MTH 3320.001, Intro to Numerical Methods
Department of Mathematics and Statistics
Fall 2021

Professor: Dr. Lynn Greenleaf
Office: 340 Mathematics building
Office Phone: 936.468.1882
Office Hours: (or by appointment)

Class Times & Place: 2-3:15 TR, Room 202, Math Building
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Course description: Basic numerical and computational techniques used in solution of mathematical problems in the real world; approximation of functions, roots and systems of equations, numerical differentiation and integration, interpolation and curve fitting, and machine computation. This course is intended to be a mathematical introduction to the theory and practical use of certain basic numerical methods that often arise in applications. Some theoretical understanding is critical to the proper practice of numerical analysis because no numerical method works 100% of the time. Thus when a method fails, the theory behind the method can often illuminate what went wrong and perhaps give insights into alternative approaches that may work better for the given problem.

Course requisites and co-requisites: MATH 2314 and CSCI 1302 or equivalent.

Course Requirements:
- Two in-class exams (If a student must miss an exam due to an excused absence, special arrangements should be made in advance.)
- A comprehensive final exam (lasting 2 hours on Tuesday, December 7, 1-3 pm.)
- Homework will be assigned and collected.
- Projects will be assigned and submitted to D2L/Course Tools/Dropbox.
- Class attendance and participation: Students are expected to attend all class meetings, arriving on time.

Communication: Check your university email regularly, as you may be sent reminders, assignments, or announcements.

Exam Schedule: Please note that the dates for our in-class exams below are subject to change. If you need to change the date of your exam, you must get it approved through Student Rights & Responsibilities, sfajudicial@sfasu.edu. The final is university scheduled and cannot be taken at a different time without permission of the Dean of the College of Sciences and Mathematics. Please schedule your end-of-semester travel plans accordingly.
Midterm 1 – Thursday, September 30
Midterm 2 – Thursday, November 11
Final Exam – Thursday, December 7, 1-3 pm

Grading Policy:
- Exams: 40%
- Homework: 20%
- Project: 20%
- Comprehensive Final Exam: 20%

Grading Scale:
- 90% - 100%: A
- 80% - 90%: B
- 70% - 80%: C
- 60% - 70%: D
- Below 60%: F
Course outline:

- Taylor Series (5%)
- Representation of Numbers (5%)
- Error Analysis (5%)
- Equations of One Variable (20%)
- Interpolation and Polynomial Approximation (15%)
- Numerical Differentiation and Integration (20%)
- Numerical Methods for Systems of Equations (10%)
- Differential Equations (10%)
- Splines (15%)

Per SFA policy 5.4, your schedule should reflect that there is (1) an amount of student work per credit hour that reasonably approximates not less than one hour of class or direct faculty instruction and two hours of out-of-class student work per week for fifteen weeks over a long semester, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as outlined in item 1 above for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

COMPLETE COURSE POLICY SHEET ACCESSIBLE ONLINE
Math 3320 – Introduction to Numerical Methods

Course Syllabus

Course description: Basic numerical and computational techniques used in solution of mathematical problems in the real world: approximation of functions, roots and systems of equations, numerical integration, interpolation and curve fitting, and machine computation.

Credit hours: 3

The following is an excerpt from SFA Policy 5.4:

The federal definition of a credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates:

1. Not less than one hour of classroom or direct faculty instruction and a minimum of two hours out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or 10 to 12 weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time, or;

2. At least an equivalent amount of work as outlined in item 1 above for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.

To this end, all students in courses offered by the Department of Mathematics and Statistics that wish to be successful should plan to spend a minimum of two hours outside of class for every credit hour associated with this course. Expected activities to be completed in the time outside of class include reviewing notes from previous class meetings, reading assigned course resources, completing all assigned exercises and projects, and performing periodic assessment preparation.

Course Prerequisites and Corequisites: MTH 234 and CSC 102 or equivalent.

