

# Syllabus

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Tiger gotta hunt. Bird gotta fly.  
Man gotta sit and wonder why, why, why.  
Tiger gotta sleep. Bird gotta land.  
Man gotta tell himself he understand.

*Kurt Vonnegut Jr.*

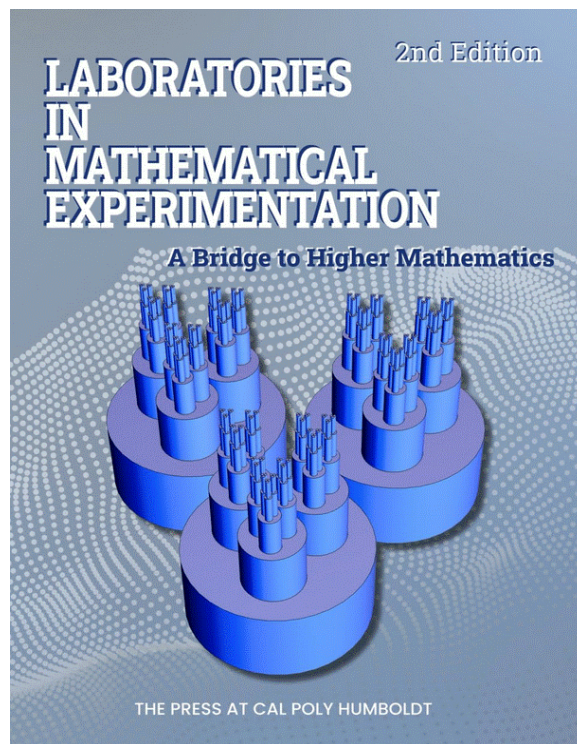
**Topic.** Introduction to Higher Mathematics.

**Time and Place.** This course is completely online.

**Instructor.** Helmut Knaust, hknaust@utep.edu

**Office Hours.** **(1) In person:** Bell Hall 219, M 15:00-16:00, T 14:00-14:50, R 16:30-17:30. **(2) Virtual:** Reserve a time [here \(https://calendly.com/hknaust/office-hours-for-math-2325\)](https://calendly.com/hknaust/office-hours-for-math-2325) for a 30-minute time slot on Zoom. Please schedule one day in advance.

**Textbook and materials.** J. William Bruce, et al.: Laboratories in Mathematical Experimentation. A Bridge to Higher Mathematics, 2nd edition, The Press at Cal Poly Humboldt, 2024. The textbook is available [for download here \(http://helmut.knaust.info/class/202610\\_2325/Labs-in-Math-Experimentation.pdf\)](http://helmut.knaust.info/class/202610_2325/Labs-in-Math-Experimentation.pdf). A [printed version \(https://www.amazon.com/Laboratories-Mathematical-Experimentation-Bridge-Mathematics/dp/1962081117\)](https://www.amazon.com/Laboratories-Mathematical-Experimentation-Bridge-Mathematics/dp/1962081117) is available at Amazon for a nominal fee.



**Co-requisite.** Calculus I (Math 1411).

**Course Description.** An introduction to mathematical problem solving, experimentation, and proof writing, and the relationship among all three. The course will be built around a series of in-depth problems from a variety of areas of higher mathematics, especially those not encountered in pre-calculus and calculus courses.

**Course Objectives.** This course is built on the proposition that you learn mathematics, and how to construct mathematical proofs, better when you formulate the questions and discover the answers yourself. Upon successful completion of the course, you will be able to investigate mathematical questions, big and small, both experimentally and theoretically. This is very different from courses like pre-calculus, calculus and differential equations, which are primarily focused on computations. Although there are computations in this course, they are a tool for discovering, and proving, more general mathematical truths.

**Laboratories.** You will work exclusively in small teams on lab projects. You can meet with your teammates on Zoom. Each lab will start with a video, giving a brief explanation of the question or problem to be explored. Your team will perform experiments with the computer software program Mathematica and gather data. The data will lead you to make your own conjectures, which you will then test and refine by further experimentation. Finally, when you are more certain of your conjectures, you will prove them carefully. (In practice, this process is rarely as straightforward and linear as outlined here. You will often revisit earlier steps as you carry out later steps.) After about two weeks of work on a project you will write up your discoveries, both experimental and theoretical, into a clearly-written report. (Grading criteria are below.) The reports are written jointly by the members of your group. After each report is graded and returned to you, you will have approximately one more week to revise your report for a better grade, if you like.

