

## **Transport Phenomena**

ECH 6285 Section CAMP

**Class Periods:** Monday (12:50 PM – 2:45 PM) and Wednesday (12:50 PM – 1:40 PM)

**Location:** Monday (FLG 0280) and Wednesday (PSY 0130)

**Academic Term:** Fall 2024

### **Instructor:**

Dr. Henry Chu

Email Address : h.chu@ufl.edu

Office Phone Number: (352) 294-7008

Office Hours: Monday 3PM – 5PM at Chemical Engineering Building 329A

### **Teaching Assistant/Peer Mentor/Supervised Teaching Student:**

Mr. Eric Imhoff

Email Address: eimhof@ufl.edu

Office Hours: To be confirmed.

### **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, solve, and analyze advanced problems in transport phenomena in fluid mechanics and heat and mass transfer. Specific topics covered will include:

- Momentum transport
  - Continuity equation, Navier-Stokes equation, non-dimensionalization
  - Boundary conditions, steady flow problems
  - Lubrication flows
  - Flows in porous media
- Mass transport
  - Diffusion equation and problems
  - Convection-diffusion equation, non-dimensionalization, and problems
  - Taylor dispersion and problems
  - Mass transport with reactions, non-dimensionalization, and problems
- Heat transport
  - Heat equation, non-dimensionalization
  - Steady and unsteady heat problems

### **Materials and Supply Fees**

None

### **Required Textbooks and Software**

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

### **Recommended Materials**

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

## Course Schedule

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

Week	Dates	Content	HW/Quiz
Momentum transport (fluid flow)			
1	8/26, 8/28	Continuity equation, Navier-Stokes equation, non-dimensionalization	
2	9/4	Boundary conditions, steady flow problems	
3	9/9, 9/11	Boundary conditions, steady flow problems	HW1 due on 9/11
4	9/16, 9/18	Lubrication flows	HW 2 due on 9/18
5	9/23, 9/25	Flows in porous media	HW 3 due 9/25
6	9/30, 10/2	Flows in porous media, Team list due on 10/2	Team list due on 10/2
Mass transport (species flow)			
7	10/7, 10/9	Diffusion equation and problems	HW 4 due on 10/9
8	10/14, 10/16	Quiz 1 on Momentum transport on 10/14, Project consultation	Quiz 1 on 10/14
9	10/21, 10/23	Convection-diffusion equation, non-dimensionalization, and problems	HW 5 due on 10/23
10	10/28, 10/30	Taylor dispersion and problems	HW 6 due on 10/30
11	11/4, 11/6	Mass transport with reactions, non-dimensionalization, and problems	HW 7 due on 11/6
Heat transport (energy flow)			
12	11/13	Heat equation, non-dimensionalization	HW 8 due on 11/13
13	11/18, 11/20	Quiz 2 on Mass transport on 11/18	Quiz 2 on 11/18
14	12/2, 12/4	Steady and unsteady heat problems, Project due on 12/2	Project due on 12/2

### Important Dates

- See the last column of the above table

### 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.

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 (8)	100 each	20%; 2.5% for each homework set
Quizzes (2)	100 each	60%; 30% for each Quiz
Group project (1)	100 each	20%
		100%

### Homework sets:

There are 8 homework sets. Student should submit the homework sets to Canvas before the due date. No credits will be given for late submission. Students may discuss and finish the homework with their peers.

### Quizzes:

There are 2 quizzes. Students will take the quizzes during 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 quizzes are listed below:

- Students have 100 minutes 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) before the proctor's announcement for the end of the exam.
- Write your name and page number on every answer sheet that you submit.

- The quizzes are closed book and closed notes.
- 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.

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, the other Quiz, and the Group project. The student should notify the instructor about his/her absence prior to the Quiz, at least two weeks in advance, or as soon as possible after the Quiz in case of an emergency.

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

**Group project:**

Students will form teams of 3 to 4 people (no more than 4 people are allowed). In each team, a representative should email the names of all their members (along with the “General Consent and Release Form” signed by each member; to be distributed) to the instructor no later than the “Team list due” date on the syllabus. Students who are not in a team by this date will be assigned into teams randomly. Once a team is formed, members cannot be changed. The instructor will send the finalized list of teams to all students within 5 days after the “Team list due” date.

Upon team formation, students will read Chapter 8 of the course textbook (Truskey) and other relevant materials to learn about Flows in Porous Media by themselves and via discussion. Each team will create a video (in typical video format, e.g. avi, mp4; recommended that each member contributes ~ 5 mins) to teach the rest of the class what they have learnt from their reading. The video should cover both fundamental knowledge and applications. Students should give proper references to materials used in creating the video.

The instructor will evaluate the videos based on their content, creativity, proper referencing, and presentation style. Students in the same team will receive the same grade. No credits will be given to late submission.

**Grading Policy**

The following is given as an example only.

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 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 Coordinator
- HWCHE Human Resources, 352-392-0904, [student-support-hr@eng.ufl.edu](mailto:student-support-hr@eng.ufl.edu)
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, [pld@ufl.edu](mailto:pld@ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](mailto: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](mailto: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](mailto:Learning-support@ufl.edu).  
<https://elearning.ufl.edu/>.

**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>.