the course, students are able to:

CO1	Learn the notion of partial differentiation to compute rate of change of multivariate functions and the concept of calculus to solve the related problems.
CO2	Understand the concept of matrix theory for solving the system of linear equations, eigenvalues and eigenvectors.
CO3	Apply the knowledge of calculus, differential equations to solve the domain related problems.
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TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

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6	Determination of the primitive of first order differential equations.
7	Solution of higher order homogeneous linear differential equations.
8	Solution of higher order non-homogeneous linear differential equations.
9	Identifying the nature of given set of lines or planes using rank method.
10	Finding all the eigenvalues of a square matrix using Rayleigh power method.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
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Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Civil Engineering Stream

Semester: II

Course Title	Differential Calculus and Numerical Methods							
Course Code	1BMAU201A							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching Hours	Lab slots	Credits
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CIE Marks: 50	SEE Marks: 50		Total Max. marks=100			Duration of SEE: 03 Hours		

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of integral calculus, vector calculus, partial differential equations and numerical techniques to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	<p>Integral Calculus and its Applications Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find area by double integration and volume by triple integration. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Self-Study: Volume by double integration, duplication formula. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
II	<p>Vector Calculus and its Applications Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, divergence and curl. Solenoidal vector fields, irrotational vector fields and scalar potential. Vector Integration: Line integrals, work done by a force and flux. Statements of Green's theorem and Stoke's theorem problems without verification. Self-Study: Vector identities, divergence theorem. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
III	<p>Numerical Methods-1 Solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson method. Interpolation: Finite differences. Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula. Numerical Integration: Trapezoidal, Simpson's 1/3rd rule and Simpson's 3/8th rule. Self-Study: Secant method, Lagrange's interpolation formula. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
IV	<p>Numerical Methods-2 Numerical solution of ordinary differential equations of first order and first</p>	04	04

	degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector method and Adams Bashforth method. Self-Study: Euler's method to solve ODE of first order and first degree. (RBT Levels: L1, L2, L3 and L4)		
V	Partial Differential Equations (PDE) Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Method of separation of variables. Applications of PDE: Solution of one-dimensional heat equation and wave equation. Self-Study: Solution of PDE by Lagrange method. (RBT Levels: L1, L2, L3 and L4)	04	04

COURSE OUTCOMES: On completion of the course, students are able to

CO1	Apply the knowledge of multiple integrals to compute area and volume, vector differential operator to evaluate gradient, divergence, curl and numerical differences to evaluate interpolation problems.
CO2	Understand the knowledge of formation of partial differential equations, vector calculus refers to solenoidal, irrotational vectors and improper integrals.
CO3	Demonstrate the various methods of solution of partial differential equations, numerical methods to solve algebraic and transcendental equations.
CO4	Analyze the concept of multiple integrals, improper integrals, vector differentiation and vector integration to solve relevant problems.
CO5	Develop the skill of programming using the mathematical tool- wxMAXIMA, the concept of numerical methods to estimate the interpolating polynomial, to find the approximate solution of initial value problems and numerical integration.

TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022.

REFERENCE BOOKS

1. B.V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017.
2. Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 3rd Ed., 2016.
3. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
5. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011.
6. Richard L. Burden, Douglas J. Faires and A. M. Burden, Numerical Analysis, 10th Ed., 2010, Cengage Publishers.
7. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Ed., 2012.

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- <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>
- <https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring2012/pages/syllabus/>

List of Laboratory experiments (2 hours/week per batch/batch strength 15): 10 lab sessions+ 1 repetition class+ 1 Lab Assessment.	
1	Evaluation of multiple integrals and application to determine area and volume.
2	Evaluation of Gamma and Beta functions.
3	Vector differential operator applied on scalar and vector point functions.
4	Application problems on vector differential operator and Green's theorem.
5	Solution of algebraic and transcendental equations by Regula-falsi and Newton-Raphson method.
6	Interpolation using Newton's forward and backward difference formulae.
7	Applications of quadrature formula.
8	Solution of linear first order ordinary differential equations by Modified Euler's method.
9	Solution of linear first order ordinary differential equations by Runge-Kutta IV order and Milne's predictor-corrector methods.
10	Solution of one-dimensional heat equation and wave equation.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	3										
CO3	2	2										
CO4	2	3										
CO5	1	1	2		2							
Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Computer Engineering Stream

