

Introduction to Numerical Methods of Engineering Analysis

EGM 3344 Section 74DA

Class Periods: MWF, period 2, 9:30 to 10:45 pm

Location: Online Course

Academic Term: Summer 2020

Instructor:

Georges Akiki
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Office Hours: M 10:45 to 11:45 pm, W 8:30 to 9:30 pm, or by appointment, Skype for Business

Teaching Assistants

- Carlos Carrasquillo: c.carrasquillo@ufl.edu.
Office Hours: F 11:00am-12:15pm. Zoom Meeting ID: 298 786 2906
- Zheng Ren (Grader): renz@ufl.edu

Course Description

Methods for numerical solution of mathematical problems, with emphasis on engineering applications and computer implementation in MATLAB. Modeling, computers, and error analysis. Roots and optimization. Linear algebraic equations and matrices. Curve fitting. Numerical differentiation and integration. Ordinary differential equations. Credits: 3

Course Pre-Requisites / Co-Requisites

Pre-requisites: MAC 2313

COP 2271 or equivalent

Co-requisites: MAP 2302

Analytic Geometry and Calculus 3

Computer Programming for Engineers Matlab

Elementary Differential Equations

Course Objectives

The goal of EGM 3344 is to teach you how to apply computational methodologies to solve engineering problems when no closed-form, analytical solution exists. Achievement of this goal requires learning the basics of structured programming as well as learning how to combine engineering knowledge, judgment, and intuition to develop reasonable approximations through the engineering modeling process. Because mathematical judgment and approximations are involved, the material in this course will be somewhat more open-ended than the material covered in other courses. Emphasis will be placed on understanding the concepts behind the various numerical methods studied, implementing basic numerical methods using the MATLAB structured programming environment, and utilizing more sophisticated numerical methods provided as built-in MATLAB functions. This approach is taken since understanding how numerical methods work is essential for choosing the correct method and understanding its limitations. At the same time, the existence of commercial numerical libraries makes it inefficient and unnecessary for students to re-develop complex existing numerical routines.

By the end of this course, you should be able to:

- *Numerical methods.* Understand the most common numerical methods used in engineering analysis, when to use each method, and how to implement basic methods in a structured manner using MATLAB's programming language.
- *Numerical accuracy.* Estimate the amount of error inherent in different numerical methods.
- *Numerical efficiency.* Assess the efficiency of a selected numerical method when more than one option is available to solve a certain class of problem.
- *Numerical stability.* Understand the convergence properties and limitations of different numerical methods.

Materials and Supply Fees

None

Professional Component (ABET):

This course prepares graduates to have a knowledge of a range of numerical methods for solving a variety of engineering problems as well as the critical thinking required for problem solving in life and engineering.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3) An ability to communicate effectively with a range of audiences	Low
4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome significantly addressed by this course.

Required Textbooks and Software

- Title: *Applied Numerical Methods with MATLAB for Engineers and Scientists*
- Author: Steven C. Chapra
- Publication date and edition: 2017, 4th Edition (McGraw Hill)
- ISBN number: 978-0-07-339796-2

- Software: MATLAB Student Version (**any recent version** should be fine)
You may consider using UFApps to access a number of popular software applications for “free” including Matlab at: <http://info.apps.ufl.edu/>
Matlab is also available for purchase and download at http://www.mathworks.com/academia/student_version/index.html

Recommended Reading

We will largely follow the layout of the Chapra book. I suggest you read the relevant chapters, especially if you are having issues with the homework.

Course Outline (subject to revision during semester as needed)

Duration (Lectures)	Topic Covered	Book Chapter
6	Part 1: Modeling, Computers, and Error Analysis	Chapters 1, 2, 3, and 4
3	Part 2: Roots and Optimization	Chapters 5 and 6
8	Part 3: Linear Systems	Chapters 8, 9, 10, 11, 12, and 13
5	Part 4: Curve Fitting	Chapters 14, 16, and 17
4	Part 5: Integration and Differentiation	Chapters 19, 20, and 21
4	Part 6: Ordinary Differential Equations	Chapters 22 and 24

Evaluation of Grades (dates are tentative, subject to revision during semester as needed)

Assessment	Percentage of Final Grade
Homework	25%
Exam 1 (Week of June 8)	25%
Exam 2 (Week of July 13)	25%
Exam 3 (August 14)	25%
	100%

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance

- Regular class attendance is expected, although not explicitly included in the grade evaluation

Homework

- HW will be posted on Canvas along with its due date.
- You are required to follow the homework formatting instructions provided with this syllabus and to complete all assigned problems
- Book chapters and due dates for homework assignments will be provided on the assignment files
- Turn in your homework via Canvas (NO HW submission via email)
- Late HW is not accepted. Hardship cases will be considered on an individual basis and only if the instructor has been contacted before the due date of the assignment. Students with hardship cases (e.g., due to medical problems) will be referred to the Dean of Students office, which will perform a background investigation to determine if the hardship is legitimate.

- If you do not agree with the grading of a HW problem, you will have one week from the date the HW is returned to submit a written argument of why you think the grade should be higher. However, the final decision will remain the instructor's

Exams

- Exams will be administered via the Canvas platform.
- Exam problems may be taken directly from the homework problems or from lecture discussions with some modifications. Thus, in addition to the weight placed on homework in the final grade, it is to your advantage to understand as many of the homework problems in the textbook as possible.
- Makeup exams are not allowed. Students with extreme, documented circumstances must contact the instructor as soon as possible to provide documentation and request that the assessment percentage be moved to future exams.
- If you do not agree with the grading of a particular exam problem, you will have one week from the date the exam is returned to submit a written argument of why you think the grade should be higher. However, the final decision will remain the instructor's

E-learning course web site (Canvas)

- Students are expected to check Canvas on a regular basis for up-to-date course information. This may include changes to the syllabus, homework assignment due dates, and exam schedules.

Class E-mail Alias

- To facilitate communication with the class, an e-mail alias will be created by the University. In order to be included in the distribution list, you will need to have a @ufl.edu e-mail address. You can check this by going to the University of Florida home page, clicking on Phonebook at the top of the page, and then searching for your name. If your e-mail address is not listed as XXXXX@ufl.edu, then you will need to contact the UF Computing Help Desk (<http://helpdesk.ufl.edu>) to have this corrected during the first week of classes. If you do not have your e-mail address corrected, then you will not receive potentially important e-mail distributions from the instructor to the class. Note that you could forward your @ufl.edu e-mail to some other e-mail address if desired.

Workload

- Numerical Methods requires a lot of programming, and completing the assignments is the only way to solidify your understanding of the material. The lectures will introduce the material, but you should expect to spend a significant amount of time on the homework, this is where the real learning takes place.

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Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.