Foundations in Calculus Syllabus

Course Information

Course Number: MATH 1104
Course Title: Foundations in Calculus
Term: Spring 2020

Class Schedule:

Section	Day	Time	Location	Instructor
.01	Tuesday	7:00pm – 8:30pm	www.twitch.tv/tsogtv	Dr. Foland

Live streams will be archived for 60 days on Twitch, followed by permanent archival on Youtube. Links to these archives will be documented on TSoG eLearning.

Instructor Contact Information

Course Instructor

Steven J. Foland, PhD
Email: stevenfoland@tsogiants.org

Office Hours: Saturday, 10:00am – 12:45pm
Office hours will be held virtually on Twitch.

Use the #stream-chat (text) or #stream-calls (voice) channels on Discord to direct your questions to Dr. Foland during class or office hours.

Please use the #copernicus channel or contact Dr. Foland directly (drfoland#6708) for questions outside these times.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Pre-requisites and Co-requisites: *MATH 1101 – Foundations in Python*

Students must be actively enrolled as TSoG.tv students to receive credit for this course.

Program Educational Objectives

The Shoulders of Giants' Mentorship students at all levels should strive to adopt an attitude of lifelong learning, build confidence as valuable members of a technical team, and embrace their responsibilities as good citizens of the scientific community.

In addition to this personal and professional growth, students at the Copernicus level are expected to develop and retain the logical, mathematical, and computational tools for solving practical problems in science and engineering.

Student Outcomes

Student Outcomes broadly represent the knowledge and skills that students are expected to attain in order to achieve the Program Educational Objectives at their current level of study. At the Copernicus level, these Student Outcomes are as follows:

C1. *Knowledge* of mathematical and computational terminology used to describe practical problems and their solutions.
C2. *Understand* the tools and techniques used to find numerical solutions of mathematical problems.
C3. *Understand* analytical solutions of simple practical problems in science and engineering.
C4. *Apply* computational tools and techniques to find approximate numerical solutions to practical problems in science and engineering.
C5. *Apply* statistics to quantitatively test a hypothesis using experimental data.
C6. *Apply* computational thinking methods to reduce simple tasks into algorithms.
C7. *Understand* modern professional communication practices.

Course Learning Objectives

Course Learning Objectives, followed by their corresponding Copernicus-level Student Outcomes, are listed below:

1. Recognize the notation and mathematical conventions of calculus. – *SO (C1)*
2. Identify simple derivatives and integrals using analytical techniques such as the power rule. – *SO (C3)*
3. Explain how differential and integral equations may be converted into difference and sum equations to find numerical approximations. – *SO (C2)*
4. Solve difference and sum equations numerically by converting iterative techniques such as Euler's method and the Runge-Kutta methods into functional code. – *SO (C6)*

Required Materials and Resources

Access to TSoG eLearning (http://elearning.tsogiants.org) required for completion of this course.

A notebook or well-structured digital note-taking method is required for success in this program.

Course Description

An introduction to the fundamental principles of calculus with an emphasis on numerical computation. Throughout this course, you will learn how to compute approximate solutions to problems involving rates of change (differential) and accumulation of change (integral) equations. The Python programming language will be used to apply both direct and iterative solution techniques to several real-world problems.

Tentative Calendar

Week Of	Description
March 1st	Introduction to Derivatives and their Applications
March 8th	The Power Rule for Derivatives
March 15th	Introduction to Integrals and their Applications
March 22nd	The Power Rule for Integrals
March 29th	Numerical Approximation of Derivatives
April 5th	Solving Real-world Problems with The Finite Difference Method
April 12th	Numerical Approximation of Integrals
April 19th	Solving Real-world Problems with The Trapezoidal Rule
April 26th	Iterative Solution Techniques
May 3rd	Euler's Method and the Runge-Kutta Methods
May 10th	Approximating Kepler's Law's of Planetary Motion
May 17th	*Review and Assessment*

Course Completion Policies

- Students must complete all weekly objectives in eLearning to be eligible for assessment.
- Eligible students may participate in the course assessment at any time
- Course assessment will cover materials from all Course Learning Objectives.
- An overall score of at least 80% on all assessment criteria will be needed to receive credit for the course.
- Students may retake the assessment at the instructor's discretion if they fail to meet assessment criteria on the first attempt.

TSoG Policies and Procedures

The description and timelines contained in this syllabus are subject to change at the discretion of the instructor.

Communications regarding such changes will be handled via Discord and TSoG eLearning.