College of the Environment, Forestry, and Natural Sciences

Department of Mathematics & Statistics

MAT 362 Sec. 007 - Spring 2019: Introduction to Numerical Analysis
MWF 10:00 AM - 11:00 AM, Room: Adel Mathematics, Rm 163

Instructor: Dr. Bhagya Athukorallage
Email: bhagya.athukorallage@nau.edu
Course webpage: https://buathukorala.github.io/numerical362/
Office: AMB 104
Office Hours: MWF 12:30 PM – 1:30 PM and TuTh 9:30 AM – 10:30 AM or by appointments (send email to book one).
Phone: 806-543-8291

Textbook: "Numerical Analysis" by Burden and Faires, 10th ed., 2016

NAU has an Emergency Textbook Loan Program for First Generation students.
See https://nau.edu/first-generation/textbook-loan-program/ for details

Prerequisites: A grade of C or better in MAT 239 and knowledge of a computer language, as evidenced by a C or better in (CIS 220, CS 112, CS 122H, CS 123,CS 126, or EE 222).

Course Description: Algorithms, computational errors, root finding, curve fitting, interpolation, numerical differentiation and integration, numerical solutions of differential equations and linear systems of equations.

Student Learning Outcomes: Upon successful completion of the course, the student will be able to:

1. Explain basic algorithms for solving numerical problems including how they work, and their strengths and weaknesses.
2. Implement the algorithms in a programming language (such as MATLAB).
3. Produce coherent reports explaining the implementation of these algorithms and results on sample problems.
4. Express an understanding of the limitations of coded algorithms related to error analysis, convergence rates and criteria, memory usage, and ease of implementation.

Structure and Approach:
The course will use any or all of: lecture, discussion, student presentations, in-class work, or group work. In addition students will use technology (e.g., MATLAB).

Course Outline:

1. Taylor polynomial expansion, intermediate-value theorem, mean-value theorem.
2. Errors and Algorithms: Error analysis, Convergence rates of algorithms
3. Coding algorithms in MATLAB and presenting results graphically.

4. Root Finding: Bisection, Fixed point iteration, Newton's method.

5. Interpolation: Lagrange interpolation and cubic spline approximation.

6. Numerical Differentiation: simple, higher order, error formulas. Numerical Integration: simple, composite, multiple.

7. Differential Equations: initial value problems: Euler's and Runge-Kutta; boundary value problems, nonlinear methods, PDE: Heat and Laplace Equations.

8. Linear Algebra: Matrix/vector operations, Solving Linear Systems Numerically: Gaussian elimination, Jacobi and Gauss-Seidel; eigenvalues/eigenvectors, the power method.

Grade Distribution:
Attendance: 5% of the final grade (see the 'Attendance Policy' section)
Quizzes: 5% of the final grade
Written Homework: 15% of the final grade
MATLAB Assignments: 10% of the final grade
Exam 1: 15% of the final grade
Exam 2: 15% of the final grade
Exam 3: 15% of the final grade
Comprehensive Final exam: 20% of the final grade

Assessment of the Learning Outcomes:

Written Homework:
Sets of practice problems will be posted on the course website, generally one set for each section covered in class. For each set, some of the problems will be graded thoroughly while partial credit will be given for completion of the rest of the problems. Homework should either written by hand very neatly (well-organized and well-written) or by typed in LaTeX (encouraged). **Clarity in writing and presentation will be taken into account in grading.**

MATLAB Assignments:
Each assignment will contain coding of some numerical techniques.

Quizzes:
Quiz date will be announced in class (expect at least one quiz every week,); the quiz will be at the immediate start of class and students will have 10 minutes to finish the quiz.

Examinations:

Exam 1: Monday, February 25th
Exam 2: Wednesday, March 29th
Exam 3: Friday, April 26th
Final exam: Wednesday May 8th from 10:00 am – 12:00 pm

Grading Policy: Below 60% F, 60–69% D, 70–79% C, 80–89% B, 90–100% A

Attendance Policy:

Attendance is mandatory!

The primary reason for poor performance of students on tests and homework is repeated failure to attend class.

Attendance:
$N \leq 6 \rightarrow 5\%$ of FG $\quad 6 < N < 10 \rightarrow 3\%$ of FG $\quad N \geq 10 \rightarrow 0\%$ of FG
(N = Number of missed classes; FG- final grade)

• I expect that students will read each section of the textbook in advance of the lecture. If you miss a class, it is your responsibility to find out what you missed (announcements, assignments, notes, . . .).
• This course moves very fast. If you fall behind, even by one section, you may not be able to catch up, since each section generally depends very heavily on the ones before.
• Classes start and end always on time. Students are not allowed to leave the class before the end of the class without authorization.
• Why is it so important to be on time?
- Students who arrive late inevitably **disrupt their classmates** and disturb the flow of the lecture.
• **During the class time it is not allowed to text, chat, and sleep. All cell phones are to be turned off upon entering the classroom.**

Make ups:
There are NO make ups for the examinations except for a VALID reason. I shall give make-ups only for tests and only if I am both notified of your absence in advance and am given some kind of proof once you return to class.

Important dates:
Last day to drop delete (Course will not appear on transcripts): January 24th
Last date to drop:

Academic Honesty is a must: Please see NAU Academic Policies and Academic Dishonesty Policies.
`http://www2.nau.edu/gradcol/UGC_2013-14/6_021214/AcademicIntegrity_PolicyHear`
`011314.pdf`

Extra Help: Dot not hesitate to come to my office during office hours or by appointment to discuss a homework problem or any aspect of the course.

How to Succeed in This Course: Read the textbook and lecture notes before and after class. Do homework diligently. Ask for help when stuck. Participate in class. Make sure you connect the theory learned in class to homework and especially to programming questions.
Students are requested to attend at least three session of office hours during the course.

Disclaimer: This syllabus provides a general plan; deviations may be necessary.