Introduction to Numerical Methods of Engineering Analysis
EGM 3344 Section 2605  Class# 13873

Class Periods:  MWF 9 (4:05 pm to 4:55 pm)
Class Location:  WEIL 270
Academic Term:  Fall 2019

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 website.

Instructor:
Renwei Mei
Room 307 Nuclear Science Building
rwmei@ufl.edu
352-392-0888
Office Hours:  MW 10:30 -12:00 am  @ 307 Nuclear Science Building
(I will be moving my office to New Engineering Building during the semester. I will update you once I move)

Teaching Assistants:  Mr. Bo Han Huang: Office Hours: Tu & Fr 10:30-11:30
Grader:  Zheng Ren

Catalog Description

Course Pre-Requisites & Co-requisites
MAC 2313 Analytic Geometry and Calculus 3; COP 2271, or equivalent  Computer Programming for Engineers Matlab
Co-requisites: MAP 2302 Elementary Differential Equations

Course Objectives
The objective of the course is to teach students how to apply computational methodologies to solve engineering problems when no closed-form, analytical solution exists. Students will learn the basics of using structured programming to combine engineering knowledge, judgment, and intuition to develop reasonable approximations and numerical solutions. Emphasis will be placed on understanding the basic 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. The objective will be achieved through:

• In class lectures and examples
• Student completion of homework and projects
• Student preparation for and completion of exams

Professional Component (ABET):
This course prepares graduates to apply knowledge of calculus based physics to engineering modeling, knowledge of advanced mathematics through multivariate calculus and differential equations to engineering problem solving, and knowledge of statistics and linear algebra to data analysis.

Relation to Program Outcomes (ABET):

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Coverage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</td>
<td>High</td>
</tr>
<tr>
<td>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</td>
<td>Low</td>
</tr>
<tr>
<td>3) an ability to communicate effectively with a range of audiences</td>
<td>Low</td>
</tr>
<tr>
<td>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</td>
<td>Low</td>
</tr>
<tr>
<td>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</td>
<td>Low</td>
</tr>
<tr>
<td>6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions</td>
<td>Low</td>
</tr>
<tr>
<td>7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies</td>
<td>Low</td>
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</tbody>
</table>

*Coverage is given as high, medium, or low. An empty box indicates that this outcome significantly addressed by this course.
Materials and Supply Fees
None

Required Textbooks and 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

Additional Recommended Materials
None.

Course Schedule
See table at end of syllabus.

Attendance Policy, Class Expectations, and Make-Up Policy
Regular class attendance is expected. Students attendance will be collected randomly and course attendance will be a factor in determining course grade. Late HW and makeup exams are only allowed for students with documented circumstances consistent with UF policy. Excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation. For more information on UF policies see https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx
No early exam will be given to ANY student.

Evaluation of Grades
• Homework will be assigned regularly during the semester.
• Class participation will be a factor. For individuals in the gray area between two grades, performance on the homework and attendance will be used to make the final decision.
• 3 hourly exams will be given during the regular class period.
• The final exam is given at the time scheduled by the registrar.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>10%</td>
</tr>
<tr>
<td>Projects (2)</td>
<td>5% + 5 %</td>
</tr>
<tr>
<td>Exam 1</td>
<td>Wed Sept. 18</td>
</tr>
<tr>
<td>Exam 2</td>
<td>Mon Oct. 21</td>
</tr>
<tr>
<td>Exam 3</td>
<td>Wed Nov. 20</td>
</tr>
<tr>
<td>Final exam (cumulative)</td>
<td>Dec. 9 @ 10:00 AM - 12:00 PM</td>
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Grading Policy

<table>
<thead>
<tr>
<th>Percent</th>
<th>Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 - 100</td>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>87 - 89</td>
<td>A-</td>
<td>3.67</td>
</tr>
<tr>
<td>84 - 86</td>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>80 - 83</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>77 - 79</td>
<td>B-</td>
<td>2.67</td>
</tr>
<tr>
<td>74 - 76</td>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>70 - 73</td>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>68 - 69</td>
<td>C-</td>
<td>1.67</td>
</tr>
<tr>
<td>65 - 67</td>
<td>D+</td>
<td>1.33</td>
</tr>
<tr>
<td>62 - 64</td>
<td>D</td>
<td>1.00</td>
</tr>
<tr>
<td>59 - 61</td>
<td>D-</td>
<td>0.67</td>
</tr>
<tr>
<td>0 - 59</td>
<td>E</td>
<td>0.00</td>
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</tbody>
</table>

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](https://www.dso.ufl.edu/drc)) by providing appropriate documentation. Once registered, students will receive an accommodation letter to present 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 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.ufl.edu/students/](https://gatorevals.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/](https://ufl.bluera.com/ufl/). Summaries of course evaluation results are available to students at [https://gatorevals.ufl.edu/public-results/](https://gatorevals.ufl.edu/public-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/](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. A violation of the honor code will result in academic sanctions (typically a failing grade assigned for the course) and further disciplinary action. If you have any questions or concerns, please consult with the instructor or TAs in this class.

**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, please see: [http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html](http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html)

**Campus Resources:**

**Health and Wellness**

<table>
<thead>
<tr>
<th>U Matter, We Care:</th>
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<tbody>
<tr>
<td>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 <a href="mailto:umatter@ufl.edu">umatter@ufl.edu</a> 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.</td>
</tr>
</tbody>
</table>

| Counseling and Wellness Center: | [http://www.counseling.ufl.edu/cwc](http://www.counseling.ufl.edu/cwc) and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies. |
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<table>
<thead>
<tr>
<th>Sexual Assault Recovery Services (SARS)</th>
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<tbody>
<tr>
<td>Student Health Care Center, 392-1161.</td>
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</table>

| University Police Department | at 392-1111 (or 9-1-1 for emergencies), or [http://www.police.ufl.edu/](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](https://lss.at.ufl.edu/help.shtml). |
Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. [https://www.crc.ufl.edu/](https://www.crc.ufl.edu/)

Library Support, [http://cms.uflib.ufl.edu/ask](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/](https://teachingcenter.ufl.edu/)

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. [https://writing.ufl.edu/writing-studio/](https://writing.ufl.edu/writing-studio/)


**Course Outline:** The course will cover the following general topics:

Part 1  Modeling, Computers, and Error Analysis  
- Mathematical Modeling  
- Numerical Methods & Problem Solving  
- Numerical Differentiation  
- Roundoff and Truncation Errors

Part 2  Root Finding  
- Roots: Bracketing Methods  
- Roots: Open Methods

Part 3  Linear Algebraic Equations and Matrices  
- Linear Algebraic Equations and Matrices  
- Gauss Elimination  
- LU Factorization  
- Matrix Inverse and Condition  
- Iterative Methods

Part 4  Curve Fitting  
- Linear Regression  
- General Linear Least-Squares and non-linear Regression  
- Polynomial Interpolation  
- Splines and Piecewise Interpolation

Part 5  Numerical Integration  
- Numerical Integration based on given data  
- Numerical Integration based on given Functions

Part 6  Fourier Analyses  
- Fourier Series  
- Fourier Integral  
- Fourier Transformation

Part 7  Ordinary Differential Equations  
- Initial Value Problems  
- Adaptive Methods and Stiff Systems