Numerical Methods of Engineering Analysis I
EGM 6341

Sections 12730, 11680, 11681,11682

Class Periods: MWF, Period 3 (9:35 AM - 10:25 AM)
Location: NEB 100
Academic Term: Spring 2023

Instructor:

Name: Renwei Mei

Email Address: rwmei@ufl.edu

Office Phone #: 352-392-0888

Office Hours: MWF, 11:00-12:00 pm, NEB 127

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
None

Course Description
Finite-difference calculus; interpolation and extrapolation; roots of equations; solution of algebraic equations; eigenvalue problems; least-squares method; quadrature formulas; numerical solution of ordinary differential equations; methods of weighted residuals. Use of digital computer.

Course Pre-Requisites / Co-Requisites
Requisites: EGM 4313 or equivalent.

Course Objectives
The objective of the course is to introduce a broad range of numerical methods for solving mathematical problems that will be encountered in engineering fields. The emphasis is on a thorough understanding of the derivation, analyses, and use of these numerical methods. See course outline below for detailed coverage.

Materials and Supply Fees
None

Required Textbooks and Software

- Title: An Introduction to Numerical Analysis
- Author: Kendall E. Atkinson
- Publication date and edition: 1990, 2nd ed
- ISBN number: 0471624896

Lecture notes in ppt format will be sent to you via Canvas.

Recommended Materials

- Title: An Introduction to Numerical Analysis

- Author: F.B. Hildebrand
- Publication date and edition: 1987, 2nd ed
- ISBN number: 978-0-486-65363-1

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/

Course Schedule

Spring 2023	Lecture #	assignments	Topic	Chapter
1/9/2023	1		Why Numerical Method? Mean Value Thm	Ch. 1
1/11/2023	2	HW1 assigned	Taylor series; Fourier analyses	Ch. 1
1/13/2023	3		Errors & Floating point arithmetic	Ch. 1
1/16/2023	Holiday			
1/18/2023	4		Significant digits & error propagation	Ch. 1
1/20/2023	5	HW1 due	Bisection & Newton's methods; order of convergence	Ch. 2
1/23/2023	6		Convergence of Newton's method; secant method	Ch. 2
1/25/2023	7		False position & Fixed point iteration methods	Ch. 2
1/27/2023	8	HW2 due	Muller's method & repeated roots; Linear system	Ch. 2
1/30/2023	9		Linear algebra	Ch. 7
2/1/2023	10		Cramer's rule; Norms; Gauss elimination	Ch. 7 & 8
2/3/2023	11		Gauss Jordan eliminations Pivoting	Ch. 8
2/6/2023	12	HW3 due	Operation count; tridiagonal algorithm	Ch. 8
2/8/2023	13		LU decomp, Crout reduction, Det., & inv matrix	Ch. 8
2/10/2023	14		Cond #, error analysis, iterative methods	Ch. 8
2/13/2023	15		Gauss Seidel, relaxation, & nonlinear system	Ch. 8
2/15/2023	16	HW4 due	Lagrange Interpolation	Ch. 3
2/17/2023	17		Newton Div. Diff; finite diff.; error detection	Ch. 3
2/20/2023	18		Interpolation Error & Hermite interpolation	Ch. 3
2/22/2023	19	HW5 due	Cubic Spline	Ch. 3
2/24/2023	20		Least Square Method for Regression	Notes
2/27/2023	21		Function approximation	Ch. 4
3/1/2023	22		Least square Approximation for function	Ch. 4
3/3/2023	23	HW6 due	Approximation using orthogonal polynomials	Ch. 4
3/6/2023	24		Numerical differentiation	Ch. 5
3/8/2023	Midterm		Midterm exam via Honorlock	
3/10/2023	25		Newton-Cotes integration	Ch. 5
3/13/2023	Spring brk			
3/15/2023	Spring brk			
3/17/2023	Spring brk			
3/20/2023	26		Composite mid-point & trapezoidal rules	Ch. 5