Course outline: Approximate time spent

- **Equations in One Variable**
  - Background
    - Calculus Review
    - Roundoff Error and Computer Arithmetic
    - Convergence, Algorithms and Computer Software
  - Numeric Solution Methods
    - Bisection, Secant, and Newton’s methods
    - Error analysis and Accelerating convergence
    - Other methods for polynomials
  - **Interpolation and Polynomial Approximation**
    - Interpolation and the Lagrange method
    - Divided differences
    - Hermite Polynomials
    - Spline interpolation
    - Parametric curves
  - **Numerical Differentiation and Integration**
    - Numerical differentiation
    - Numerical Integration
      - Basic and composite quadratures
      - Other methods; Romberg, Gaussian, Adaptive
      - Multiple and Improper integrals
  - **Numeric methods for Systems of Equations**
    - 30%
    - 20%
    - 25%
    - 25%
Student Learning Outcomes (SLO): At the end of MTH 305, a student who has studied and learned the material should be able to:

1. Recognize circumstances when numeric methods can and should be used. [PLO: 1, 2,3]
2. Use several basic numeric methods for solving equations of one variable. [PLO: 1, 2,3]
3. Find polynomial approximations for functions. [PLO: 1, 2,3]
4. Numerically approximate derivatives and integrals. [PLO: 1, 2,3]
5. Use methods for solving linear and nonlinear systems of equations. [PLO: 1, 2,3]
6. Use “current” computer software available for numeric solutions. [PLO: 1, 2,3]

Program Learning Outcomes (PLO): Students graduating from SFA with a B.S. Degree and a major in mathematics will:

1. Written Communication - SFA Mathematics majors communicate mathematical ideas effectively in written form, integrating mathematical notation correctly and consistently.
2. Verbal Communication - SFA Mathematics majors communicate mathematics effectively to diverse audiences.
3. Mathematical Maturation - SFA Mathematics majors grow from a computational understanding of mathematics to an integrated approach which includes critical thinking proficiency, computational facility, conceptual understanding, and problem-solving persistence.

Academic Integrity
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

The penalty for a student found cheating on any part of an assignment, quiz, or exam in this class will range from a grade of zero on the work to a grade of F in the course, and may result in additional, more severe disciplinary measures. A student who allows another to copy his work and the student copying the work are both guilty of cheating. Do your own work. Do not show your completed work to others. Do not allow others to copy your work.

Definition of Academic Dishonesty (SFA policy 4.1):
Academic dishonesty includes both cheating and plagiarism. Cheating includes, but is not limited to:
- using or attempting to use unauthorized materials on any class assignment or exam;
- falsifying or inventing of any information, including citations, on an assignment;
- helping or attempting to help other student(s) in an act of cheating or plagiarism.

Plagiarism is presenting the words or ideas of another person as if they were one's own. Examples of plagiarism include, but are not limited to:
- submitting an assignment as one's own work when it is at least partly the work of another person;
- submitting a work that has been purchased or otherwise obtained from the Internet or another source;
- incorporating the words or ideas of an author into one's paper or presentation without giving the author credit.

Withheld Grades Semester Grades (SFA Policy 5.5)
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average. The circumstances precipitating
the request must have occurred after the last day in which a student could withdraw from a course. Students requesting a WH must be passing the course with a minimum projected grade of C.

**Students with Disabilities**
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to [http://www.sfasu.edu/disabilityservices](http://www.sfasu.edu/disabilityservices).

**SFASU Mental Health Statement:** SFASU values students’ mental health and the role it plays in academic and overall student success. SFA provides a variety of resources to support students mental health and wellness. Many of these resources are free, and all of them are confidential.

**On-campus Resources:**
SFASU Counseling Services
[www.sfasu.edu/counselingservices](http://www.sfasu.edu/counselingservices)
3rd Floor Rusk Building
936-468-2401

SFASU Human Services Counseling Clinic
[www.sfasu.edu/humanservices/139.asp](http://www.sfasu.edu/humanservices/139.asp)
Human Services Room 202
936-468-1041

**Crisis Resources:**
Burke 24-hour crisis line 1(800) 392-8343
Suicide Prevention Lifeline 1(800) 273-TALK (8255)
Crisis Text Line: Text HELLO to 741-741

**Acceptable Student Behavior**
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy 10.4). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.

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