

MTH 6V23 (Calculus of Variations) Syllabus

Fall 2026 - Baylor University

Last updated: Aug 24, 2026

Instructor Information

Instructor

Son Tu

Email

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Office & Phone

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General Information

Course Description

The calculus of variations studies how to find functions that minimize or maximize quantities, typically expressed as integrals. It is a fundamental tool in analysis and optimization, underlying key principles in physics such as least action, as well as applications in engineering, including optimal design and control. Applications also include geodesics and minimal surfaces, materials science, image processing, partial differential equations, and machine learning, where one seeks optimal configurations or structures.

Course Schedule

MTH 6V23-04

MWF SDRICH 216 1:25 PM - 2:15 PM

Office Hours

MWF: 11:00 AM - 12:00 PM, and by appointment (starting Aug 31, 2026)

Prerequisite

Functional Analysis, Real Analysis (will be recalled)

Course Materials and Requirements

Textbook

(Optional)

Chapters 3, 8, 10 of Lawrence C. Evans, Partial Differential Equations: Second Edition

Chapters 1, 2 of Hung V. Tran, Hamilton-Jacobi Equations: Theory and Applications

Attendance

Attendance is not required but is **STRONGLY** encouraged.

Your regular attendance and participation are required to pass this course. If you are absent more than 6 times without valid reasons (e.g., severe health issues with doctor's note), you may not pass this course.

In College of Arts & Sciences Catalog (2024-2025):

"To earn course credit in the College of Arts & Sciences, a student must attend at least 75 percent of all scheduled class meetings. Any student who does not meet this minimal standard will automatically receive a grade of "F" in the course. Any University-related activity necessitating an

absence from class shall count as an absence when determining whether a student has attended the required 75 percent of class meetings.”

Homework

Optional.

Course Grading

Grading: No HWs, Quizzes, or Exams.

Academic Integrity

Plagiarism or any form of cheating involves a breach of student-teacher trust. This means that any work submitted under your name is expected to be your own, neither composed by anyone else as a whole or in part, nor handed over to another person for complete or partial revision. Be sure to document all ideas that are not your own. In addition, you must not provide course materials to other students, whether individually or generally (such as online) that would enable them to gain an unfair academic advantage. Instances of plagiarism or any other act of academic dishonesty will be reported to the Honor Council and may result in failure of the course. Not understanding plagiarism is not an excuse. I expect you, as a Baylor student, to be intimately familiar with the Honor Code at: <http://www.baylor.edu/honorcode/>

Technology in the Classroom

- Cell phones must be silenced and stored away during class.
- AirPods/Earbuds/Headphones must be turn off and stored away during class.
- You may not take photos of the board or record any part of the lecture without first receiving explicit permission in writing.
- No smart glass permitted.

All phones and electronic devices (except approved calculators) must be stowed away during exams. Any device found on your desk, in your lap, etc. will result in the exam being invalidated (grade of zero), regardless of use.

Students needing Accommodations

Any student who needs academic accommodations related to a documented disability should inform me immediately at the beginning of the semester. You are required to obtain appropriate documentation and information regarding your accommodations from the Office of Learning Accommodation (OALA). Stop by the first floor of Sid Richardson, East Wing in the Paul L. Foster Success Center or call (254) 710-3605 or email OALA@baylor.edu.

Title IX Office

Civil Rights Policy and Sexual and Interpersonal Misconduct Policy

Baylor University does not tolerate unlawful harassment or discrimination on the basis of sex, gender, race, color, disability, national origin, ancestry, age (over 40), citizenship, genetic information or the refusal to submit to a genetic test, past, current, or prospective service in the uniformed services, or any other characteristic protected under applicable federal, Texas, or local law (collectively referred to as Protected Characteristics).

If you or someone you know would like help related to an experience involving:

- Sexual or gender-based harassment, sexual assault, sexual exploitation, stalking, intimate partner violence, or retaliation for reporting one of these types of prohibited conduct, please visit www.baylor.edu/titleix, or contact us at (254) 710-8454, or TitleIX_Coordinator@baylor.edu.

- Harassment (excluding those issues listed in #1) or adverse action based on Protected Characteristics, please visit www.baylor.edu/civilrights, or contact us at (254) 710-7100 or Civil_Rights@baylor.edu.

The Office of Equity and Title IX understands the sensitive nature of these situations and can provide information about available on- and off-campus resources, such as counseling and psychological services, medical treatment, academic support, university housing, and other forms of assistance that may be available. Staff members at the office can also explain your rights and procedural options. You will not be required to share your experience. **If you or someone you know feels unsafe or may be in imminent danger, please call the Baylor Police Department (254-710-2222) or Waco Police Department (9-1-1) immediately.**

Except for Confidential Resources, all University Employees are designated Responsible Employees and thereby mandatory reporters of potential sexual and interpersonal misconduct violations. Confidential Resources who do not have to report include those working in the Counseling Center, Health Center and the University Chaplain, Dr. Burt Burleson.

Military Student Advisory

Veterans, active duty military personnel, and dependents are encouraged to connect with the VETS program, a space dedicated to supporting our military-connected students. Please communicate, in advance if possible, any special circumstances (e.g., upcoming deployment, drill requirements, disability accommodations).

Resources for Success Summary

1. My Office Hours
2. Free Tutoring with the Paul Foster Academic Success Center
 - (254) 710 - 8696
 - www.baylor.edu/support_programs
 - Website for tutor and course availability:
<https://successcenter.web.baylor.edu/tutoring>
 - Located in the Sid Richardson 1st Floor Study Commons
3. Private (paid) Tutoring
 - <https://math.artsandsciences.baylor.edu/undergraduate-program/math-lab-and-tutors>

Syllabus Disclaimer

The instructor reserves the right to modify or adapt the course schedule, policies, and requirements as deemed necessary.

Topics:

- The Euler-Lagrange equation, gradient descent, and applications (the geodesic problem).
- The direct method of Calculus of Variations: coercivity, lower semicontinuity, Sobolev spaces, existence and uniqueness of minimizers, regularity theory.
- Some applications to PDEs, Optimal Control Theory, Dynamic Programming Principle and Hamilton--Jacobi equations, weak KAM theory, policy iteration, optimal transport, graph-based learning, ...