

**The University of Iowa**  
**The College of Liberal Arts and Sciences**  
**Spring 2024**

**Engineering Math V: Vector Calculus, MATH:3550:0091 and MATH:3550:0131**  
**Course meeting time and place: 10:30-11:20 and 11:30-12:20 MWF, 217MLH**  
**Department of Mathematics: [\[Web\]](#)**

**Course ICON site:** To access the course site, log into Iowa Courses Online (ICON)  
<https://icon.uiowa.edu/index.shtml> using your Hawk ID and password.

**Course Home**

The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the add and drop deadlines, the “second-grade only” option (SGO), academic misconduct policies, and other undergraduate policies and procedures. Other UI colleges may have different policies.

**Instructor: *Dr. Tong Li***

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                  1:30-3:30PM Fridays  
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Website address: <https://icon.uiowa.edu/>

Class announcements, due dates, and information pertaining to homework, quizzes, and tests will be posted regularly on ICON.

**Prerequisites:** MATH:1560 and (MATH:2550 or MATH:2700)

Some of the policies relating to this course (such as the drop deadline) are governed by its administrative home, the College of Liberal Arts and Sciences, 120 Schaeffer Hall.

**Description of the Course:** Central topics of this course include partial derivatives of functions of several variables, max-min problems, integration of functions of several variables along curves, surfaces, and solids, Stokes’ Theorem and the Divergence Theorem, classical partial differential equations. Although the course is designed as a part of the engineering sequence of mathematics courses, it is not restricted to engineering students. Multivariable calculus is an essential tool for the study of various real-life processes. There are two midterm exams and a comprehensive final exam. Regular quizzes and homework assignments are included in this course.

**Objectives and Goals of the Course:** The objectives of a student taking MATH:3550 are to gain an understanding of concepts and techniques of multivariate and vector calculus appropriate to an engineering curriculum.

MATH:3550 Vector Calculus is the final course in the engineering mathematics sequence. In this course, many of the topics studied in earlier courses are considered in a multi-variate setting in 2 or 3 dimensions. The course begins with definitions and concepts of limits and differentiation for multivariable functions, including partial derivatives, the chain rule, directional derivatives and gradients, and critical points and extreme values. Double

integrals and applications are studied in rectangular and polar coordinates, followed by triple integrals in rectangular, cylindrical, and spherical coordinates. Applications of multiple integrals include area, volume, centers of mass, moments, and others. The course turns next to important topics in vector calculus. After introducing line integrals, we consider vector fields, potential functions, and work. We study the concept of path independence and conservative fields leading up to Green's Theorem in the plane. Following this, we move to three dimensions and consider parameterized surfaces, surface integrals, Stokes' Theorem, and the Divergence Theorem. In the final part of the course, we discuss partial differential equations which describe vibration of a string and membrane, and the conductance of heat.

**Textbook:** We will use two textbooks: (A) E. Herman and G. Strang, "*Calculus 3*". It can be downloaded from <https://openstax.org/details/books/calculus-volume-3> (B) P. Lax and M.S. Terrell, "*Multivariable Calculus with Applications*", 978-3-319-74073-7 (eBook) (It can be downloaded from University of Iowa Libraries (need UI credentials): <https://link-springer-com.proxy.lib.uiowa.edu/book/10.1007/978-3-319-74073-7>

**Material to be covered:** It is planned to study the most important facts and concepts of Chapters 1 – 6 of the textbook (A) by E. Herman and G. Strang, and Chapter 9 of the textbook (B) by P. Lax and M.S. Terrell.

