Math 390R: Special topics in Mathematics

Winter 2025

Class meeting: M, W, F 10 - 10:50 AM at SCB 304.
Instructor: Dr. Tuan Pham
Email: tpham@byuh.edu
Office: SCB 316, telephone: 808-675-3044
Office hours: M, W, F 11:00 AM-12:30 PM or by appointment
Canvas: https://byuh.instructure.com/courses/1480568
Course website: https://web.engr.oregonstate.edu/~phamt3/Courses/W25-Math-390R-490R
Prerequisite: Math 213 (Corequisite recommended: Math 343).
Credit hours: This 3-credit hour course approximates one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately 14 weeks.
Textbook: the course will use multiple sources for reference, including but not limited to the following textbooks:

- "Mathematical modeling : branching beyond calculus" by by Crista Arangala, Nick Luke, Karen A Yokley (Link to ebook)
- "Fundamentals of Optimization Techniques with Algorithms" by Sukanta Nayak (Link to ebook)
- "An Introduction to Neural Network Methods for Differential Equations" by Neha Yadav, Anupam Yadav, Manoj Kumar (Link to ebook)

Course description: Students will learn classic mathematical models for various real-life problems and classic/modern techniques to solve them. These models include linear programming, optimization with or without constraints, differential equations, and neural network. The course builds upon the foundational concepts learned in Calculus II (Math 213) and further develops students' understanding of Calculus, Linear Algebra, Numerical Methods, and Differential Equations. Computer programming for simulation is an integrated component of the course.

Learning Outcomes: Upon successful completion of this class, a student will be able to:

1. Solve systems of linear equations using Gauss-Jordan elimination;
2. Solve linear optimization problems using the simplex method;
3. Solve numerically nonlinear optimization problems using Newton's method, steepest descent method, and Lagrange multipliers;
4. Solve basic differential equations and partial differential equations numerically using the finite difference method;
5. Understand the basic mathematical mechanism behind neural networks and apply it to solve differential equations;
6. Program with Python to solve numerically the above problems;
7. Enhance critical thinking and problem-solving skills;
8. Communicate mathematical solutions effectively in written and oral formats.

Course goals: By the end of the course, your mathematical reasoning skills and programming skill will be increased and you will begin to understand how to approach and solve problems. Mathematics also promotes the development of critical thinking and logic.

Grading components:

Homework: 25%
Attendance: 10%
Quizzes: 15%
Labs: 15%
Presentations: 15%
Projects: 20%
There will be opportunities for extra credit during the course.

Evaluation:

- **Homework**: homework are to be turned in at the beginning of the class on the day it is due.
- **Attendance**: after the deadline for dropping the class, the instructor will check attendance every day of class.
- **Quizzes**: quizzes will be given in class (see class schedule) at a random time. These quizzes are to test students' understanding of recent topics.
- **Labs**: we will be using Python, mostly on the coding space called Google Colab, for programming. The labs help you understand algorithms and practice implementing them on the computer.
- **Presentations and Projects:** students will submit their project and present them on **Wednesday, April 16, 2025, 11 AM - 1:50 PM** in the regular classroom (SCB 304).

Make-up work and due-date extension: Extension of due dates for assignments will be given only in exceptional circumstances, with appropriate documentation, such as illness or family emergency. If possible, notify the professor as soon as you are aware of the issue.

Use of Artificial Intelligence (AI): in this course, the use of AI tools is permitted only under the following condition:

- While working on homework, you may use AI to find more examples in addition to the examples given in class to help you better understand the method taught in class. However, you must write the homework yourself instead of having AI write the homework for you. You must use the method taught in class for your homework.
- While working on labs, you may use AI to assist you with the coding. However, you must use the coding techniques shown in the lab instruction.
- While working on the project, you may use AI in the ways explained for homework and labs. Keep in mind that you will present your project and answer questions asked by the audience.

