

Course Syllabus for ECH 6285

Transport Phenomena

Fall 2023

- Class Meetings:** Monday, 12:50 to 1:40 pm in LAR 310
Friday, 12:50 to 2:45 pm in WEIL 270
- Instructor:** Jason E. Butler, Professor of Chemical Engineering
431 Chemical Engineering Bldg. (CHE)
e-mail: butler@che.ufl.edu
Office hours every Tuesday and Thursday,
1:00 pm to 2:00 pm, or by appointment.
- Supervised Teacher:** Suriya Ramasubramanian, Doctoral Candidate
e-mail: ramasubra.suriya@ufl.edu
Office hours Wednesdays, 4:00 - 5:00 pm, via zoom
- Course Description:** Integrated introduction to transport processes in continuous media with emphasis on fluid mechanics and heat and mass transfer.
- Prerequisites:** Admission to the chemical engineering graduate program or by consent of instructor, dependent upon prior background in undergraduate fluid mechanics and heat and mass transfer, at a level required to obtain an undergraduate degree in Chemical Engineering.
- Class Website:** Access at <http://elearning.ufl.edu/>
- Textbook:** *Analysis of Transport Phenomena* by William M. Deen
Oxford University Press, ISBN: 9780199740284
- Exam dates:**
- Final Assessment
Thursday, December 14, 7:30 AM - 9:30 AM
 - Regular Assessments
to be announced periodically, six expected
- Grading Criteria:** 67% Regular Assessments
33% Final Assessment
** All assessments cumulative.
- Homework:**
- Homework will not be graded.
 - Suggested homework problems will be assigned on a periodic basis and solutions will be posted.

Grading:

- Completing $\geq 80\%$ of all possible points will earn a letter grade of *at least* A-.
- Completing $\geq 65\%$ will earn a letter grade of *at least* B-. Note that a B- is required for doctoral students to continue in the program.
- Completing $\geq 55\%$ will earn a letter grade of *at least* C. Note that a C is required for masters students to continue in the program.
- The instructor guarantees these grades if you earn the posted percentages. Other marks (B, B+, etc.) will be decided by the instructor based upon a curve.
- The instructor may decide to *lower* the thresholds needed to attain the grades listed above, but will not raise the threshold.
- Award of partial credit on individual questions will be made on a basis specified by the instructor and will be consistently applied.
- Graders will attempt to assess the value of all work accurately; however, you should present solutions that are neat and well thought-out to maximize your grade.
- Clearly identify solutions by boxing all final and intermediate answers.
- Include enough details to justify your solutions.
- More information on UF grading policy may be found at: UF Graduate Catalog and Grades and Grading Policies

Attendance:

- Students are strongly encouraged to attend all lectures, though attendance is not required.
- Exams/quizzes will be rescheduled only for those students who missed due to an acceptable reason.
- 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/>
- 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.

Teaching Objectives for ECH 6270, Fall 2023

This course will provide students with a unified formulation of transport processes, with special emphasis on momentum, heat, and mass transport. The goal is to enable students to read and utilize literature that is relevant to their own work, as well as to give students the tools to create their own models and calculations. By the end of this course, students will be able to apply the differential mass and momentum balances for fluid flow to a wide range of processes including those involving non-Newtonian flow, turbulent flow, and convective heat and mass transfer:

- Identify and setup problems involving individual or combined transport of momentum, energy, and mass, or any other conserved physical quantity;
- Formulate the appropriate governing equations and associated boundary conditions for such problems;
- Simplify the governing equations for such problems, through dimensional analysis, scaling, and other asymptotic techniques.

- Apply advanced mathematical and numerical methods to obtain solutions for such problems.

Students taking this course should have a background in undergraduate fluid mechanics and heat and mass transfer, at a level required to obtain an undergraduate degree in Chemical Engineering. Students should also have a strong background in calculus and differential equations, commensurate with what is required to obtain an undergraduate degree in Chemical Engineering in the United States.

Recommended Materials: In addition to the required textbook, recommended references include:

- Vectors, Tensors, and the Basic Equations of Fluid Mechanics, by R. Aris. Dover Publications, New York, NY, 1989. This relatively inexpensive book provides a thorough introduction to the nomenclature and mathematics of vectors and tensors, within the context of fluid mechanics.
- Transport Phenomena, Second Edition, by R. B. Bird, W. E. Stewart, and E. N. Lightfoot. Wiley, New York, NY, 2001. This second edition of the classic textbook provides an introduction to the relevant aspects of momentum, heat, and mass transport at the undergraduate level, with selected advanced topics. Studying/reviewing the material presented in this book is recommended for students who feel the need to strengthen their background on transport phenomena.
- Advanced Engineering Mathematics, 9th Edition, by E. Kreyszig. Wiley, New York, NY, 2005. This is only one of many available textbooks on engineering mathematics. This textbook covers topics relevant to the course, such as solution methods for ordinary differential equations, special differential equations and the properties of their solutions (e.g. Bessel equations and functions), and Fourier series and generalized Fourier representation of functions. While this textbook is recommended any textbook with similar coverage should serve students well as reference.

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 Health and Wellness Resources:

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/>.

Campus 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 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>.