CoSM Class Syllabus/Policy
Introduction to Numerical Methods
Fall, 2023, MATH 3320.001

**Professor:** Jonathan Mitchell Ph.D.
**Email:** mitchelljonat@sfasu.edu
**YouTube Channel:** youtube.com/MathDoctorMitchell
**Phone:** Office: 936-468-1606
**Office:** Math 352

**Office Hours:** by appointment or ...

**Mon**  | **Tues**  | **Wed**  | **Thurs**  | **Fri**  
--- | --- | --- | --- | ---
9-10 AM | 10 AM - 12 PM | 9-10 AM | 10 AM - 11 AM | (by appt)

**Department:** Mathematics and Statistics

**Class meeting times and places:** Tues/Thurs
12:30 – 1:45 PM, Bush Math Room 202

**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.

**Text and Materials:**
- **MATLAB:** students will use this licensed software regularly in this course. There are at least two ways to access this licensed software created by MathWorks.
  - Use one of the (dozens of) licenses SFA has already purchased for SFA students to utilize.
  - Purchase your own student license for $50 (or $100 if you also want Simulink).

**Course Requirements**
- **When you arrive to class,** put your cell phone and other devices on silent (or turn off) and away from you unless told otherwise.
- **Homework** — Exercises from the textbook will be assigned for each major topic in the course. Students are expected to start each HW assignment THE SAME DAY we cover that material. HW will be submitted a few different ways. When instructed, you’ll turn in your work physically to me during class. At other times, you will scan and upload a pdf file to the appropriate dropbox in D2L (follow Scanning Guidelines in D2L).
- **Quizzes** — You will have periodic in-class quizzes. Some of these will be announced; some will not. No make-up quizzes will be offered. Your lowest quiz grade will be dropped at the end of the term.
- **Three In-class Exams** — Exams will be scheduled on a specified day, but each student will have some freedom in selecting an exam time. If a student must miss an exam due to an excused absence, special arrangements should be made at least two class days in advance. Student ID with photo may be required for exams.
- **A cumulative final exam** — The final exam is MATH 3320.001: Thursday, December 14, 10:30 AM – 12:30 PM
- **Participation** — Students are expected to attend every class, ask questions, and engage in the discussion. Students should be prepared to invest several [4-6] hours per week outside of class reading the text, practicing examples, and working homework exercises. Check your @jacks email and D2L Brightspace daily. On the day before class, students are expected to look at the schedule (online), see the topic to be covered during class, read the corresponding section in the textbook.

**Grading Policy:** Your grade will be computed by a weighted average with the following items and percentages.

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW &amp; Participation</td>
<td>5%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>15%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>18%</td>
</tr>
<tr>
<td>Exam 3</td>
<td>22%</td>
</tr>
</tbody>
</table>
Tentative Content Schedule: See D2L Brightspace

| Aug 28 – Sept 15: | Chapters 1 – 3 | Overview of Course and MATLAB Introduction |
| Sept 18 – 22: | Chapter 4 | Error Analysis |
| Sept 25 – Oct 13: | Chapters 5 – 7 | Root finding and Optimization |
| Oct 16 – Nov 11: | Chapters 8 – 13 | Computational Linear Algebra |
| Nov 14 – Nov 20: | Chapter 14 – 18 | Interpolation and Splines |
| Nov 22 – Dec 8: | Chapters 19 – 21 | Numerical Integration and Differentiation |

Attendance Policy:
Students are expected to attend every class. Students who are late are counted absent. Following a second absence, a student will be given a written warning in an email. For each additional absence one of the five percentage points for “Participation” will be deducted from your overall numerical grade.

Academic Integrity (4.1)
The Code of Student Conduct and Academic Integrity outlines the prohibited conduct by any student enrolled in a course at SFA. It is the responsibility of all members of all faculty, staff, and students to adhere to and uphold this policy.

Articles IV, VI, and VII of the new Code of Student Conduct and Academic Integrity outline the violations and procedures concerning academic conduct, including cheating, plagiarism, collusion, and misrepresentation. Cheating includes, but is not limited to: (1) Copying from the test paper (or other assignment) of another student, (2) Possession and/or use during a test of materials that are not authorized by the person giving the test, (3) Using, obtaining, or attempting to obtain by any means the whole or any part of a non-administered test, test key, homework solution, or computer program, or using a test that has been administered in prior classes or semesters without permission of the Faculty member, (4) Substituting for another person, or permitting another person to substitute for one’s self, to take a test, (5) Falsifying research data, laboratory reports, and/or other records or academic work offered for credit, (6) Using any sort of unauthorized resources or technology in completion of educational activities.

