

Transport Phenomena

ECH 6285 Section CAMP, 1FE2, 2FED, and OVER

Class Periods: Monday Period 6 (12:50pm – 1:40pm) and Friday Period 6-7 (12:50pm – 2:45pm)

Location: NEB 0201

Academic Term: Fall 2022

Instructor:

Dr. Henry Chu

Email Address: h.chu@ufl.edu

Phone Number: (607) 319-6298

Office Hours: Office hours will be held by the supervised teaching student as shown below.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Mr. Igin Ignatius

Email Address: igin.ignatius@ufl.edu

Phone Number: (908) 338-2923

Office Hours: Wednesday (8:30am – 9:20am) and Thursday (8:30am – 9:20am)

Course Description

3 credits; Integrated introduction to transport processes in continuous media with emphasis on fluid mechanics and heat and mass transfer.

Course Pre-Requisites / Co-Requisites

Admission to the ChE 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.

Course Objectives

Upon completion of this course, a student is expected to be able to formulate and solve advanced problems in transport phenomena in fluid mechanics and heat and mass transfer. In addition to formulating and solving the problems, a student is expected to interpret and analyze the results of the problem. Students will be assessed by 3 homework sets and 3 quizzes which are elaborated later in this syllabus. Specific topics covered will include:

- Diffusive fluxes and material properties, e.g., basic constitutive equations and diffusivities for energy, species and momentum.
- Fundamentals of heat and mass transfer, e.g., conservation equations and boundary conditions of mass, energy, and chemical species.
- Formulation and approximation methods, e.g., one-dimensional transport problems, order-of-magnitude estimation and scaling, dimensionality and times scales in modeling.
- Solution methods based on scaling concepts, e.g., similarity method, regular perturbation analysis, and singular perturbation analysis.
- Solution methods for linear problems, e.g., properties of the finite Fourier transform method and application of the method to solve transport problems in Cartesian, cylindrical, and spherical coordinates.
- Fundamentals of fluid mechanics, e.g., conservation of momentum, fluid kinematics, constitutive equations for viscous stress, force calculations, stream function, dimensionless groups and flow regimes.
- Unidirectional and nearly unidirectional flow, e.g., steady flow with a pressure gradient and moving surface, time-dependent flow, nearly unidirectional flow by lubrication approximation.
- Creeping flow, e.g., general features of low Reynolds number flow, stream function solutions.
- Laminar flow at high Reynolds number, e.g., general features of high Reynolds number flow, inviscid flow, irrotational flow, boundary layers at solid surfaces, internal boundary layers.

Materials and Supply Fees

None.

Required Textbooks and Software

“Analysis of transport phenomena” 2nd Edition, by William M. Deen. ISBN: 978-0-19-974028-4

The majority of the course notes are developed by the instructor based on this textbook and will be given to students via Canvas.

Recommended Materials

“Transport Phenomena in Biological Systems” 2nd Edition, by George A. Truskey, Fan Yuan, and David F. Katz. ISBN 978-0-13-156988-1

Some course notes are developed by the instructor based on these textbooks and will be given to students via Canvas.

Course Schedule

The schedule below is subject to change depending on the class progress.