Grade lines: the course grade lines will not be harder than the standard grade lines: A 100-93%, A- 92.99-90%, B+ 89.99-87%, B 86.99-83%, B- 82.99-80%, C+ 79.99 - 77%, C 76.99-73%, C- 72.99-70%, D+ 69.99-67%, D 66.99-63%, D- 62.99 - 60% and F $<$ 60%.

Other Learning Resources:

- The instructor has office hours dedicated to help you. Don't hesitate to make an appointment if the office hours conflict with your schedule.
- Your fellow classmates are also a good resource. Form a study group and you will find it helpful.

- You can find peer tutors at the Math Lab, located in SCB 302. Online tutoring is also available. Check out their hours here: https://mc.byuh.edu/math-lab.

Student Academic Grievance policy:
Students, who feel that their work has been unfairly or inadequately evaluated by an instructor, are encouraged to pursue the matter as an Academic Grievance by following the steps found in the Academic Grievance policy at https://catalog.byuh.edu/policies-procedures/grievances.

Final Exam Schedules: Final exams are to be offered on the specific day and time as determined by the official final exam schedule. Students must plan travel, family visits, etc., in a way that will not interfere with their final exams. Less expensive air fares, more convenient travel arrangements, family events or activities, and any other non-emergency reasons are not considered justification for early or late final exams.

Honor Code: The Honor Code exists to provide an education in an atmosphere consistent with the ideals and principles of the Church of Jesus Christ of Latter-day Saints. Students, faculty and staff are expected to maintain the highest standards of honor, integrity, morality, and consideration of others in personal behavior. Academic honesty and dress and grooming standards are to be maintained at all times on and off campus. For specific information see http://honorcode.byuh.edu.

Discrimination: The University is committed to a policy of nondiscrimination on the basis of race, color, sex, pregnancy, religion, national origin, age, disability, genetic information or veteran status in admissions, employment or in any of its educational programs or activities. For specific information see the non-discrimination policy at https://policies.byuh.edu.

Title IX and Sexual Misconduct: The University will not tolerate any actions proscribed under Title IX legislation, specifically sexual harassment, sexual violence, domestic or dating violence or stalking perpetrated by or against any university students, university employees or participants in university programs. For specific information see https://titleix.byuh.edu. All faculty and staff are deemed responsible reporting parties and as such mandated to report incidents of sexual misconduct including sexual assault to the Title IX.

```
Title IX Office
Lorenzo Snow Administrative Building
55-220 Kulanui St.
Laie, HI  96762
Office Phone: (808) 675-4585
E-Mail: titleix@byuh.edu
```

Accommodating Students with Disabilities: Disability Services is dedicated to assisting students with disabilities by providing opportunities for success and equal access at Brigham Young University-Hawaii. We are committed to coordinating reasonable accommodations as outlined by Federal and State law. To learn more about available supports, go to https://disability.byuh.edu, call (808) 675-3518 or go to McKay Building 181 across from the Cafeteria. You may also email disabilityservices@byuh.edu with questions.

Mental Health Resources: As a college student, there may be times when personal stressors interfere with your academic performance and/or negatively impact your daily life. If you or someone you know is experiencing mental health challenges at BYUH, please contact Counseling Services at (808) 675-3518. Services are free and confidential. For more information, visit https:

//counseling.byuh.edu/. Free mental health self-help resources are available through TAO Connect. To access them, simply go to https://us.taoconnect.org/register and sign in using your BYUH email address. In a crisis situation, or after hours, please contact BYUH Campus Safety at (808) 675-3911 or call 911 if you are off campus. You can also call the 24-hour crisis hotline at 1-800-753-6879 or contact the Crisis Text Line at 741-741.

Report a Concern: If you have a concern to report go to http://about.byuh.edu/reportaconcern. If you have reason to believe a student or dependent of a student is a danger to self or others please do one of the following depending on the urgency of the situation:

a. Call 911,

b. Call BYU-H Public Safety (675-3911),

c. Report a concern to the Behavior Intervention Team.