Elementary Transport Phenomena

ECH 3264, 13121

Class Periods: Monday, Wednesday, Friday, period 3, 9:35 - 10:25 AM

Location: TUR L011

Academic Term: Spring 2019

Instructor:

Dr. Whitney L Stoppel, PhD (you can call me Dr. Stoppel or Prof. Stoppel)

whitney.stoppel@ufl.edu

Office: ChE building room 321, 352-392-6205

Office Hours with Dr. Stoppel: 1:30-3:30 pm Wednesdays, currently in ChE 321, additional room TBD

***See edits to some dates/times on Canvas Calendar

Office Hours with Amineh Baniani: 2:45-3:15 Tuesdays NSB 515

10:45-12:15 pm Thursdays NSB 515

Contacting Dr. Stoppel

- Email is the best form of initial communication. For prompt responses, **please make the subject line of your email "ECH 3264 Question"** and I will respond to your email within 36 hours M-F and within 48 hours on the weekend.
- Always feel free to drop by office hours or set up an appointment via email if you have questions.
- All announcements related to the class will be sent out through canvas and grades will be recorded in canvas.
- Dr. Stoppel will be at the Society for Biomaterials Meeting April 3-7, 2019. During this time, a librarian and/or Amineh will offer help sessions on searching the literature and using Endnote. This will be scheduled shortly after the semester starts and will focus on "Fluids and Transport in Real Life".

Graduate Student Teaching Assistant

Amineh Baniani

abaniani@ufl.edu

As a graduate student supplementary teaching assistant, Amineh will provide sessions each week to go over problems and help with homework. Amineh will reinforce topics covered in class and also help with grading assignments. For all of these items, Amineh is expected to spend 10 hours a week assisting with the class, so please do not ask her to offer more sessions or give more of her time.

Course Description

Flux law and conservation equations of mass, energy and momentum; steady and unsteady states as applied to physical and chemical processing; macroscopic and microscopic analysis.

Textbooks:

*as a package deal, you can purchase both texts as "online content" at a significantly reduced price. This strategy will work well as the textbooks are good references to the things we will cover in class and recommended homework problems will be assigned from these texts.

1. Fundamentals of Momentum, Heat, and Mass Transfer Revised 6th edition by Welty, et al. (ISBN 978-1-118-94746-3)

2. Introductory Transport Phenomena, 1st Edition by R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, Daniel J. Klingenberg. (ISBN: 978-1-118-95372-3)

Course Pre-Requisites / Co-Requisites

ECH 3023, MAP 2302 and MAC 2313

Course Objectives

1. Derive differential equations from basic conservation principles describing heat, mass, and momentum transport
2. Define and utilize Fourier's Law and Fick's Law
3. Define the characteristics of Newtonian and Non-Newtonian Fluids
4. Define and explain the origins of the quantities (such as heat transfer coefficient, viscosity, and diffusivity) used to describe heat, momentum, and mass transport
5. Use the equations of change to formulate differential equations with proper boundary conditions to describe transport phenomena
6. Solve one dimensional steady problems of mass, momentum, and heat transport with and without source terms
7. Solve selected multidimensional problems of mass, momentum, and heat transport with and without source terms

Relation to Program Outcomes (ABET)

Course objectives 1 and 4-7 are linked to program outcome (e) and course objectives 3 and 6 are linked to program outcome (j).

Outcome (e): an ability to identify, formulate, and solve engineering problems.
Outcome (j): a knowledge of contemporary issues.

Course Schedule:

	Topics	Dates
Side Note 1	Integrals, derivatives, and using them to solve problems- tables and how to use them	1/7/2019-1/9/2019
Section 1: Heat/Energy Transport	Thermal conductivity and Fourier's law, Deriving equations for the heat flux from shell balances, Solving for steady temperature distributions, Steady conduction in cylindrical and spherical geometries, Heat transfer coefficients, Time-dependent conduction, Multi-dimensional heat flow, Dimensionless numbers and variables	1/9/2019 to 2/1/2019
Side Note 2	Vectors and tensors- need to refresh on these topics to make sure that we can solve more problems and define our systems appropriately	2/4/2019-2/8/2019
Section 2: Momentum Transport or "Fluid Mechanics"	Viscosity and Newton's Law, Convective momentum transport, velocity distributions via shell balances, multi-dimensional momentum transport, Newtonian and Non-Newtonian fluids, general mass and momentum balances	2/11/2019-3/1/2019
Section 3: Mass Transport	Diffusivity and Fick's first law, transport by convection, concentration distributions via shell balances, Fick's second law	3/15/2019-4/1/2019

Section 4: More complex situations and combinations of parameters from Sections 1-3	Unsteady states, viscous heat sources, Eigen value problems	4/8/2019-4/22/2019

Homework, Quizzes, Exams and other Important Dates

- Homework will not be collected or graded and solutions will be provided on canvas 2 class periods prior to the "deadline." It is strongly recommended that you work in groups to solve the homework problems. You are responsible for your own learning and problem set completion. It is also recommended that you take advantage of the office hours provided by the supplementary instructors for help with problems and understanding concepts. It will be almost impossible to learn transport in just three 50 minute course periods per week, which is why we offer so many opportunities to get additional help.
- Your comprehension of the material will be assessed via 2 Exams and periodic in-class quizzes.
- In class quizzes will be given on the day a homework is due. Tables of derivatives and integrals will be provided with all quizzes and exams.
- Quizzes and Exams are independent assessments and students are not allowed to work together on these assignments. By writing your name on your quiz or exam, you are confirming that you are abiding by the honor code and aren't cheating.
- Calculators will be allowed on exams, along with a pencil and eraser.
- For Quizzes, you will need just a pencil and eraser.