Semester: II

Course Title	Numerical Methods							
Course Code	1BMAU201B							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06	40	20	04
CIE Marks: 50	SEE Marks: 50	Total Max. marks=100			Duration of SEE: 03 Hours			

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of differential equations, modular arithmetic and numerical techniques to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	Introduction to Numerical methods Errors and their computation: Round off error, Truncation error, Absolute error, Relative error and Percentage error. Solution of algebraic and transcendental equations: Bisection, Regula-falsi, Secant and Newton-Raphson methods. Self-Study: Solution of equations by Ramanujan's method. (RBT Levels: L1, L2, L3 and L4)	04	04
II	Interpolation Finite differences, interpolation using Newton Gregory forward and backward difference formulae, Newton's divided difference. Lagrange interpolation formulae, Piecewise interpolation-linear and quadratic. Self-Study: Numerical Differentiation. (RBT Levels: L1, L2, L3 and L4)	04	04
III	Numerical Integration and Numerical Solution of Differential Equations Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule and Weddle's rule. Numerical solution of ordinary differential equations of first order and first-degree- Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method. Self-Study: Adam's Bashforth predictor and corrector method. (RBT Levels: L1, L2, L3 and L4)	04	04
IV	Differential Equations of First and Higher Order Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factors: $\frac{1}{N} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right)$ and $-\frac{1}{M} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right)$. Homogeneous and non-homogeneous differential equations of higher order with constant coefficients. Inverse differential operator: e^{ax} ,	04	04

	$\sin(ax+b)$ or $\cos(ax+b)$, x^n . Self-Study: Variation of parameter method. (RBT Levels: L1, L2, L3 and L4)		
V	Modular Arithmetic Introduction to congruence's. Linear Diophantine equations, basic properties of congruence's. Linear congruence's, system of linear congruence's-Remainder theorem (no proof). Fermat's little theorem. Wilson theorem. Applications of congruence's – RSA algorithm. Self-Study: Euler's theorem on congruence's (RBT Levels: L1, L2, L3 and L4)	04	04

COURSE OUTCOMES: On completion of the course, students are able to:

CO1	Apply the knowledge to compute various types of numerical errors, interpolation problems, congruence related problems.
CO2	Understand the knowledge of different equations, modular arithmetic, numerical methods to solve relevant problems.
CO3	Demonstrate the idea of numerical methods to solve algebraic and transcendental equations, numerical ordinary differential equations.
CO4	Analyze the concept of differential equations, numerical integrations to solve domain related problems.
CO5	Develop the skill of programming using the mathematical tool- wxMAXIMA, the concept of numerical methods to estimate the interpolating polynomial, to find the approximate solution of initial value problems and numerical integration.

TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 8th Ed., 2022.
2. David C Lay, Linear Algebra and its Applications, Pearson Publishers, 5th Ed., 2023.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.

REFERENCE BOOKS

1. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education, 11th Ed., 2017.
2. N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, 10th Ed., 2022.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Ed. 2012.
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5. Richard L. Burden, Douglas J. Faires, A. M. Burden, Numerical Analysis, 10th Edition.,2010, Cengage Publishers.

