Principles of Engineering Analysis-I

EGM 6321 Sections 12791 – 12793 – 12819 - 12792
Class Periods: Thursdays Period 7-8 (1:55PM-3:50PM) and Tuesdays Period 7 (1:55PM-2:45 PM)
Location: Online
Academic Term: Fall 2023

Instructor:
Name: Francisco J. Montáns
Email Address: fco.montans@ufl.edu
Office Phone Number: TBA
Office Hours: Fridays 3:00--5:00 pm EST; online

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- Miguel Perilla, FASt Lab. MAE-A 120
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Catalog Course Description
Solution of linear and nonlinear ordinary differential equations. Methods of Frobenius, classification of singularities. Integral representation of solutions. Treatment of the Bessel, Hermite, Legendre and Mathieu equations. Asymptotic methods including the WBK and saddle point techniques. Treatment of nonlinear autonomous equations. Phase-plane trajectories, limit cycles, Thomas-Fermi, Emden, van der Pol equations.

Course Pre-Requisites / Co-Requisites
Completion of elementary calculus (derivatives, integrals, series, functional analysis, etc) and undergraduate differential equations course (some parts will be reviewed, but as a refresh); for example: EGM 4311 or MAP 4305. Otherwise, a permission of the instructor is needed. Minimal working use of MATLAB, Mathematica, Maple or similar software or programming language (Python, Julia, etc) is recommended.

Course Objectives
The goal of EGM 6321 is to provide the students with the ability to model engineering problems that are expressed as differential equations, and learn strategies to find and analyze the solutions.

Materials and Supply Fees
It is recommended that students have access to MATLAB, Mathematica, Maple, Scilab, Python, Julia or similar software (mainly for simple programming and plotting of solutions).

Required Textbooks and Software
No required text. Online notes will be given by the instructor *after* each class. Class notes are developed by instructor mostly based on the recommended books.

Recommended Materials

1. [BD] Boyce, DiPrima (2012). Elementary Differential Equations and Boundary Value Problems, 10th Ed (or any other) Wiley.
2. [KZ] Kreyzig (1993). Advanced Engineering Mathematics, 7th Ed (or any other). Wiley.
3. [KBO] King, Billingham, Otto (2003). Differential Equations: Linear, Nonlinear, Ordinary, Partial. Cambridge U Press.
4. [EP] Edwards, Penney (2008). Differential Equations and Boundary Value Problems, 4th Ed. Pearson.
5. [RO] Ross (1984). Differential Equations 3rd Ed. Wiley.
6. [LE] Lebedev (1972). Special Functions and Their Applications. Dover.
7. [JS] Jordan, Smith (2017). Nonlinear Ordinary Differential Equations: An Introduction for Scientists and Engineers, 4th Ed. Oxford U Press.
8. [BO] Bender, Orszag (1999). Advanced Mathematical Methods for Scientists and Engineers. Springer.

9. [DR] Drazin (1992). Nonlinear Systems. Cambridge.

Course Schedule

Week 1: Presentation. Introduction (Aug 24).
Week 2: First order differential equations I (Modeling, graphs, separable, autonomous, and exact ODE)
Week 3: First Order differential equations II (Bernoulli, Ricatti, numerical solutions and stability)
Week 4: Second and higher order order differential equations I. Homogeneous ODE.
Week 5: Second and higher order order differential equations I. Non-homogeneous ODE.
Week 6: Systems of ODE.
Week 7: Series solutions of ODE I: Power series, Airy, Legendre, Hermite, Chebechev polynomia, Rodrigues formula.
Week 8: Review and **[EXAM 1]**
Week 9: Series solutions of ODE II: Method of Frobenius. Besel equation and functions. Mathieu functions. Integral representation of solutions of 2nd ODE. Properties (Hermite, Laguerre, Legendre, Bessel)
Week 10: Nonlinear ODE I
Week 11: Nonlinear ODE II
Week 12: Asymptotic methods for ODE.
Week 13: Perturbation methods, stability, bifurcations.
Week 14: Review and **[EXAM 2]**
Week 15: Additional topics in nonlinear ODE.

Attendance Policy, Class Expectations, and Make-Up Policy

Instruction is online, except for review classes (Sec 12791; room TBA before these classes). In person attendance is not required, but you are responsible for learning all the information disseminated during the lectures, including homework, due dates, and possible changes in the programme.

There will be 12 homework sets, approximately weekly, assigned on most Thursdays and due the following Thursdays. No late homework is allowed. However, since hardships during the semester are possible, only 10 out of the 12 homework sets will be used for the final grade. If the student hands more than 10 assignments, only those 10 with the highest marks will be used for the final grade (so 2 can be skipped). There will be no final exam. There will be two Exams, 1:45 hours each, during regularly scheduled classes, i.e. Thursdays during periods 7-8 (1:55PM-3:50PM). Tentative date for Exam 1 is October 19, 2023. Tentative date for Exam 2 is November 30, 2023.

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://gradcatalog.ufl.edu/graduate/regulations/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (10) (Out of twelve, two assignments discarded)	100 each	60%
Exam 1	100	20%
Exam 2	100	20%
		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:
UF Graduate Catalog
Grades and Grading Policies

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 varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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
- HWCOE Human Resources, 352-392-0904, student-support-hr@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

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/getting-help/; https://distance.ufl.edu/state-authorization-status/#student-complaint.*