

**Centre for High Energy Physics  
Faculty of Science  
University of the Punjab, Lahore  
Course Outline**



<b>Program</b>	BSCP	<b>Course Code</b>	CPHY 101	<b>Credit Hours</b>	3
<b>Course Title</b>	<b>Calculus I</b>				
<b>Course Introduction</b>					
<p>The Calculus course is a comprehensive mathematical journey that teaches students the fundamentals of functions, their behavior, and real-world problems. It covers the basics of real numbers, functions, and inverse functions, as well as limits, continuity, derivatives, differentiation techniques, graphing, optimization, and partial derivatives. The course also covers the role of derivatives in graphing and applications, such as concavity and relative extrema. By the end of the course, students will have a solid understanding of calculus, enabling them to navigate the complexities of functions, derivatives, and their applications in theory and practice.</p>					
<b>Learning Outcomes</b>					
<p>The course introduces the subject of differential calculus at undergraduate level. Its objectives are as following.</p> <ol style="list-style-type: none"> <li>1. Understanding the concepts of functions, limit and differentiation.</li> <li>2. Study the application of differentiation.</li> <li>3. Be able to solve relevant numerical problems.</li> <li>4. Be able to use calculus in physics and advance courses in mathematics.</li> </ol>					
<b>Course Content</b>					
<b>Week 1</b>	Functions, Domain and Range				
	Introduction to Limit, Limit at infinity				
<b>Week 2</b>	Rigorous definition of limit, Technique for evaluation limits.				
	Continuity: Definition and examples, Properties of continuous functions				
<b>Week 3</b>	Derivative: Tangent lines and rates of change				
	Derivative rules: Power, Product, Quotient, and chain rules				
<b>Week 4</b>	Differentiability and continuity				
	High order derivative and Leibniz theorem				
<b>Week 5</b>	Increasing and decreasing functions				
	Extrema, maxima and minima				
<b>Week 6</b>	Convexity and point of inflection				
	Curve sketching				
<b>Week 7</b>	Mean value theorem				
	Intermediate forms and L'Hopital's rule				
<b>Week 8</b>	Functions of two or more variables, partial derivatives				

	Local linear approximation;
<b>Week 9</b>	Integration as antiderivative
	Riemann sum and definite integral
<b>Week 10</b>	Integration by substitution
	Integration of elementary and trigonometric functions
<b>Week 11</b>	Integration of logarithmic and exponential functions
	Integration by parts
<b>Week 12</b>	Integration by partial fraction
	Improper integrals
<b>Week 13</b>	Average value
	Area between curves
<b>Week 14</b>	Volume by slicing
	Volumes by Cylindrical shells
<b>Week 15</b>	Length of a plane curve
	Area of surface of revolution,
<b>Week 16</b>	Work, Moments, Centre of gravity, and Centroids
	Using Computer algebra systems and tables of integrals

#### Textbooks and Reading Material

1. Calculus, H. Anton, I. Bevens, S. Davis (10th Edition), *Laurie Rosatone*(2012).
2. Calculus by Thomas (13th Edition), *Addison Wesley* (2005)
3. Calculus with Analytic Geometry, E. W. Swokowski, *PWS Publishers, Boston* (1988).
4. Calculus and Analytic Geometry (9<sup>th</sup>Edition), G.B. Thomas and R.L. Finney, *Addison-Wesley Publishing Company* (1995).
5. Calculus and Analytics Geometry, C. H. Edward and E. D Penney, *Prentice Hall* (1988).

#### Teaching Learning Strategies

The instructor is required to make use of Mathematica/Maple/Python to teach the concepts through visualization/animation and symbolic/numerical calculations. The students are required to solve a large portion of related exercises/questions/problems of the main textbooks.

#### Assignments: Types and Number with Calendar

At least two assignments and two quizzes. A course project may also be assigned.

#### Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.

2.	Formative Assessment	25%	Continuous assessment includes Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. At least fifty percent of the question paper would involve new problems related to the concepts learned in the course. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.