Math 4311: Numerical Analysis
Course Syllabus

This syllabus is current and accurate as of its posting date, but it will not be updated. For the most complete and up-to-date course information, contact the instructor.

Contact Information

Instructor: Dr. Dennis Hall
Office: MCS 220J
Office Hours: Monday: 9:50am-11:00am and 11:50am-1:00pm
Tuesday: 10:20am-12:30pm
Wednesday: 10:00am-11:00am
Thursday: 10:20am-12:30pm
Friday: 9:50am-11:00am and 11:50am-1:00pm

Note: Office hours are held virtually and in person. During the times listed above, you may visit my office in person or virtually by visiting hall.run/office.

E-mail: dennis.hall@angelo.edu
Office Phone: 325-486-5426

Course Information

Course Description: Number representations, error analysis; roots of equations; numerical integration, approximation, and differentiation; systems of equations; approximation by spline functions; ordinary differential equations; Monte Carlo methods and simulation.


Course Content: The following chapters and topics will be covered.

1. Introduction to Python and Monte Carlo Simulation. General Information, Core Python, Functions and Modules, Writing and Running Programs, Monte Carlo Simulation.
3. **Roots of Equations.** Incremental Search, Bisection, Newton-Raphson Method, Linear Interpolation, and Other Methods

4. **Numerical Differentiation.** Finite Difference Approximations, Richardson Extrapolation, Derivatives by Interpolation

5. **Numerical Integration.** Newton-Cotes Formulas, Romberg Integration, Gaussian Integration


**Course Delivery:** To maintain academic quality while accommodating social distancing needs this semester, this course will use a split delivery model that combines face-to-face teaching with remote instruction.

The goal is to provide face-to-face instruction to students who want to return to campus, while also allowing students who may need to learn remotely to participate via virtual class sessions.

**How Does It Work?**

The course enrollment is small enough and the classroom large enough to allow for all students to attend in person. All presentations will be streamed live using Blackboard Collaborate.

Please refer to this [Health and Safety web page](#) for updated information about campus guidelines as they relate to the COVID-19 pandemic.

**Technology Requirements:** You must have access to a computer that is capable of running Microsoft Visual Studio Code or other Python IDE. Most homework and projects will involve writing and interpreting code in Python.

**Communication:** Most email will receive a response within 24 hours during working hours Monday through Friday. Please include your course name (Calculus III, Seminar, Calculus I, etc.) in your messages for the quickest reply. Office hours will be held using WebEx and may be accessed via [hall.run/office](#).

**Course Evaluation**

Your grade for this course will be determined by your performance on exams, homework, and projects.

Final grades will **be based on a standard 10-point grading scale.**

- 25%: Projects
- 25%: Midterm Exam
- 25%: Final Exam
- 25%: Homework

**Midterm Exam (25%):** There will be a midterm examination on Friday, March 19. This examination may involve a combination of written questions and questions intended to be answered using Python.

**Final Exam (25%):** There will be a final examination on Wednesday May 12. This examination may involve a combination of written questions and questions intended to be answered using Python.
Projects (25%): There will be several projects assigned throughout the semester. These will typically be more involved than the homework problems and require some insight to complete. Students are not allowed to work together on the projects but may consult the instructor or media resources.

Homework (25%): Homework sets will be assigned most days and will typically be due at the beginning of the following class. You may work with other students on the homework, but your final submission should be your own work and not be virtually identical to another student’s. On homework problems requiring the use of a computer, please include comments in your computer program or output to indicate important steps or information. Do not simply submit a printout of data with no explanation. Late homework will not be accepted.

Other Information

All students are required to follow the policies and procedures presented in these documents:

- [Angelo State University Student Handbook](#)
- [Angelo State University Catalog](#)

Academic Integrity

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

The College of Science and Engineering adheres to the university’s [Statement of Academic Integrity](#).

Accommodations for Students with Disabilities

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA) and subsequent legislation.

Student Disability Services is located in the Office of Student Affairs and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student’s responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at ADA@angelo.edu. For more information about the application process and requirements, visit the [Student Disability Services website](#). The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dallas Swafford

Director of Student Disability Services

Office of Student Affairs
Incomplete Grade Policy

It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing coursework. Documentation may be required. See ASU Operating Policy 10.11 Grading Proceduresvii for more information.

Student Absence for Observance of Religious Holy Days

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for Observance of Religious Holy Dayviii for more information.

