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

Program	BSCP	**Course Code**	CPHY 102	**Credit Hours**	3
Course Title	**Calculus II**				

Course Introduction

The Multivariable Calculus course offers a comprehensive exploration of advanced calculus concepts and their applications in multiple dimensions. It covers Infinite Series, Parametric and Polar Curves, Three-Dimensional Space, Quadratic Surfaces, Vector-Valued Functions, Multiple Integrals, Vector Fields, Line Integrals, Conservative Vector Fields, and theorems of Green, Gauss, and Stokes. The course covers sequences, monotone sequences, convergence tests, Maclaurin and Taylor series, parametric equations, tangent lines, arc length, and polar coordinates. It also explores vector fields, line integrals, conservative vector fields, and theorems of Green, Gauss, and Stokes. By the end of the course, students will have a profound understanding of multivariable calculus and its diverse applications, making them skilled problem solvers in mathematics, engineering, and natural sciences.

Learning Outcomes

The course introduces the subject of analytical geometry, Infinite series and sequences, and vector analysis at undergraduate level. Its objectives are as following.

1. Introduce plane analytical geometry and analytical geometry in 3D.
2. To study the concept of integration, relevant theorems, and techniques of evaluating integrals.
3. Study definite integrals and its applications.
4. Study multiple integrals and its applications.

Course Content

Week 1	Infinite Series
	Sequences
Week 2	Monotone Sequences
	Convergence tests
Week 3	The comparison, ratio, root, and integral tests
	Maclaurin series
Week 4	Taylor series
	Convergence of Taylor series
Week 5	Parametric and Polar Curves
	Parametric equations
Week 6	tangent lines and arc length for parametric curves
	Polar coordinates
Week 7	Area of polar curves

	Conic sections
Week 8	Conic sections in polar coordinates.
	Three- dimensional space: rectangular coordinate in 3D space
Week 9	spheres; cylindrical surfaces,
	Vectors, Dot product, Cross product, Parametric equation of lines
Week 10	Planes in 3D space, Quadratic surfaces, cylindrical surfaces, Spherical surfaces
	Vector-valued functions: Calculus of vector valued functions
Week 11	Unit tangent, normal, and binomial vectors
	Multiple integrals: Double integrals in cartesian coordinates, Surface area
Week 12	Examples (Multiple integrals: Double integrals in polar coordinates, Surface area)
	Triple integrals in cartesian, cylindrical and spherical coordinates, Change of variables and Jacobians
Week 13	Vector fields, Line integrals
	Conservative vector fields, Green's theorem
Week 14	Surface integrals,
	Applications of surface integral
Week 15	Flux, The Divergence theorem
	Applications of the Divergence theorem
Week 16	Stokes's theorem
	Applications of the Stokes's theorem

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^{th}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/antimutation 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.