**Tentative timetable:**

Weeks 1 - 3: Parametric equations and Polar coordinates; calculus of parametric equations; conic sections; dot and cross products of vectors; quadric surfaces; cylindrical and spherical coordinates

Week 4 - 5: Calculus of vector-valued functions; arc length, curvature; motion in space

Week 6 – 9: Differentiation and integration of functions of several variables: limits, continuity, partial derivatives, Chain Rule, max-min problems, Lagrange multipliers; double and triple integrals, triple integrals in cylindrical and spherical coordinates, change of variables

Week 10 – 12: Vector calculus: conservative vector fields, line and surface integrals, divergence and curl, Green's Theorem, Stokes Theorem, Divergence theorem

Week: 13 – 15: Partial differential equations (string and membrane vibrations, conductance of heat) in Chapter 9 of the textbook (B) by P. Lax and M.S. Terrell.

**Grading System:** Plus/minus grading will be used.

**Grades:** 35% - final exam,  
20% + 20% - midterm 1 and midterm 2,  
15% - homework,  
10%- quizzes

**Exam dates:**

**Midterm 1:** 6:30PM- 8:00PM 02/21/2024 Wed 107 EPB/109EPB

**Midterm 2:** 6:30PM- 8:00PM 04/10/2024 Wed 107 EPB/109EPB

**Final Exam:** TBA

**Date and Time of the Final Exam:** The date and time of every final examination is announced by the Registrar generally around the 5<sup>th</sup> week. All students should plan on being at the UI through the final examination period. Once the Registrar has announced the date, time, and location of each final exam, the complete schedule will

be published on the Registrar's web site and will be shared with instructors and students. It is the student's responsibility to know the date, time, and place of the final exam.

***Grade cuts and Grade Distribution: Two midterms and the final exam are going to be common exams for all sections. The course grades will be determined by the exam grades, HW and Quiz grades described above.***

I will use the +/- grading system. Cutoffs for the letter grade are expected to follow the recommended scale given by CLAS, and cutoffs for +/- are at the discretion of the instructor. You should not view this as a predetermined grade scale for assigning the final grade, but rather as a guaranteed minimum grading scale.

A [90, 100], B [80, 89], C [60,79], D [41, 59], F [0, 40].

### **Course Policies:**

**Course attendance:** Students are expected to attend every class session. More information about the attendance and absence policy can be found on <https://clas.uiowa.edu/faculty/student-attendance-and-absences>

**Rules on Student Collaboration:** In this class, students are allowed to talk with others about homework. However, do not share your written work with others or ask others to see their completed assignments since both are considered academic misconduct. In other words, you can discuss a problem with other students, but you write your solution alone. If you worked/discussed a problem with others, you must state their names on your homework before the beginning of that problem, even if you wrote the solution yourself. HWs showing duplication will be considered as the result of academic dishonesty. If you need help, please stop by during my office hours. Students are responsible for understanding this policy; if you have questions, ask for clarification.

**Participation in class discussions:** Students are strongly encouraged to ask questions and participate in class discussions.

**Homework assignments** will be assigned weekly on your course ICON under Assignments and will be collected weekly in class beginning the second week.

**Quizzes:** There will be biweekly quizzes given approximately every second week (excluding the weeks of the exams), consisting of problems similar to those assigned as homework. Taking all quizzes and the three exams (two midterms and final) is mandatory.

**Cell phones** must be turned off during lectures and exams. During the exams, cell phones are required to be put (far) away, preferably at the bottom of your backpack. You cannot hold them in your hand, not keep them on your desk, chair, or anywhere easily accessible, and you cannot use it as a calculator.

### **Resources for Students:**

Math Tutorial Lab, see [Tutored courses, Department of Mathematics](#) and <https://math.uiowa.edu/math-tutorial-lab>

**Engineering Tutoring** provides group tutoring and tutor-led exam review sessions to students taking this course, <https://www.engineering.uiowa.edu/current-students/support-resources/engineering-tutoring>.

Students will find the Writing Center and the Speaking Center very useful for this course:

Writing Center: <http://www.uiowa.edu/~writingc/>

COLLEGE OF LIBERAL ARTS AND SCIENCES

Information for CLAS Undergraduates

Spring 2024

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**[Basic Needs and Support for Students](#)**

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