Mathematical Basis of Chemical Engineering

ECH6847 Sections 01E5, 01E9, 152H
Class Periods: MWF, period 9, 4:05 pm – 4:55 pm
Location: NEB 201
Academic Term: Fall 2019

Instructor:
Dmitry Kopelevich
Email: dkopelevich@che.ufl.edu
Office Phone Number: 352-392-4422
Office Hours: Wednesdays, 10:00 am – 12:00 pm, CHE 315.
If you cannot attend the office hours, please email to make an appointment.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
(Please contact through the Canvas website)
Abdullateef Gari, agari@ufl.edu, Mondays, 10:30 am – 12:30 pm, location TBA.

Course Description
3 credit hours. Methods of linear systems, chemical engineering applications in finite and infinite dimensional spaces, concepts of stability, application to transport phenomena.

Course Pre-Requisites / Co-Requisites
None.

Course Objectives
Upon completion of this course, a student should be able to:

1. Solve systems of linear algebraic equations.
2. Solve eigenvalue problems in finite- and infinite-dimensional spaces.
3. Solve linear ODEs and PDEs.
4. Analyze nonlinear differential equations.
5. Perform statistical analysis of experimental data.

Materials and Supply Fees
N/A

Required Textbooks
"Modeling and Analysis Principles for Chemical and Biological Engineers", M. D. Graham and J. B. Rawlings (2013); ISBN 978-0-9759377-1-6.

Recommended Materials (On Reserve in Marston Science Library)

1. M. D. Greenberg "*Foundations of Applied Mathematics*" (1978); ISBN 0133296237.
2. Varma and M. Morbidelli "*Mathematical Methods in Chemical Engineering*" (1997); ISBN 0195098218. Electronic version (ISBN 1628701595) is also available on UF library website.
3. G. Strang "*Introduction to Linear Algebra*" (2016); ISBN 0980232775

Course Outline
(Exact dates and reading and homework assignments will be posted on the course website)

1. Review of methods of ODE and PDE solutions (material necessary for Continuum Basis):
    - Linear ODEs with constant coefficients.
    - Application of Laplace transform to solution of inhomogeneous linear ODEs.
    - Linear ODEs with variable coefficients.
    - Solution of PDEs using separation of variables.

2. Linear algebra
    - Linear spaces.
    - Matrices and linear operators.
    - Systems of linear equations and Gaussian elimination.
    - Eigenvalue problem.

3. Function spaces
    - Orthogonal bases; Fourier series and Fourier transform.
    - Differential operators.
    - Eigenvalue problems in function spaces. Sturm-Liouville problem. Application to solutions of PDEs.

4. Nonlinear differential equations
    - Stability analysis.
    - Qualitative analysis in phase space.
    - Introduction to perturbation methods.

5. Green's functions and their application to solution of ODEs and PDEs.

6. Probability theory.
    - Random variables.
    - Central limit theorem.
    - Application to analysis of experimental data.

Attendance Policy, Class Expectations, and Make-Up Policy

- The students are required to attend all lectures. It is student's responsibility to obtain the information (e.g. notes, assignments, and announcements) that they have missed due to their absence.
- Exams and quizzes will be rescheduled only for those students who missed them due to an acceptable reason (illness, serious family emergencies, military obligation, religious holidays, and participation in official university activities) as listed in the Graduate Catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance). Excused absences require appropriate documentation. It is required that whenever possible the student notifies the instructor about an expected absence before an exam.
- Students arriving late for a quiz/exam will be given only the balance of time remaining to complete their work unless an acceptable reason (see above) is provided.

Exams and Quizzes

- The final exam is scheduled to take place on December 9th, 10:00 AM - 12:00 PM.
- Dates of the midterm exams will be announced in class and posted on the course Canvas page.
- Quizzes may be given without a prior announcement.
- Students may not leave the room during a quiz/exam except in emergencies.
- Students may use their course notes and the textbook during quizzes but not during the exams. Use of any other material is not allowed.
- Only a basic (i.e. not graphing, programmable, etc.) scientific calculator can be used during exams and quizzes. Use of other electronic devices (graphing calculators, cell phones, laptops, tablets, etc.) is not allowed unless announced otherwise before the exam or quiz.
- Only one solution per problem should be turned in. If a student turns in two or more different solutions for the same problem, all of them will be graded but only the lowest of these grades will be counted towards the exam

or quiz grade. The motivation for this policy is that the students should learn to identify correct solutions without outside help.

Homework Policy

- Homework will be assigned on a 1-2 week basis.
- Homework solutions must be submitted in class on the due date.
- Late homework submissions will not be accepted.
- Homework solutions will be posted on the Canvas website after the due date.
- A randomly selected subset of problems will be graded on each homework assignment.
- **A failing grade will be assigned to students whose cumulative homework grade is less than 50%.**

Format for Assignments (Exams, Quizzes, and Homework)

- Write name, date, course number, and exam/quiz/homework number on top of the front page.
- Write page number on each page.
- Write (neatly) on 8.5x11 inch sheets of paper. Staple all pages together.
- Clearly indicate the problem number.
- Clearly identify solutions by boxing all final and intermediate answers.
- **Include enough details to justify your solutions.**

Evaluation of Grades and Grading Policy

Assignment	**Percentage of Final Grade**
Homework	10%
Quizzes	10%
Midterm Exam #1	25%
Midterm Exam #2	25%
Final Exam	30%
	100%

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

Cooperation Policy

- Students are free to consult among themselves on the approach taken to solve any **homework** problem. However, *copying* homework solutions is a violation of the Honor Code. In particular, showing other students a copy of the actual manuscript to be submitted as homework *is not allowed*. Acceptable consultation includes discussing which equations should be used for solving a problem, writing down relevant relationships, etc.
- No consultation among students is allowed during **quizzes and exams.**

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/policies/student-honor-code-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.

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 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/.

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
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: http://www.counseling.ufl.edu/cwc, 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 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.