

Mathematical Basis of Chemical Engineering

ECH6847

Class Periods: MWF, period 9, 4:05 pm – 4:55 pm

Academic Term: Spring 2021

Instructor:

Dmitry Kopelevich

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Office Phone Number: (352) 392-4422

Office Location: CHE 315

Office hours: Fridays, 10:00 am – 12:00 noon or by appointment.

Office hours will be held remotely via Zoom meetings. Links to Zoom meetings for office hours will be posted on Canvas.

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.

Materials and Supply Fees: N/A

Course Objectives

Upon completion of this course, a student should be able to be able to formulate and solve advanced problems of relevance to chemical engineering that require knowledge and ability of the following mathematical subjects and methods:

- Solution of Ordinary Differential Equations (ODEs):
 - First-order linear systems.
 - Linear equations with variable coefficients.
 - Asymptotic analysis and perturbation methods.
 - Application of Laplace transform to solution of ODEs.
- Solution of Partial Differential Equations (PDEs):
 - Linear partial differential equations.
 - Separation of variables.
 - Application of Fourier and Laplace transforms to solution of PDEs.
 - Green's Functions.
- Vector Calculus:
 - Index notation.
 - Vector and tensor algebra.
 - Differential operators and integral theorems.
- Linear Algebra:
 - Linear spaces.
 - Linear operators and matrices.
 - Systems of linear algebraic equations.
 - Eigenvalue problems.
- Probability and Random Variables.
 - Probability distribution functions.
 - Central limit theorem.
 - Statistical analysis of experimental data.

Required Textbooks

None

Recommended Materials

1. M. D. Graham and J. B. Rawlings, "Modeling and Analysis Principles for Chemical and Biological Engineers", (2013); ISBN 978-0-9759377-1-6.
2. Varma and M. Morbidelli "Mathematical Methods in Chemical Engineering" (1997); ISBN 0195098218. Electronic version (ISBN 1628701595) is available on UF library website.
3. G. Strang "Introduction to Linear Algebra" (2016); ISBN 0980232775
4. M. D. Greenberg "Foundations of Applied Mathematics" (1978); ISBN 0133296237.

Course Schedule

Topics covered in each lecture and instructor's notes for the lectures will be posted on the course website.

Course Website (Canvas)

- To access the class E-learning (Canvas) website, go to elearning.ufl.edu
- Alternatively, the class website can be found by searching for "UF Elearning" on Google and following links.
- After logging in using your UF credentials, you should be able to identify our class website and navigate to it.
- The homepage of the course website will contain topics and dates of completed lectures, as well as links to lecture notes.
- Links to lecture recordings will be available after each class in the "Cloud Recordings" tab of the "Zoom Conferences" section of the Canvas website. Please note that it usually takes several hours after recording for a video to become available online.
- Homework assignments and their solutions will be posted in the "Assignments" tab of the website.

Class Meetings

- Lectures will take place synchronously (i.e., live) on zoom. Links to zoom sessions will be posted in the "Zoom Conferences" tab on Canvas and a recording of each lecture will be posted after class.
- Information on downloading and using Zoom can be found here: <https://elearning.ufl.edu/zoom/>.
- Please mute your microphone during class unless you are speaking.
- Please feel free to ask questions during class by unmuting your microphone.
- Please give me feedback if the video and/or audio are not clear from my side.

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.

Attendance Policy, Class Expectations, and Make-Up Policy

- Students are strongly encouraged to attend all lectures, although attendance is not required. 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

- The final exam is scheduled to take place on April 27, 2021, 5:30 pm - 7:30 pm.
- Dates of midterm exams will be announced in class and posted on the course Canvas page.
- Proctoring of assessments will be done using Honorlock. A guide is available at <https://warrington.ufl.edu/covid-19/information-for/for-students/honorlock-student-guide/>.
- You will take an exam using Honorlock, typing your final answer to each question into the computer. Then, you will need to scan and upload your detailed work to E-learning within a few minutes of the exam ending.
- A practice quiz will be posted so that you can confirm that your equipment works correctly and that you understand the procedure.
- 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 should be completed, scanned, and uploaded to E-learning prior to the 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. Please note that you are responsible for checking your own work against the solutions, as not every homework may be graded.
- Grade for some of the homework problems may be based on having completed the assignment, not on whether the results are correct or incorrect.
- **A failing grade will be assigned to students whose cumulative homework grade is less than 50%.**

Format for Assignments (Exams and Homework)

- Write name, date, course number or title, and exam /homework number on top of the front page.
- Write page number on each page.
- Clearly indicate the problem number.
- Clearly identify solutions by boxing all final and intermediate answers.
- Present solutions that are neat and well thought-out to maximize your grade.
- **Include enough details to justify your solutions.**

Evaluation of Grades and Grading Policy

Assignment	Percentage of Final Grade
Miscellaneous (see below)	5%
Homework	10%
Midterm Exam #1	27.5%
Midterm Exam #2	27.5%
Final Exam	30%
Total	100%

Miscellaneous:

- 2.5% points for completing an example quiz. This will prepare you for using Honorlock, as will be required for the exams.
- 2.5% points will be added to your final grade for introducing yourself and sharing your background with mathematics with me. You must meet with me during office hours within the first four weeks of the class to receive credit.

Grading Scale:

- These percentages will earn you a letter grade of *at least*
 - 85%: A-
 - 70%: B-
- The instructor guarantees these grades if you earn the posted percentages.
- Percentages for other grades (A, B+, etc.) will be decided by the instructor based upon a curve and the instructor may decide to *lower* the thresholds for the grades listed, based upon a curve. The instructor may employ a curve only to lower these thresholds.
- 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 **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 in this class.

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/>.

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 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://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.