

Calculus (I)	Code & No:	MATH 112
	Credits:	3(3,0,1)
	Pre-requisite:	PMTH 127
	Co-requisite:	None
	Level:	3

Course Description:

This course includes the following topics:

- 1) **Limits and Continuity:** Undetermined forms, Concept of Limit, Computation of Limits, Limits Involving Infinity, Continuity and its Consequences, Asymptotes
- 2) **Ordinary Differentiation and Its Applications:** The Power Rule, Higher Order Derivatives, The Product and Quotient Rules, Chain rule, Derivatives of trigonometric functions, Exponential functions, inverse function's, logarithmic functions, hyperbolic functions, differentiation of implicit functions, higher order derivatives. Tangent and Normal lines, extreme values of a function, L- Hospital 's Rule, Mean value theorem for differentiation
- 3) **Coordinate systems:** Cartesian Coordinates, Polar Coordinates, Parametric coordinates, Cylindrical and Spherical Coordinates: Plane Curves, conversion of coordinate system and Parametric Equations
- 4) **Curve Sketching:** Rules of sketching, graphs of curves in Cartesian coordinate system

Integrals: Anti-derivatives, Indefinite Integral, Integration by Substitution, Integrals involving logarithmic, exponential, and hyperbolic functions, definite Integral, area under curves, Mean value theorem for integration, Fundamental theorem of calculus

Course Aims:

1. Give the intuitive knowledge of limits and continuity of a function
2. Study the fundamental concepts of differentiation and their applications
3. Understand different coordinate systems and their relationship
4. Develop skills to sketch curves
5. Study the fundamental concepts of integrations, definite integral, area under the curves

Student Outcomes (SOs):

- (a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline
- (b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

- (c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
- (d) An ability to function effectively on teams to accomplish a common goal
- (e) An understanding of professional, ethical, legal, security and social issues and responsibilities
- (f) An ability to communicate effectively with a range of audiences
- (g) An ability to analyze the local and global impact of computing on individuals, organizations, and society
- (h) Recognition of the need for and an ability to engage in continuing professional development
- (i) An ability to use current techniques, skills, and tools necessary for computing practice.
- (j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices. [CS]
- (k) An ability to apply design and development principles in the construction of software systems of varying complexity. [CS]
- (j) An ability to use and apply current technical concepts and practices in the core information technologies of human computer interaction, information management, programming, networking, and web systems and technologies. [IT]
- (k) An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation, and administration of computer-based systems. [IT]
- (l) An ability to effectively integrate IT-based solutions into the user environment. [IT]
- (m) An understanding of best practices and standards and their application. [IT]
- (n) An ability to assist in the creation of an effective project plan. [IT]

Course Learning Outcomes (CLOs):

Upon successful completion of the course, students should be able to:

1. Find limit and continuity of a function.
2. Compute derivatives of functions and used it to solve problems like tangent normal, extreme values of a function, L-Hospital rules.
3. Study various coordinate systems and their relationship
4. Develop skills to sketch the graph of a function in Cartesian coordinates
5. Find integrals of various functions, definite integrals and apply it to find the area under the curves

SOs and CLOs Mapping:

CLO/SO	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CLO1	√	√							√					
CLO2	√	√							√					
CLO3	√	√							√					
CLO4	√	√							√					
CLO5	√	√							√					

No.	Topics	Weeks	Teaching hours
1	<u>undetermined forms</u> , Concept of Limit, Computation of Limits, and, <u>Limits Involving Infinity</u> , Continuity and its Consequences, Definition of asymptotes, working rules to find asymptotes	3	9
2	The Power Rule, Higher Order Derivatives, The Product and Quotient Rules, Chain rule, Derivatives of trigonometric functions, Exponential functions, inverse function's, logarithmic functions, hyperbolic functions, differentiation of implicit functions, higher order derivatives.	3	9
3	Tangent and Normal, extreme values of a function, L- Hospital 's Rule, Mean value theorem for differentiation	3	9
4	Cartesian Coordinates, <u>Polar Coordinates</u> , <u>Parametric coordinates</u> , <u>Cylindrical and Spherical Coordinates</u> , <u>Plane Curves</u> , <u>conversion of one coordinate system to another coordinate system</u> and <u>Parametric Equations</u> Introduction of curve sketching, Rules of sketching a curve in Cartesian coordinate system	2	6
5	Introduction of Integrals: Anti-derivatives, Indefinite Integral Integration by Substitution, Integrals involving logarithmic, exponential, and hyperbolic functions, definite Integral, Area under curves, Mean value theorem for integration, fundamental theorem of calculus	3	9

Total	14	42
-------	----	----

Textbook:

- Calculus, Early Transcendental Functions, Robert Smith, Roland Minton, ISBN10: 0077235908 ISBN13: 9780077235901, McGraw-Hill Science Engineering, 4th Edition, 2011.

Essential references:

- Schaum's Outline of Calculus, Sixth Edition, ISBN-10: 0071508619, McGraw-Hill, 2013
- Calculus, L. Hostetler & Edwards, Cengage Learning, 10th (2013)
- Higher Engineering Mathematics, B.V. Ramana, ISBN-13: 978-0-07-063419-0 ISBN-10: 0-07-063419-X, Tata McGraw -Hill, Sixth Edition (2008)