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- <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>
- <https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring2012/pages/syllabus/>

List of Laboratory experiments (2 hours/week per batch/batch strength 15): 10 lab sessions+ 1 repetition class+ 1 Lab Assessment.	
1	Computation of different types of errors in numerical methods.
2	Solution of algebraic and transcendental equations by Regula-falsi and Newton-Raphson method.
3	Interpolation using Newton's forward and backward difference formulae.
4	Interpolation using Lagrange's formula.
5	Application of quadrature formula.
6	Solution of linear first order ordinary differential equations by Modified Euler's method.
7	Solution of linear first order ordinary differential equations by Runge-Kutta IV order and Milne's predictor-corrector methods.
8	Determination of the primitive of first order differential equations.
9	Solution of higher order homogeneous linear differential equations.
10	Solution of higher order non-homogeneous linear differential equations.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	1			3							
Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Mechanical Engineering Stream

Semester: II

Course Title	Multivariable Calculus and Numerical Methods							
Course Code	1BMAU201C							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06	40	20	04
CIE Marks: 50	SEE Marks: 50		Total Max. marks=100		Duration of SEE: 03 Hours			

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of integral calculus, vector calculus, partial differential equations and numerical techniques to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theory	Tutorial
I	<p>Integral Calculus and its Applications Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find area by double integration and volume by triple integration. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Self-Study: Volume by double integration, duplication formula. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
II	<p>Vector Calculus and its Applications Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, divergence and curl. Solenoidal vector fields, irrotational vector fields and scalar potential. Vector Integration: Line integrals, work done by a force and flux. Statements of Green's theorem and Stoke's theorem problems without verification. Self-Study: Vector identities, divergence theorem. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
III	<p>Numerical methods-1 Solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson method. Interpolation: Finite differences. Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula. Numerical Integration: Trapezoidal, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule. Self-Study: Secant method, Lagrange's interpolation formula. (RBT Levels: L1, L2, L3 and L4)</p>	04	04

IV	Numerical methods-2 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, Milne's predictor-corrector method. Self-Study: Euler's method and Adams Bashforth method to solve ODE of first order and first degree. (RBT Levels: L1, L2, L3 and L4)	04	04
V	Partial Differential Equations (PDE) Formation of PDEs by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Method of separation of variables. Applications of PDE: Solution of one-dimensional heat equation and wave equation. Self-Study: Solution of PDE by Lagrange method. (RBT Levels: L1, L2, L3 and L4)	04	04

COURSE OUTCOMES: On completion of the course, students are able to:

CO1	Apply the knowledge of multiple integrals to compute area and volume, vector differential operator to evaluate gradient, divergence, curl and numerical differences to evaluate interpolation problems.
CO2	Understand the knowledge of formation of partial differential equations, vector calculus refers to solenoidal, irrotational vectors and improper integrals.
CO3	Demonstrate the various methods of solution of partial differential equations, numerical methods to solve algebraic and transcendental equations.
CO4	Analyze the concept of multiple integrals, improper integrals, vector differentiation and vector integration to solve relevant problems.
CO5	Develop the skill of programming using the mathematical tool- wxMAXIMA, the concept of numerical methods to estimate the interpolating polynomial, to find the approximate solution of initial value problems, and numerical integration.

TEACHING-LEARNING PROCESS: Chalk and Talk, PowerPoint presentation, animations, videos.

TEXTBOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2021.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2018.
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4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication, 3rd Ed., 2014.
5. Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, McGraw Hill Book Co., New York, 6th Ed., 2017.
6. Steven V. Chapra and Raymond P. Canale, Applied Numerical Methods with Matlab for Engineers and Scientists, McGraw-Hill, 3rd Ed., 2011.
7. Richard L. Burden, Douglas J. Faires and A. M. Burden, Numerical Analysis, 10th Ed., 2010, Cengage Publishers.
8. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, 5th Ed., 2012.

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- <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>
- <https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring2012/pages/syllabus/>

List of Laboratory experiments (2 hours/week per batch/batch strength 15): 10 lab sessions+ 1 repetition class+ 1 Lab Assessment.	
1	Evaluation of multiple integrals and application to determine area and volume.
2	Evaluation of Gamma and Beta functions.
3	Vector differential operator applied on scalar and vector point functions.
4	Application problems on vector differential operator and Green's theorem.
5	Solution of algebraic and transcendental equations by Regula-falsi and Newton-Raphson method.
6	Interpolation using Newton's forward and backward difference formulae.
7	Applications of quadrature formula.
8	Solution of linear first order ordinary differential equations by Modified Euler's method.
9	Solution of linear first order ordinary differential equations by Runge-Kutta IV order and Milne's predictor-corrector methods.
10	Solution of one-dimensional heat equation and wave equation.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	1			3							
Strength of correlation: Low-1, Medium-2, High-3												