Plagiarism is the appropriation of material that is attributable in whole or in part to another source or the use of one’s own previous work in another context without citing that it was used previously, without any indication of the original source, including words, ideas, illustrations, structure, computer code, and other expression or media, and presenting that material as one’s own academic work being offered for credit or in conjunction with a program course or degree requirements.

Collusion is the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any provision of the rules on academic dishonesty, including disclosing and/or distributing the contents of an exam.

Misrepresentation is providing false grades or résumés; providing false or misleading information in an effort to receive a postponement or an extension on a test, quiz, or other assignment for the purpose of obtaining an academic or financial benefit for oneself or another individual or to injure another student academically or financially.

Withheld Grades Semester Grades 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 coursework 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 to compute the grade point average. For additional information, go to https://www.sfasu.edu/policies/course-grades-5.5.pdf.

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 promptly may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Updated: August 2023
Student Wellness and Well-Being
SFA values students’ overall well-being, mental health and the role it plays in academic and overall student success. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure and challenges associated with relationships, emotional well-being, alcohol and other drugs, identities, finances, etc.

If you are experiencing concerns, seeking help, 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:
The Dean of Students Office (Rusk Building, 3rd floor lobby)
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936.468.7249
dos@sfasu.edu

SFA Human Services Counseling Clinic Human Services, Room 202
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The Health and Wellness Hub “The Hub”
Location: corner of E. College and Raguet St.

To support the health and well-being of every Lumberjack, the Health and Wellness Hub offers comprehensive services that treat the whole person – mind, body and spirit. Services include:
• Health Services
• Counseling Services
• Student Outreach and Support
• Food Pantry
• Wellness Coaching
• Alcohol and Other Drug Education
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Crisis Resources:
• Burke 24-hour crisis line: 1.800.392.8343
• National Suicide Crisis Prevention: 9-8-8
• Suicide Prevention Lifeline: 1.800.273.TALK (8255)
• Crisis Text Line: Text HELLO to 741-741

See https://math.sfasu.edu/docs/syllabi/MATH3320Syllabus.pdf for elements common to all sections.
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 2314 and CSC 1302 or equivalent.

Course outline:  

<table>
<thead>
<tr>
<th>Approximate time spent</th>
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</thead>
<tbody>
<tr>
<td><strong>Equations in One Variable</strong> 30%</td>
</tr>
<tr>
<td>o Background</td>
</tr>
<tr>
<td>▪ Calculus Review</td>
</tr>
<tr>
<td>▪ Roundoff Error and Computer Arithmetic</td>
</tr>
<tr>
<td>▪ Convergence, Algorithms and Computer Software</td>
</tr>
<tr>
<td>o Numeric Solution Methods</td>
</tr>
<tr>
<td>▪ Bisection, Secant, and Newton's methods</td>
</tr>
<tr>
<td>▪ Error analysis and Accelerating convergence</td>
</tr>
<tr>
<td>▪ Other methods for polynomials</td>
</tr>
<tr>
<td><strong>Interpolation and Polynomial Approximation</strong> 20%</td>
</tr>
<tr>
<td>o Interpolation and the Lagrange method</td>
</tr>
<tr>
<td>o Divided differences</td>
</tr>
<tr>
<td>o Hermite Polynomials</td>
</tr>
<tr>
<td>o Spline interpolation</td>
</tr>
<tr>
<td>o Parametric curves</td>
</tr>
<tr>
<td><strong>Numerical Differentiation and Integration</strong> 25%</td>
</tr>
<tr>
<td>o Numerical differentiation</td>
</tr>
<tr>
<td>o Numerical Integration</td>
</tr>
<tr>
<td>▪ Basic and composite quadratures</td>
</tr>
<tr>
<td>▪ Other methods; Romberg, Gaussian, Adaptive</td>
</tr>
<tr>
<td>▪ Multiple and Improper integrals</td>
</tr>
<tr>
<td><strong>Numeric methods for Systems of Equations</strong> 25%</td>
</tr>
</tbody>
</table>
- Linear Systems
  - Norms of vectors and matrices
  - Eigenvalues and eigenvectors
  - Jacobi, Gauss-Seidel and SOR methods
- Nonlinear Systems
  - Newton and Quasi-Newton methods
  - Steepest descent techniques

**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.

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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.

Date of document: 08/23/2023