Lamar University

Department of Mathematics

MATH 5315-01 Numeral Analysis
Fall 2015, TR 9:35-10:55, Lucas 118

Instructor: Mohsen Maesumi, Ph.D.
Contact: Lucas L206, maesumi@gmail.com, 409-880-8766
Office Hours: MWF 1:40-2:40, TR 11:00-12:00
Other times are available by appointment.
Text: Class notes and online resources, recommended text:
Applied Numerical Analysis using MATLAB by Fausett.
Prerequisites: MATH 3328 and MATH 3301, and one of ELEN 1301, COSC 1377,
or COSC 3306. Detailed description given below.
Computer: In case computer labs are not available students are to bring their own
laptop with MATLAB software.

Catalog Description: Algorithms for solving linear and non-linear equations and systems thereof, interpolating polynomials, finite difference approximations of derivatives, techniques of numerical integration, one-step and multi-step methods for solving ordinary differential equations and systems thereof. Prepares for: MATH 4316. Offered: Other.

MATH 4315 Learning Outcomes: Upon completion of the course, students will:
1. Write mathematically oriented computer programs in MATLAB
2. Write programs to solve a single nonlinear equation by Newton method
3. Describe the order of convergence of method
4. Experimentally determine the order of convergence of each method
5. Describe finite precision calculation issues, catastrophic cancellation, error analysis
6. Calculate basic functions (sine, cosine, exponential, Bessel) from Taylor series and perform error analysis
7. Write programs to calculate a definite integral using Newton-Cotes quadratures rules
8. Describe and experimentally determine the order of the methods
9. Combine Newton-Cotes rules of low order to design higher order methods
10. Perform Richardson or Romberg acceleration/extrapolation methods (*)
11. Write programs to calculate a definite integral using Gauss-Legendre quadrature rules (*)
12. Describe and experimentally determine the order of the methods
13. Write a program to solve a single differential equation using one of Runge-Kutta family of one-step methods
14. Describe and experimentally determine the order of the methods
15. Perform phase plane analysis for a system of ODEs (*)
16. Write a program to solve a boundary value problem using shooting method
17. Solve a system of linear equations by Gaussian elimination or one of iterative methods
(*) If time permits.

Lectures/Discussions: We will have a lecture then the class will turn into a lab where students write their own code and analyze it with the instructor or other students.

Prerequisites: This is a "cap-stone" course, as such many ideas have to be at your finger tips for you to succeed. Students are expected to be familiar with the content of applied analysis track as explained here. You must be able to quickly refresh your memory or study topics in ODE 3301, Linear Algebra 3328, Calculus I,II,III, and a basic programming course (ELEN 1301, COSC 1374, COSC 3306). While it is possible to overcome some deficiency it should be noted too many missing elements can prevent students from succeeding. The following concepts deserve special attention.
From Calculus I: functions, continuity, The Intermediate Value Theorem, derivative as a limit, Newton's method, integral as Riemann sum.
From Calculus II: Power/Taylor/MacLauren series, radius of convergence.
From Calculus III: Partial derivatives.
From Linear Algebra: Matrices and vectors.
From ODE: Exact solutions, solution via Euler Method.
From Programming: Functions, argument list, input, output, formatting, arrays, indexing, loops (do/for/while), conditionals (if/elseif), and having written a program at least 10 lines long by yourself.

Grading Policies: Most of your grade (45%) comes from daily homework as I observe you doing them in the lab. Mathematical and programming preparation and improvement achieved during the semester will reflect heavily on the grade. You need to attend all classes and be there to show your folder upon request. There will be three exams each counting for 15% of final grade. There will be a project worth 10% of final grade. During tests you may have access to your programs, MATLAB help facility, and your lecture notes. Use of other help facilities, programs, web pages or communication with another person is not allowed. You should be able to email programs and print them in the lab.
Grading scale A>90>B>80>C>70>D>60>F.

Attendance Policy: Students are expected to drop me an email on any day they were absent and let me know as to the reason. Absence in the excess of 4 days will start to count against your final grade. Make up test requires written proof of emergency within 2 days.

Final Exam: Date to be announced.

Error Correction Policy: While I have made a sincere effort to ensure that this syllabus is correct, changes may be required. I will announce any substantive changes during a regularly scheduled class. If you find an error or omission, please advise me at once so that the other members of the class may be advised.