**Grades.** Each lab will be graded based on the following criteria: (1) Experimental design, (2) Organization and presentation of data, (3) Analysis of data, (4) Statement of conjectures, and most importantly (5) Mathematical analysis (including proofs) of conjectures (see p. xv-xviii of the text). The final grade for each lab will be the average of the grades you receive on your initial report, and on your revision. If you do not turn in a revision, it will simply be the grade of your initial report. **Your grade for the course will be the average of the final grades for each of the labs.** Deadlines for the various assignments can be found below on the calendar. A late submission of an assignment will result in a grade of zero.

**Mathematica.** All of the projects will use the computer algebra system "Mathematica" available at [https://www.utep.edu/technologysupport/ServiceCatalog/SOFTWARE\\_PAGES/soft\\_mathematica.html](https://www.utep.edu/technologysupport/ServiceCatalog/SOFTWARE_PAGES/soft_mathematica.html) ([https://www.utep.edu/technologysupport/ServiceCatalog/SOFTWARE\\_PAGES/soft\\_mathematica.html](https://www.utep.edu/technologysupport/ServiceCatalog/SOFTWARE_PAGES/soft_mathematica.html)). Choose "Mathematica **Online**", not "Mathematica"!

Learning how to code is not required, but if you want to learn more about coding in "Mathematica", a nice but voluminous introduction to Mathematica can be found at [An Elementary Introduction to the Wolfram Language, by Stephen Wolfram](https://www.wolfram.com/language/elementary-introduction/) (<https://www.wolfram.com/language/elementary-introduction/>).

**Time Requirement.** I expect that you spend an absolute minimum of nine hours a week on the projects. Not surprisingly, it has been my experience that there is a strong correlation between class grade and study time.

**Drop Policy.** To be fair to your team members, please drop the course only immediately after at a project due date and **notify both your team and me.** The class schedule lists "Friday, October 31", as the last day to drop with an automatic "W". After the deadline, I can only drop you from the course with a grade of "F".

**Academic Integrity.** All students must abide by UTEP's academic integrity policies. For detailed information visit the Office of Student Conduct and Conflict Resolution (OSCCR) website. Academic Integrity is a commitment to fundamental values. From these values flow principles of behavior that enable academic communities to translate ideals into action." Specifically, these values are defined as follows:

- Honesty: advances the quest for truth and knowledge by requiring intellectual and personal honesty in learning, teaching, research, and service.
- Trust: fosters a climate of mutual trust, encourages the free exchange of ideas, and enables all to reach their highest potential.
- Fairness: establishes clear standards, practices, and procedures and expects fairness in the interaction of students, faculty, and administrators.
- Respect: recognizes the participatory nature of the learning process and honors and respects a wide range of opinions and ideas.
- Responsibility: upholds personal responsibility and depends upon action in the face of wrongdoing.

If you use resources other than the textbook, you must cite them at the end of your papers.

**AI (Artificial Intelligence) Use.** Use of AI technologies or automated tools, particularly generative AI such as ChatGPT or DALL-E, is only allowed with approval from the instructor **before** being used. Without permission, you will be expected to think creatively and critically to complete assignments without aid from these tools. If given permission to use any of these tools, you must properly cite and give full credit to the program used upon submission of the assignment.

**Military Service.** If you are a military student with the potential of being called to military service and/or training during the course of the semester, you are encouraged to contact the instructor as soon as possible.

**Counseling Center.** You are encouraged to go to Counseling and Psychological Services (202 Union West) for personal assistance as you work through personal concerns. Confidential counseling services are offered in English or in Spanish.

**Disabilities.** If you have a disability and need special accommodation, please contact the Center for Accommodations and Support Services (CASS). The Center aspires to provide students accommodations and support services to help them pursue their academic, graduation, and career goals. Phone 747-5148. E-mail: [cass@utep.edu](mailto:cass@utep.edu).