

The Continuum Basis of Chemical Engineering

ECH 6270 All Sections

Class Periods: Monday Wednesday Friday NEB 102, 5th period (11:45 AM - 12:35 PM)

Location: NEB 0102

Academic Term: Fall 2021

Instructor:

Name: R. Narayanan

Email: ranga@ufl.edu (please include ECH 6270 in your email to receive an answer)

Office Hours: Wednesday 10:00-11:00 Friday 10:00-11:00 via the ZOOM room (928 756 54190) unless indicated otherwise in Announcements. Office hours will commence from the second week of class.

Supervised Teaching Student:

Rivera-Llabres, Victor

Email and office hours To be determined.

Course Description

(3 credit hours) Integrated introduction to transport processes in continuous media with emphasis on fluid mechanics and heat and mass transfer.

Course Pre-Requisites / Co-Requisites

Undergraduate Courses in Fluid Dynamics, Transport Phenomena, Heat Transfer, Differential Equations, Separation of Variables

Course Objectives

Students will learn a series of transport phenomena modeling methods used widely throughout science and engineering. Emphasis will be on Fluid Dynamics.

Materials and Supply Fees

N/A

Required Textbooks and Software

Text: Optional: Analysis of Transport Phenomena by William Deen

I will NOT follow this book for its style for its chapter sequence. Therefore it is NOT assigned. However, the book's problems are good and I will refer to some of the problems, in which case I will make those problems available on CANVAS and only if I refer to them. In any case it's a good reference book to have in general but not required for the course.

Videos: In addition to the class lectures, you should view the pre-recorded lectures on mediasite below:

https://ufedge.video.ufl.edu/Mediasite/Catalog/catalogs/fall2017_ech6270

Logon and use your UFID to view these lectures.

Notes (some NOTES will be posted online. However, you must be prepared to make your notes of the class lectures. The online notes are from J.S. Vrentas' course on Transport Phenomena. I will follow the sequence given in these notes and will supplement this with class lectures

This is a graduate course and so you must be prepared to spend a lot of time on it. Some of the material will come from research in the literature. At the end of the course, you should be in a position to read a book on your own and when you need to for your own research or for your reference.

Course Schedule (Approximately corresponds to weekly schedule)

- 1) Vector and Tensor notation. Summation convention. Manipulations with vectors
- 2) Reynolds Transport Theorem, Derivation of the continuity. Stress vector and tensor. Derivation of the momentum equations. The Jump mass balance.
- 3) Jump momentum balance, Condition for Angular momentum. Problems on Steady Rectilinear flow in Cartesian and cylindrical coordinates.
- 4) Mechanical Energy balance. The Decay constants in a perturbed viscous fluid. Energy method and what we can learn from them.- Eigenvalues
- 5) Creeping flow, Stokes flow, Regular perturbation, Driven cavity
- 6) Ideas on stability of flows.; Static stability, Hydrodynamic stability
- 7) More on stability; Faraday's problem
- 8) Lubrication approximations.- Review and summary
- 9) HEAT: Thermal energy equation, Jump energy balance. Applications-Fluid flow and energy- problems
- 10) Solidification problems; Convection, Benard Problem
- 11) The entropy inequality and making a connection of entropy generation to gradients
- 12) Mass Transfer- Species equations; Jump Species Balance, Problems

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is voluntary and the ZOOM lectures will be recorded. However all quizzes will be during class times and must be taken during such times. Exam times will be announced on CANVAS if different than those posted below.

You will be assigned Homework problems. These will be posted on CANVAS and will NOT be evaluated. These problems will typically NOT involve number crunching. They will usually involve derivations of expressions. The instructor will provide hints and at times solutions to these problems will be provided during the lectures or in the office hours. However, in general we will not always provide solutions. If you have difficulty working out these problems meet the instructor via ZOOM. These problems will be reflected in the exams and quizzes with moderate changes.

There will be TWO exams and TWO quizzes. These will take place on campus. There will be NO Final exam. The exams and quizzes will be closed notes/books unless otherwise announced. No other communication devices such as smart phones will be permitted. TOTAL EXAM POINTS WILL AMOUNT TO 600 POINTS. TOTAL QUIZ POINTS AMOUNT TO 50 POINTS AND ARE BONUS. SO, IF YOU MISS A QUIZ YOU JUST MISS THE BONUS FROM THAT QUIZ. MAXIMUM POINTS ARE 600 BUT THEORETICALLY A PERSON COULD SCORE 650 POINTS (IF HE/SHE GETS ALL EXAMS AND ALL QUIZZES CORRECT).

Grades percentage % (NOT drawn on a curve).

Percent of total (600 points)	Grade
0-10	E
11-15	D (no D minus grade will be given)
16-20	D+
20-30	C (no C minus grade will be given)
31-40	C+
41-50	B-
51-65	B
66-80	B+
81-90	A-
91-100	A

Exam Dates:

November 3 and/or 5th The exam may be held on one or on both days (You will be notified in advance)

December 6th and 8th The exam may be held on one or on both days (You will be notified in advance)

Quiz Dates: (will be announced ONLY one week prior to the quizzes- you must be prepared by working out the HW and class work). ALL QUIZZES/EXAMS WILL BE HELD DURING CLASS periods unless announced otherwise.

EXAM MAKEUP POLICY: **NO MAKEUP EXAMS OR QUIZZES WILL BE PERMITTED.**

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

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 Conduct 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. 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.

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Please visit the [UF Health Screen, Test & Protect website](#) for more information.

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 Resource 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: <http://www.distance.ufl.edu/student-complaint-process>.