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Department of Mathematics
Scheme and Syllabus 2025 – 26
Electrical and Electronics Engineering Stream

Semester: II

Course Title	Calculus, Laplace Transform and Numerical Techniques							
Course Code	1BMAU201D							
Category	ASC (Applied Science Course)							
Scheme and Credits	Theory/Practical/Integrated					Total teaching Hours	Lab slots	Credits
	L	T	P	SDA	Total			
	02	02	02	00	06	40	20	04
CIE Marks: 50	SEE Marks: 50		Total Max. marks=100			Duration of SEE: 03 Hours		

COURSE LEARNING OBJECTIVES

This course is proposed to impart to the students the skills of employing the basic tools of Laplace transform, vector calculus, integral calculus and numerical techniques to solve basic and complex engineering problems with related applications.

Module	Syllabus content	No. of hours	
		Theor y	Tutorial
I	<p>Integral Calculus and its Applications Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find area by double integration and volume by triple integration. Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Self-Study: Volume by double integration, duplication formula. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
II	<p>Vector Calculus and its Applications Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, divergence and curl. Solenoidal vector fields, irrotational vector fields and scalar potential. Vector Integration: Line integrals, work done by a force and flux. Statements of Green's theorem and Stoke's theorem problems without verification. Self-Study: Vector identities, divergence theorem. (RBT Levels: L1, L2, L3 and L4)</p>	04	04
III	<p>Numerical methods-1 Solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson method. Interpolation: Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula. Numerical Integration: Trapezoidal, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule. Self-Study: Second method, Lagrange's interpolation formula. (RBT Levels: L1, L2, L3 and L4)</p>	04	04

IV	Numerical methods-2 Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector method and Adam – Bashforth method. Self-Study: Euler's method. (RBT Levels: L1, L2, L3 and L4)	04	04
V	Laplace Transforms Laplace transform (LT): Definition, LT of elementary functions. Properties- linearity, scaling, shifting property, differentiation in the s domain, division by t (without proof). LT of periodic functions and Heaviside unit step function. Inverse Laplace transform: Definition, properties, evaluation using partial fraction method and applications to solve ordinary differential equations. Self-Study: Convolution theorem on Laplace transform. (RBT Levels: L1, L2, L3 and L4)	04	04

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1	Apply the knowledge of Laplace transform to solve differential equations, vector differential operator to evaluate gradient, divergence, curl and numerical differences to evaluate interpolation problems.
CO2	Understand the knowledge of vector calculus refer to solenoidal, irrotational vectors and numerical differences to evaluate interpolation problems.
CO3	Demonstrate various properties to find the Laplace transforms, numerical methods to solve algebraic and transcendental equations.
CO4	Analyze the concept of Laplace transforms, vector differentiation and vector integration to solve relevant problems.
CO5	Develop the skill of programming using the mathematical tool- wxMAXIMA, the concept of numerical methods to estimate the interpolating polynomial, to find the approximate solution of initial value problems and numerical integration.

TEACHING–LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXTBOOKS

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2	Evaluation of Gamma and Beta functions.
3	Vector differential operator applied on scalar and vector point functions.
4	Application problems on vector differential operator and Green's theorem.
5	Solution of algebraic and transcendental equations by Regula-falsi and Newton-Raphson method.
6	Interpolation using Newton's forward and backward difference formulae.
7	Application of quadrature formula.
8	Solution of linear first order ordinary differential equations by Modified Euler's method.
9	Solution of linear first order ordinary differential equations by Runge-Kutta IV order and Milne's predictor-corrector methods.
10	Computing Laplace transform, inverse Laplace transform of standard functions and applications of Laplace transform.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	3	2										
CO3	2	3										
CO4	3	2										
CO5	2	1			3							
Strength of correlation: Low-1, Medium-2, High-3												