#	*Homework Due Dates*	*Homework Topics*
1	Monday, 1/14/2019	Math- derivatives, integrals and the things you shouldn't forget
2	Wednesday, 1/23/2019	Fourier's Law and 1-D shell balance problems, Cartesian coordinates **(QUIZ 1)**
3	Friday, 2/1/2019	Fourier's Law and other coordinate systems
4	Friday, 2/8/2019	Vectors and Tensors
5	Friday, 2/15/2019	Newton's Law and velocity distributions by shell balances **(QUIZ 2)**
6	Friday, 2/22/2018	Multi-dimensional momentum transport
7	Friday, 3/1/2018	General momentum balances, Newtonian and non-Newtonian fluids **(QUIZ 3)**
	3/4/2019-3/8/2019	Spring Break, no class
	Monday, 3/11/2019	Review Session held during class time (optional)
	Tuesday, 3/12/2019	Exam 1 (Homeworks 1-7 and all notes covered prior to spring break)
8	Monday, 3/25/2019	Fick's Law, diffusivity, 1D Shell Balances **(QUIZ 4)**
9	Monday, 4/1/2019	Using Tables and Solving Diffusion Problems
	Monday, 4/8/2019	Group Project Due- Fluid Flow in Real Life
10	Monday, 4/15/2019	More Table Use, Combining Topics **(QUIZ 5)**
11	Monday, 4/22/2019	Unsteady states and Eigen value problems
	Wednesday, 4/24/2019	Review Session held during class time (optional)
	Thursday, 5/2/2019	3-5 pm, Exam 2 (Covering Homeworks 8-11 and all topics covered in class, including problems with both flow and heat or flow and mass transport)

Attendance Policy, Class Expectations, and Make-Up Policy

Class attendance is strongly recommended, but not mandatory. However, if you miss a quiz, you cannot make it up unless an approved excused absence is provided. Situations that lead to excused absences (e.g., sports team activity) should be communicated in advance when possible so alternative arrangements can be made. Excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation. Requests for make-up exams and quizzes will be granted only if appropriate documentation about illness, family emergency or UF-related travel are provided. One quiz will be dropped for each student, enabling the student to miss a quiz for an unexcused reason without significant consequence.

Evaluation of Grades

Assignment	***Total Points***
Homework Sets (11)	0
Quizzes (5)	~50 points each, drop the lowest (~200 pts)
Exam 1	250
Exam 2 (Final)	250
Group Assignment on Fluid Flow in Real Life	125
Total Points	825

Grading Policy

Changes to the grading policy may be made at the discretion of the instructor. However, the changes will only be made to the benefit of the student and these changes will be communicated after each exam. More information on UF grading policy may be found here.

Other Important Things

Being an engineering student can be tough. Please make sure to take advantage of all of the opportunities provided by the College of Engineering as well as the services offered across campus. Please note that Dr. Stoppel is a mandatory reporter, meaning that if you want to discuss a sensitive topic, she is more than willing- but may have to have conversations on your behalf with the Engineering Dean of Students, Dr. Curtis Taylor. If you find yourself in a tricky situation and you do not wish to discuss it, but need help- please seek out assistance on campus via http://www.umatter.ufl.edu/ . This could be anything from struggling in class, dealing with a family illness or family-related situation, to dealing with a stressful roommate. Find things to help you relax, whether it is participating in sports, yoga, mindfulness, meditation, or simply enjoying a cup of tea. Please do not hesitate to reach out if you are struggling.

Find your people! Academics and learning can be way more fun if you find activities that keep you engaged. Check out the UF American Institute of Chemical Engineers Chapter, find a research opportunity, or an outreach activity.

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@ufl.edu

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

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565) 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 feedback on the quality of instruction in this course by completing online evaluations. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students here.

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 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 the class.

Plagiarism is defined as the copying of text that belongs to someone else, even yourself. For assignments in the class focused on reading primary literature and summarizing, you will be allowed to view your Turn-it-in score. You will then be given the opportunity to resubmit your document and correct the issues. However, you must submit your document early enough that you have time to resubmit before the deadline.

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.

You will need to use a citation management software such as Endnote or Mendeley for your papers. These are free and the library can assist you with figuring out how they work on your computer. We will also spend time going over it in class.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please visit the registrar's website.

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 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.