Title IX at Angelo State University

The University prohibits discrimination based on sex, which includes pregnancy, sexual orientation, gender identity, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination including: sexual assault, sex-based discrimination, sexual exploitation, sexual harassment, public indecency, interpersonal violence (domestic violence and/or dating violence), and stalking. As a faculty member, I am a Responsible Employee meaning that I am obligated by law and ASU policy to report any allegations I am notified of to the Office of Title IX Compliance.

Students are encouraged to report any incidents of sexual misconduct directly to ASU’s Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator at:

Michelle Boone, J.D.
Director of Title IX Compliance/Title IX Coordinator
Mayer Administration Building, Room 210
325-942-2022
michelle.boone@angelo.edu

You may also file a report online 24/7 at www.angelo.edu/incident-form.

If you are wishing to speak to someone about an incident in confidence you may contact the University Health Clinic and Counseling Center at 325-942-2173 or the ASU Crisis Helpline at 325-486-6345.

For more information about Title IX in general you may visit www.angelo.edu/title-ix.viii

Required Use of Masks/Facial Coverings by Students

As a member of the Texas Tech University System, Angelo State University has adopted the mandatory Facial Covering Policyix to ensure a safe and healthy classroom experience. Current research on the COVID-19 virus suggests there is a significant reduction in the potential for transmission of the virus from person to person by wearing a mask/facial covering that covers the nose and mouth areas.
Therefore, in compliance with the university policy students in this class are required to wear a mask/facial covering before, during, and after class. Faculty members may also ask you to display your daily screening badge as a prerequisite to enter the classroom. You are also asked to maintain safe distancing practices to the best of your ability. For the safety of everyone, any student not appropriately wearing a mask/facial covering will be asked to leave the classroom immediately. The student will be responsible to make up any missed class content or work. Continued non-compliance with the Texas Tech University System Policy may result in disciplinary action through the Office of Student Conduct.

Student Learning Outcomes

The student will demonstrate factual knowledge including the mathematical notation and terminology used in this course. Students will read, interpret, and use the vocabulary, symbolism, basic definitions used in numerical analysis including those related to topics learned in calculus and algebra and revisited in this course; limits, continuity, numerical integration, numerical differentiation, ordinary differential equations, and polynomial interpolation.

The students will describe the fundamental principles including the laws and theorems arising from the concepts covered in this course. Students will identify and apply the properties and theorems that result directly from the definitions as well as statements discovered in calculus and extended in this course; for example, Rolle’s Theorem, Mean Value Theorem, Intermediate Value Theorem, Taylor’s Theorem, theorems on convergence and existence and their error terms.

The students will apply course material along with techniques and procedures covered in this course to solve problems. Students will use the facts, formulas, and techniques learned in this course to develop and use algorithms and theorems to find numerical solutions and bounds on their error to various types of problems including root finding, polynomial approximation, numerical differentiation, numerical integration.

The students will develop specific skills, competencies, and thought processes sufficient to support further study or work in this field or related fields. Students will gain the ability to use a software package such as MATLAB to solve numerical problems and acquire a level of proficiency in the fundamental concepts and applications necessary for further study in academic areas requiring numerical analysis as a prerequisite for graduate work or for work in occupational fields. These fields might include further study in mathematics, engineering, computer science, or the physical sciences.

Course Schedule

Important Dates

January 27: First Day of Class
March 19: Midterm
April 2: Spring Holiday (University Closed)
April 30: Last Day to Drop/Withdraw
May 12: Final Exam 10:30-12:30
Weekly Schedule

Below is a tentative schedule, but it is likely to change throughout the semester.

Week 1: Introduction to Python
Week 2: Monte Carlo Simulation
Week 3: Interpolation
Week 4: Curve Fitting
Week 5: Richardson Extrapolation
Week 6: Derivatives by Interpolation
Week 7: Newton-Cotes Formulas
Week 8: Midterm Exam
Week 9: Romberg and Gaussian Integration
Week 10: Euler’s Method
Week 11: Runge-Kutta Methods
Week 12: Stability and Stiffness
Week 13: Additional topics as time permits
Week 14: Additional topics as time permits
Week 15: Additional topics as time permits
Week 16: Final Exam

i https://www.angelo.edu/covid-19/returning-to-campus/health-and-safety.php
ii https://www.angelo.edu/student-handbook/
iii https://www.angelo.edu/catalogs/
iv https://www.angelo.edu/student-handbook/community-policies/academic-integrity.php
v https://www.angelo.edu/services/disability-services/
vi https://www.angelo.edu/content/files/14197-op-1011-grading-procedures
vii https://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of
viii https://www.angelo.edu/services/title-ix/
ix http://www.texastech.edu/downloads/ttus-policy-face-coverings.pdf