3/22/2023	27	HW7 due	Romberg integ; Richardson extrap; integ. error	Ch. 5
3/24/2023	28		Gauss quadrature	Ch. 5
3/27/2023	29		Gauss Legendre--Gauss Laguerre quadratures	Ch. 5
3/29/2023	30	HW8 due	Improper Integral	Ch. 5
3/31/2023	31		Adaptive; ODE-IVP; Euler explicit method	Ch. 5 & 6
4/3/2023	32		Implicit, Modified; RK2; Rk4	Ch. 6
4/5/2023	33	HW9 due	RK4, automatic RK, multistep	Ch. 6
4/7/2023	34		high order odes; numerical stability	Ch. 6
4/10/2023	35		BVP: shooting; finite difference & derivative BC	Ch. 6
4/12/2023	36	HW10 due	KDV-Burgers equation	Notes
4/14/2023	37		explicit method for heat equation	Notes
4/17/2023	38		Implicit, Crank-Nickolson... methods for heat eqn	Notes
4/19/2023	39		explicit & impl methods (wave eqn); upwind; MPDE	Notes
4/21/2023	40		FD methods for wave equations	Notes
4/24/2023	41		MacCormac Scheme; FTCS for viscous Burgers eqn	Notes
4/26/2023	42	HW11 due	Other methods for viscous Burgers eqn	Notes
5/2/2023	Final exam		Via Honorlock	

Both midterm and final exams will be given via Honorlock.
A window of at least 24 hours will given for students to choose a convenient time block to work on exams.
The above lecture schedule is subject to change depending on the pace of the lectures.

Attendance Policy, Class Expectations, and Make-Up Policy
This is a UF Edge course and the lectures are video recorded.
Regular class attendance for campus students is expected but not strictly required.
Class attendance constitutes attending live lectures or watching the recorded video lectures, and completing any HWs assigned for completion prior to the due date.
Late HW and makeup exams are only allowed for students with documented circumstances consistent with UF policy. Students must contact the instructor through Canvas email as soon as possible to provide documentation and request a make-up exam or HW extension.
Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

No early exam will be given to ANY student for any reason.

HW:

i) HW will be regularly assigned on Canvas e-learning course website.
All assignments are to be turned in through Canvas e-learning course website.
See "Homework expectations" for writing your HWs.

Handwritten works need to be scanned into pdf first.
If you write your homework using Word, convert it to pdf before submitting through Canvas.
Excel files or Matlab files are not substitutes for your work. You can attach them as proof of your work, but they will usually not be graded or checked unless specifically requested.

Before you submit your work to Canvas, check the quality of your scanned file. Illegible work will not be graded.

ii) For each assigned problem, detailed solutions will be posted after you have turned in your HWs. Please review posted solutions carefully to enhance your understanding.

iii) To receive full credit, you will be required to complete all assigned problems. Your homework must be neatly written and formatted.

Exams:

i) There will be a midterm exam and a final exam.

ii) Mid-term exam is given on Wednesday, 3/8/2023.

The final exam is given on 5/2/2023.

Exams will be available at 9:00 am on the above dates and will be closed by Honorlock at 6 pm on the following day.

iii) The exams are closed-book and closed notes, but you are allowed to bring ONE piece of 8.5x11" formula sheet for each exam.

iv) NO CELL PHONE (or anything that can store formulae) is allowed during each exam.

NO programmable calculator is allowed during exams.

Only scientific calculators (such as TI-36, Casio,…) are allowed during exams.

v) The exam problems will require written response involving derivation and calculations. The emphasis of the exams will be to test your understanding, not on formulaic repetition.

vi) Some problems may be taken directly from the homework problems or from lecture discussions with some modifications.

If you do not agree with the grading of a particular HW/Exam problem, please email me your concerns within one week from the date the exams are graded. Please include a written explanation of why you think the grade should be higher. However, the final decision will remain the instructor's.

Study group:

A study group would be an excellent place to discuss the concepts, codes, and solution process to each problem. After the discussions, however, each one should write own solution.

If two identical copies of solutions/codes are uncovered, I reserve the right to give 0 credit to each student and report the incident to the appropriate university offices for further investigation.

Extra assignment/project for an individual to improve bad grade: None

If you receive low grades for the first few HW sets or your midterm exam, and you want to improve your future performance, please email me or call me. I will be more than happy to analyze your situation and discuss strategies to enhance your learning and improve grades for future assignments and exams. Do not wait till the end of semester to ask for extra-credit work as there will be none given.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (11)	10 per problem	10%
Midterm Exam	100	40%
Final Exam	100	50%
		100%

Grading Policy

The following is given as an example only.

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:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

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.aa.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.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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://sccr.dso.ufl.edu/process/student-conduct-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.

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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@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

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: https://registrar.ufl.edu/ferpa.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: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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 suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/state-authorization-status/#student-complaint*.