25MA101: Mathematics-I

w. e. f. Academic Year:		2025-26
Semester:		1
Category of the Course:		Basic Science
Prerequisite:	Basic concepts of high school Mathematical skills	
Rationale:	Mathematics-I is designed to build a strong mathematical foundation necessary for various engineering disciplines. The course introduces students to essential topics such as differential calculus and integral calculus concepts that are not only vital for further mathematics courses but are also extensively used in subjects like computer science, electronics, and mechanical engineering.	

Course Outcomes:

After completion of the course, the student will be able to:

	Course Outcome (CO)	RBT Level (Cognitive Domain)
CO1	Apply the concepts of limits, indeterminate forms, and Taylor/Maclaurin series to analyze and approximate functions.	Apply
CO2	Solve problems involving functions of several variables using partial derivatives, chain rule, and total differentials.	Apply
CO3	Analyze and interpret critical points of multivariable functions using Jacobians, tangent planes, and Lagrange multipliers.	Analyze
CO4	Evaluate double and triple integrals in Cartesian and polar coordinates and apply them to compute area and volume.	Evaluate
CO5	Test convergence/divergence of infinite series using various methods like ratio, root, and comparison tests, and determine radius of convergence of power series.	Evaluate
CO6	Compute and interpret gradient, divergence, curl, and directional derivatives, and identify solenoidal and irrotational fields.	Understand Analyze

Teaching and Evaluation Scheme:

Teaching Scheme					Examination Scheme				
L	T	P	C	Hrs/Week	IE	Theory	CIA	Practical	Total Marks
03	01	-	04	04	40	60	30	-	130

IE: Internal Evaluation   Theory: Theory Exam (End Semester)
CIA: Continuous Internal Assessment   Practical: Practical Exam (End Semester)

Detailed Syllabus:

Topic		Hrs.	% of weightage
UNIT: 1	**Differential Calculus:**	**05**	**10%**
	Review of limit, Indeterminate forms, Taylor's & Maclaurin's expansions.		
UNIT: 2	**Partial differentiation :**	**06**	**12%**
	Limit and Continuity for several variables, Definition of partial derivatives, homogeneous function, Euler's theorem (without proof), Chain rule, Partial and Total Differential Coefficient, partial differentiation of composite function and implicit function,		
UNIT:3	**Applications of Partial differentiation:**	**06**	**13%**
	Tangent plane and Normal line, Jacobians, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers to determine stationary values		
UNIT: 4	**Multiple Integrals and its applications:**	**12**	**25%**
	Double integral in Cartesian and polar form, Change of Order integration in double integral, change of variable (cartesian to polar), Triple Integral **Applications:** Area, Volume.		
UNIT: 5	**Infinite Series:**	**08**	**20%**
	Limit of Sequence, Definition of Infinite Series, Convergence and divergence, Comparison test, Cauchy's integral test, ratio test, Cauchy's Root test, Leibnitz rule for alternating series, power series, radius of convergence.		
UNIT: 6	**Vector differential Calculus:**	**08**	**20%**
	Vector differentiation, Tangent vector, Normal vector, Gradient, Directional derivatives, Curl, Divergence and their Geometrical meaning, Solenoidal vector, Irrotational vector, Conservative field.		
Total		**45**	**100%**

Reference Books:

TEXT/REFERENCE BOOKS:
1) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2) AICTE's Prescribed Textbook: Mathematics-I (Calculus & Linear Algebra), Khanna Book Publishing Co.
3) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6) Finney R. L. and Thomas G. B., Calculus and Analytical Geometry (Linear Algebra), Narosa Publishing House, 2021, 9th edition.
7) Shanti Narayan and P.K. Mittal, Differential Calculus, S Chand And Company Limited, Year: 2020

8) S.C. Malik and Savita Arora, Mathematical analysis, new age international publishers
9) Inder K. Rana, An Introduction to measure and Integration, Narosa publication, 2nd edition,2005

List of Tutorials

Sr. No.	Tutorial Content	Hours
1	Problem solving on "Differential Calculus".	2
2	Problem solving on "Partial differentiation and its applications:".	2
3	Problem solving on "Applications of Partial differentiation:".	2
4	Problem solving on "Multiple Integrals and its applications"	3
5	Problem solving on "Infinite Series"	3
6	Problem solving on "Vector differential Calculus"	3
Total		**15 Hrs**

Course Outcomes Mapping:

CO	Course Outcome (CO)	POs/ PSOs Mapped	Cognitive Level (RBT)	Knowledge Category	Lecture Sessions	Tutorial Sessions
CO1	Apply the concepts of limits, indeterminate forms, and Taylor/Maclaurin series to analyze and approximate functions.	PO1, PO2, PO12, PSO1, PSO2	Apply (Ap)	Conceptual	5	2
CO2	Solve problems involving functions of several variables using partial derivatives, chain rule, and total differentials.	PO1, PO2, PO4, PO12, PSO1, PSO2	Apply (Ap)	Procedural	6	2
CO3	Analyze and interpret critical points of multivariable functions using Jacobians, tangent planes, and Lagrange multipliers.	PO1, PO2, PO4, PO12, PSO1, PSO2	Analyze (An)	Procedural	6	2
CO4	Evaluate double and triple integrals in Cartesian and polar coordinates and apply them to compute area and volume.	PO1, PO2, PO4, PO12, PSO1, PSO2	Evaluate (E)	Procedural	12	3
CO5	Test convergence/divergence of infinite series using various methods like ratio, root, and comparison tests, and determine radius of convergence of power series.	PO1, PO2, PO4, PO12, PSO1, PSO2	Evaluate (E)	Conceptual	8	3

CO6	Compute and interpret gradient, divergence, curl, and directional derivatives, and identify solenoidal and irrotational fields.	PO1, PO2, PO4, PO12, PSO1, PSO2	Understand & Analyze (U & An)	Procedural	8	3

Mapping of COs with POs & PSOs:

CO	PO												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	0	0	0	0	0	0	0	0	0	3	3	3
CO2	3	3	0	3	0	0	0	0	0	0	0	3	3	3
CO3	3	3	0	3	0	0	0	0	0	0	0	3	3	3
CO4	3	3	0	3	0	0	0	0	0	0	0	3	3	3
CO5	3	3	0	3	0	0	0	0	0	0	0	3	3	3
CO6	3	3	0	3	0	0	0	0	0	0	0	3	3	3

3: High, 2: Medium, 1: Low