Contact Info: Students are expected to have an *active* email with University. The email list will be made by the 12th class day from university database and you need to make sure your entry is correct. Each email must be signed by putting your full name and the course name. You may be contacted with some last minute course information by email. My preferred contact is through my email: maesumi@gmail.com. If you leave a phone message for me (8766) please duplicate it by email.

No: Food, drinks, gum, ice, noise, tardiness, e-activity in class. Please put your phones and Ipods away.

Test Code: During tests you are to look at your own paper and computer and protect your papers from others. No more than two students per table. Your face should be visible to the instructor. No obstruction by sunglasses, hair, hand, caps, etc.

Important Information for Students

Course Evaluations Policy: You will have an opportunity to evaluate all aspects of this course in a formal process to be completed online near the end of the term. You will receive an email reminder through your LU account.

No Intimidation Policy: Lamar University expressly prohibits intimidation and harassment of students, faculty, staff, or applicants. http://students.lamar.edu/academic-support/code-of-conduct.html

Drop Policy: Please make note of the three dates indicated in this drop policy. Any drop will be your responsibility; I will not drop a student from the course.
September 9, 2015: (Census Date-Six Drop Rule does not apply) A student may drop or withdraw without consulting with the instructor. The Six Drop Rule does not apply to a drop before 5:00 PM.
September 28, 2015: (Six Drop Rule applies) A student may drop or withdraw from the course without academic penalty and receive a Q, however, the Six Drop Rule applies. The student will consult with the instructor and the Records Office to initiate a drop.
November 9, 2015: (Six Drop Rule applies) Last day to drop or withdraw with academic penalty; the student must be passing the course at the time of the requested drop in order to receive a Q. The drop form, including all required signatures, must arrive in the Records Office by no later than 4:00 PM. No drop is allowed after this date except in extreme extenuating circumstances. Any "late drop" must be approved by the instructor, department chair, college dean, and provost.

Academic Integrity Policy: Students are expected to maintain complete honesty and integrity in their academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Students are specifically warned against all forms of cheating and plagiarism. The *Lamar University Student Handbook* clearly reads: "Any student found guilty of academic dishonesty in any phase of academic work will be subjected to disciplinary action. Punishable offenses include, but are not limited to, cheating on an examination or academic work which is to be submitted, plagiarism, collusion, and the abuse of source materials." One aspect of the *Handbook*'s definition of cheating includes "purchasing or otherwise acquiring and submitting as one's own work any research paper or other writing assignment prepared by an individual or firm." Plagiarism is defined as "the appropriation and the unacknowledged incorporation of another's work or ideas into one's own and submitted for credit." Faculty members in the College of arts and Sciences investigate all cases of suspected plagiarism. Any student who is found cheating in this course will receive a course grade of F. http://students.lamar.edu/student-handbook.html

Disability Accommodations Policy: Lamar University is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center (DRC) is located in the Communications building room 105. Office staff collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability

(e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact the DRC at 409-880-8347 or drc@lamar.edu to arrange a confidential appointment with the Director of the DRC to explore possible options regarding equitable access and reasonable accommodations. If you are registered with DRC and have a current letter requesting reasonable accommodations, we encourage you to contact your instructor early in the semester to review how the accommodations will be applied in the course. http://www.lamar.edu/disability-resource-center/

Campus Closure Policy: In the event of an announced campus closure in excess of four days due to a hurricane or other disaster, students are expected to login to Lamar University's website's homepage for instructions about continuing courses remotely.   http://lamar.edu

Emergency Procedures: Many types of emergencies can occur on campus; instructions for severe weather or violence/active shooter, fire, or chemical release can be found at: http://www.lamar.edu/about-lu/administration/risk-management/index.html
Following are procedures for the first two:
Severe Weather:
- Follow the directions of the instructor or emergency personnel.
- Seek shelter in an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside.
- If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building.
- Stay in the center of the room, away from exterior walls, windows, and doors.

Violence/Active Shooter:
- **CALL -** 8-3-1-1 from a campus phone (880-8311 from a cell phone). Note: Calling 9-1-1 from either a campus phone or cell phone will contact Beaumont City Police Dispatch rather than University Police.
- **AVOID-** If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- **DENY-** Barricade the door with desks, chairs, bookcases or any other items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it is safe.
- **DEFEND-** Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.