

EGM3344: Intro to Numerical Methods

Section:

18114

Class Period:

MWF 2nd period (9:30 AM - 10:45AM)

Location: Online

Academic Term: Summer 2021

*It may become necessary to modify this syllabus during the semester.
In this event, students will be notified and the revised syllabus will be posted on the course web site.*

Instructor:

Mike Griffis

mwg@ufl.edu

352-392-9473 (o)

352-317-4045 (c)

Office: MAEC-132

Office Hours: Monday: 12:50p—1:40p

Other times can be arranged (or will be announced).

Zoom Link: <https://ufl.zoom.us/j/3857943045>

Teaching Assistants:

Cale Byczkowski: cale.byczkowski@ufl.edu

Office Hours: Tuesday: TBD

Jimmy Almacdissi: jimmyalmacdissi@ufl.edu

Office Hours: Wednesday: TBD

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-Req: COP2271-Matlab, MAC 2313.

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.

Professional Component (ABET):

This course prepares graduates to learn how to numerically deal with engineering challenges.

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	
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	Medium
7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course.

Required Textbooks and Software:

Book:

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:

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

Required Computer:

This is discussed on both the department and college websites:

- <https://www.eng.ufl.edu/students/resources/computer-requirements/>
- <https://mae.ufl.edu/academics/prospective/undergraduate/computer-requirements/>

Bottomline: if you don’t have a laptop, you need one. If you have one that works, feel free to discuss with the instructor whether it will suffice.

Weekly Schedule:

Week 1	Matlab review, mathematical modeling; Euler’s method
Week 2	Floating-point representation; round-off error; Taylor series; truncation error; finite-difference approximations
Week 3	Root-finding: bisection, false position, Newton-Raphson, secant methods Brent’s method; gradient descent method; Newton’s method of optimization;
Week 4	Linear algebra; Solving linear systems: Cramer’s rule, Gauss elimination, LU factorization;
Week 5	Matrix inverse; norms; condition number; Jacobi method; Gauss-Seidel method; multidimensional Newton-Raphson method
Week 6	Eigenvalues and eigenvectors;

Week 7	Linear regression using linear least squares; Polynomial regression; multiple linear regression; general linear least squares; nonlinear least squares
Week 8	Fourier analysis: Fourier series, frequency-domain representation of functions
Week 9	Fourier analysis: Fourier transform, discrete Fourier transform
Week 10	Interpolation: Newton and Lagrange polynomials, splines
Week 11	Numerical integration: Newton-Cotes formulas, Romberg integration
Week 12	Gauss quadrature; numerical differentiation; Runge-Kutta

Course Schedule:

Jun 4:	Exam 1 (8:20 pm — 10:10 pm In-class)
Jun 18:	Exam 2 (In-class)
Jul 23:	Exam 3 (8:20 pm - 10:10 pm)
Aug 6:	Exam 4 (In-class)

Attendance Policy, Class Expectations, and Make-Up Policy

For all intents and purposes, the course is online. Students should expect a synchronous lecture schedule, where the initial portion is instructor presentation and the final 10 to 15 minutes is open discussion and further exploring of examples. The intent is to record the instructor presentation segment, but sometimes the instructor forgets. During the open discussion portion, there will be no recording, so students should feel more open about discussing the topic du jour. Participation points will be awarded for attending lectures, and further participating.

You are responsible for staying up-to-date on all announcements, bonus video lectures, reading assignments, exams, and homework. Course notes will not always be supplied on the Canvas webpage. Late homework is not accepted. Makeup exams are only allowed for students with extreme, documented circumstances. Students must contact the instructor as soon as possible to provide documentation and request a make-up exam. Exam 4 is required and there is no make-up. Note: club sport activities are not excused absences, personal vacations are not excused absences, job activities and job interviews are not excused absences.

Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Homework should be taken seriously, and best effort should be applied. Be sure to read our comments on your homework, so that you get better. It is anticipated that there will be 6 homework assignments. Each takes time. If you wait until the last day, you will not be successful.

Evaluation of Grades

Component	Percentage of Final Grade
Homework	25%
Participation (in-class activities)	5%
Exams (Two lowest)	15% (each)
Exams (Two highest)	20% (each)
	100%

Note: Participation feedback scores will be provided throughout semester. It's a good idea to make sure your name is displayed on your Zoom portal, so you get participation points.

Grading Policy

Percent	Grade	Grade Points
93 - 100	A	4.00
90 - 92.9	A-	3.67
87 - 89.9	B+	3.33
83 - 86.9	B	3.00

80 – 82.9	B-	2.67
77 - 79.9	C+	2.33
73 - 76.9	C	2.00
70 – 72.9	C-	1.67
67 - 69.9	D+	1.33
63 - 66.9	D	1.00
60 – 62.9	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>

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.

Honorlock:

Per University of Florida policy, Honorlock will be used for all exams. Please see the following link: <https://dce.ufl.edu/services/online-proctoring/> for more information.

Course Evaluation:

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

Honesty Policy:

In this class, use of unauthorized aid, copying of homework, sharing of files, functions, or programs, dishonest attendance logging (in-class activities, etc.) are considered honor code violations. (If you are leaving class early or leaving our Zoom meeting, fine. Do not log attendance for an in-class activity. Logging and leaving is an honor code violation.)

Honor code violation can result in “E” for the course if it’s your first offense. 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 (e.g. the instructor). A violation of the honor code will result in academic sanctions (typically a failing grade “E” assigned for the course) and further disciplinary action. If you have any questions or concerns, please consult with the instructor in this class.

Commitment to a Safe and Inclusive Learning Environment:

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use and Copyrighted Material:

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use and the use of copyrighted material. 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, see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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>.