Date	Lecture	Content (Numbers inside brackets correspond to book chapters in Deen's book.)	HW/Quiz
8/26	1	Chapter 1: Diffusive fluxes and material properties (1.1 - 1.2)	
8/26	2	(1.3) Chapter 2: Fundamental of heat and mass transfer (2.1 - 2.2)	
8/29	3	Chapter 2: ... (2.3 - 2.5)	
9/2	4	Chapter 2: ... (2.6 - 2.7)	
9/2	5	Chapter 3: Formulation and approximation (3.1 - 3.3)	
9/9	6	Chapter 3: ... (3.4)	
9/9	7	Chapter 3: ... (3.5)	
9/12	8	Chapter 4: Solution methods based on scaling concepts (4.1 - 4.2)	
9/16	9	Chapter 4: ... (4.3)	
9/16	10	Chapter 4: ... (4.4)	
9/19	11	Chapter 4: ... (4.4)	
9/23	12	Chapter 5: Solution methods for linear problems (5.1 - 5.3)	9/23 HW1 due
9/23	13	Chapter 5: ... (5.4)	9/27 Quiz 1
9/26	14	Chapter 5: ... (5.5)	
9/30	15	Chapter 5: ... (5.6)	
9/30	16	Chapter 5: ... (5.7)	
10/3	17	Chapter 5: ... (5.8)	
10/7	18	Chapter 6: Fundamentals of fluid mechanics (6.1-6.3) Recorded	
10/7	19	Chapter 6: ... (6.4) Recorded	
10/10	20	Chapter 6: ... (6.5 - 6.6)	
10/14	21	Chapter 6: ... (6.6 - 6.7)	
10/14	22	Chapter 6: ... (6.8)	
10/17	23	Chapter 6: ... (6.9)	
10/21	24	Chapter 7: Unidirectional and nearly unidirectional flow (7.1 - 7.2)	
10/21	25	Chapter 7: ... (7.3 - 7.5)	
10/24	26	Chapter 7: ... (7.5 - 7.6)	
10/28	27	Chapter 7: ... (7.6)	
10/28	28	Chapter 8: Creeping flow (8.1 - 8.2)	
10/31	29	Chapter 8: ... (8.3)	10/31 HW2 due
11/4	30	Chapter 8: ... (8.4)	11/3 Quiz 2
11/4	31	Chapter 8: ... (8.4)	
11/7	32	Chapter 8: ... (8.4)	
11/14	33	Chapter 8: ... (Fluid flow in porous media)	
11/18	34	Chapter 9: Laminar flow at high Reynolds number (9.1 - 9.2)	
11/18	35	Chapter 9: ... (9.2)	
11/21	36	Chapter 9: ... (9.3)	
11/28	37	Chapter 9: ... (9.3)	
12/2	38	Chapter 9: ... (9.4)	
12/2	39	Chapter 9: ... (9.5)	
12/5	40	Review / Question sessions	12/5 HW3 due
			12/7 Final exam

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance of lectures is highly recommended, although not compulsory and no penalty will be imposed for absence. However, it is the student's responsibility to obtain any notes, assignments, etc. that they may have missed during their absence. Students should turn off the ringers for all cell phones during lecture and they should not answer incoming calls. If a student is expecting an emergency call, notify the instructor prior to class.

No credits will be given for homework submitted after the due date.

If a student misses a quiz without submitting formal documentations accepted by the university to the instructor, no credit will be given to the quiz. If a student misses a quiz with submitting formal documentations accepted by the university to the instructor, there is no makeup quiz but the overall grade of the student will be calculated based on the homework and the other two quizzes. The student should notify the instructor about his/her absence prior to the quiz, preferably at least two weeks in advance, or as soon as possible after the quiz in case of an emergency. 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://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

A student must attend at least two quizzes in order to pass this course, even if the student's absence is supported by formal documentations.

Given the current COVID pandemic, students are strongly encouraged to stay at home if they are tested positive for COVID or feel ill. All lectures will be recorded and available for students on Canvas.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (3)	100 each	3% each 1% bonus for completion all three homework sets
Quizzes (3)	100 each	30% each
		100%

Homework sets: There are 3 homework sets in total. Student should submit the homework sets before the due date. No credits will be given for late submission. A submitted homework set will not be given back to the student and therefore students should make a copy of their homework prior to submission, if needed. Students may discuss and finish the homework with their peers.

Quizzes: There are 3 quizzes in total with one of them being the final exam. Students will attend the quizzes which will be held on campus and outside of the lecture hours. The date, time, and location of the quizzes will be announced by the instructor at least 1 week before the quiz. Rules for the quiz are given below,

- Students have two hours to work on each quiz.
- Writing for the quiz is allowed only (i) after the proctor's announcement for the commencement of the quiz and (ii) proctor's announcement for the end of the exam.
- Write your name and page number on every answer sheet that you submit.
- You may open a book that you bring to this quiz. No other notes or sheets are allowed.
- No questions pertaining to the quiz questions will be answered during the quiz. If you have other questions, e.g., a request to go to the restroom, please ask the proctor.
- You should not communicate with others during the quiz, except with the proctors.
- You may use a non-graphing calculator.
- Use SI units in your answers.
- Write the answers and steps in a neat and readable manner to get full marks of the questions.
- Box all final answers.
- Any form of cheating will lead to a penalty of the total points of the quiz.

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
85 - 89	A-	3.67
80 - 84	B+	3.33
75 - 79	B	3.00
70 - 74	B-	2.67
65 - 69	C+	2.33
60 - 64	C	2.00
55 - 59	C-	1.67
50 - 54	D+	1.33
45 - 49	D	1.00
40 - 44	D-	0.67
0 - 39	E	0.00

The instructor will use the above grade table in addition to “curving the grade” for determining the final course grade. 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 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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@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 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/state-authorization-status/#student-complaint>.