MATH 2150: Vector Calculus

2022 Fall Session	
Total Class Sessions: 25	**Instructor: Staff**
Class Sessions Per Week: 5	**Classroom: TBA**
Total Weeks: 5	**Office Hours: TBA**
Class Session Length (Minutes): 145	**Language: English**
Credit Hours: 4	

Course Description:

This course introduces students to Vector Calculus. Topics include gradient divergence and curl; line and surface integrals; and the theorems of Green, Stokes, and Gauss. We will discuss Laplace Transforms and how they are used to solve Initial Value Problems. We will also introduce Separation of Variables, one of the basic solution techniques for solving partial differential equations, including partial derivations for the Heat Equation and Wave Equation.

Learning objectives:

Learning objectives are statements that articulate what students are expected to be able to do in a course. The learning objectives for this course are as follows.

- Understand the two methods of integrating along a curve in space and explore the meaning and significance of these constructions.
- Solve differential equations that involve Heaviside and Dirac Delta functions
- Use Laplace transforms to solve nonconstant coefficient differential equations
- Use convolution integral to take the inverse transforms
- Understand Separation of Variables techniques for solving partial differential equations
- Solve examples for the heat equation, the wave equation and Laplace's equation

Course Materials:

Thomas' Calculus, Early Transcendentals, 14th ed, Pearson, 2017

Vector Calculus, Colley, Susan Jane, 4th ed, Pearson, 2011

Course Format and Requirements:

Attendance:

Students are expected to attend and participate in class. Strong attendance and participation are good indicators of success. Each student is responsible for all course material, announcements, quizzes and exams made in class, whether or not the student attended that day's class.

Course Assignments:

Homework Assignments:

There will be 5 homework assignment in every week. Homework will be signed every week. All assignments must be turned in at the start of class on their due date. Late work will not be accepted.

Quizzes:

There will be 5 quizzes administered through the whole semester. Quizzes will always be completed in the first ten minutes of class. The quiz problems will be similar to homework problems and in-class examples. **There will be no make-up quizzes**.

Midterm Exams:

There will be two midterm exams in this course. The midterm exam will be based on concepts covered in class. It will be in-class, close-book and non-cumulative.

Final Exam:

The final will be cumulative to allow you to demonstrate the breadth of knowledge you've acquired throughout the semester. The final exam will be close-book. The final exam is worth 35% of the total final score. Note that the final will not be taken during the normal class times. Exact time and location for final will be announced in the last week of sessions.

Course Assessment:

Quizzes (5)	15%
Homework(5)	15%
Midterm Exams 1	15%
Midterm Exams 2	20%
Final Exam	35%
Total	**100%**

Grading Scale (percentage):

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-100	**93-97**	**90-92**	**88-89**	**83-87**	**80-82**	**78-79**	**73-77**	**70-72**	**68-69**	**63-67**	**60-62**	**<60**

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Chengdu University of Technology's *Academic Conduct Code.* Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

Course Schedule:

Week I: Homework 1, Quiz 1
Integral theorems of vector calculus Line Integrals. Scalar and Vector Line Integrals, Line Integrals Along Curves: The Effect of Reparametrization, Numerical Evaluation of Line Integrals. Green's Theorem. Conservative Vector Fields: Path Independence, Gradient Fields and Line Integrals, A Criterion for Conservative Vector Fields, Finding Scalar Potentials. Surface integrals and Vector analysis. Parametrized Surfaces: Coordinate Curves, Normal Vectors, and Tangent Planes; Area of a Smooth Parametrized Surface. Surface Integrals: Scalar Surface Integrals; Vector Surface Integrals; Further Interpretations; Reparametrization of Surfaces. Stokes's and Gauss's Theorems, The Meaning of Divergence and Curl. Further Vector Analysis; Maxwell's Equations, An Inversion Formula for the Laplacian.
Week II: Homework 2, Quiz 2, Midterm Exam 1.
Infinite series The integral test, Comparison test, Absolut convergence, The Ratio, and Root tests, Alternating series and conditional convergence, Power series, Taylor and Maclaurin Series, Convergence of Taylor Series, Applications.
Week III: Homework 3, Quiz 3.
Fourier series and transforms Periodic Functions, The Fourier expansion, Orthogonality, Calculating the Fourier components, Even

and odd expansions, Periodic extension, Complex Fourier Series, Comparing real and complex Fourier expansion, Fourier series and series expansions, Parseval's theorem.

Fourier Transforms, Fourier transforms as a limit of Fourier series, Reciprocal relations between a function and its FT, Differentiating and integrating Fourier series.

Week IV: Homework 4, Quiz 4, Midterm Exam 2.

Laplace Transforms

Laplace Transforms, Inverse Laplace Transforms, Step Functions, Solving IVPs' with Laplace Transforms, Nonconstant Coefficient IVP's, IVP's with Step Functions, Dirac Delta Function, Convolution Integral, Table of Laplace Transforms.

Week V: Homework 5, Quiz 5, Final Exam.

Partial differential equations

A linear operator, a linear partial differential equation and a homogeneous partial differential equation, the Principle of Superposition.

Separation of Variables.

The Heat Equation: Solving the Heat Equation, Heat Equation with Non-Zero Temperature Boundaries; The Wave Equation: Vibrating String – one dimensional wave equation; Laplace's Equation