Energy Transfer Operations
ECH 3223

Class Periods: Monday / Wednesday /Friday, Period 8 (3:00 – 3:50 pm)
Class Location: LAR 0330
Academic Term: Spring 2020

Instructor

Prof. Charles Hages
Assistant Professor, Chemical Engineering Department, University of Florida
Office: ChE Room 417
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Office telephone: 352-294-7002
Office hours: Will be determined during first week of class
Web site: UF course Canvas web site

Student Teacher

Julie Jameson
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Office hours: Will be determined during first week of class
Location: Will be determined during first week of class

Course Description

Steady state conduction in solids and heterogeneous materials, transient conduction, convection heat transfer, heat transfer during boiling and condensation, radiation heat transfer, design of heat-transfer equipment and heat exchange networks.

Credit Hours: 3

Course Pre-Requisites / Co-Requisites

All students should have successfully passed Computer Model Formulation (COT 3502) and Elementary Transport Phenomena (ECH 3264).

Course Objectives

Upon completion of this course the student will be able to:

1. Explain the basics of heat transfer including Newton's law of cooling, Fourier's law, and concepts concerning heat transfer coefficients and dimensionless numbers
2. Derive a mathematical description of heat transfer problems using shell balances in Cartesian, cylindrical, and spherical coordinates
3. Be able to solve unsteady and multi-dimensional heat transfer problems using the knowledge of the equations of change and knowing how to perform separation of variables and/or similarity transformations
4. Learn how to design heat exchanger networks and evaporators

Materials and Supply Fees

N/A

Professional Component (ABET):

This course provides 3 credits towards the *Engineering Topics* professional component of the Curriculum criterion of the ABET Criteria for Accrediting Engineering Programs.

Relation to Program Outcomes (ABET):

The following ABET Outcomes are assessed in this course

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Assessed
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Assessed
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks and Software

Fundamentals of Heat and Mass Transfer, 8th ed., by Bergman, and Lavine, WILEY.
ISBN 9781119320425.

Recommended Materials

Not applicable.

Course Schedule

The course will proceed according to the following tentative schedule. Updates will be posted in the Canvas Electronic Course Management site for the course.

Week 1: Intro / General heat diffusion equation	(Chapters 1 & 2)
Week 2: General heat diffusion equation & boundary conditions	(Chapters 1 & 2)
Week 3: 1D steady-state heat diffusion / Thermal resistance	(Chapter 3)
Week 4: Fins	(Chapter 3)
Week 5: Fins	(Chapter 3)
Week 6: Transient conduction	(Chapter 5)
Week 7: Transient conduction	(Chapter 5)
Week 8: Transient conduction / 2D steady-state conduction	(Chapter 5 &4)
Week 9: Spring Break	
Week 10: 2D steady-state conduction	(Chapter 4)
Week 11: 2D steady-state conduction	(Chapter 4)
Week 12: Convection	(Chapters 6)
Week 13: External Flow	(Chapters 7)
Week 14: Internal Flow	(Chapter 8)
Week 15: Heat Exchangers	(Chapter 11)
Week 16: Heat Exchangers	(Chapter 11)

Attendance Policy, Class Expectations, and Make-Up Policy

- Attendance of lectures is highly recommended, though not required.
- Homework assignments will be given no more than once per week, generally due the following week. They should be turned in to the student teacher at the beginning of class or put in her mailbox before class starts. Late homework will not be accepted.
- Dates for exams 1 and 2 will be announced at least 2 weeks in advance.
- Requests for make-up exams will be considered only for those students who missed due to an acceptable reason (illness, family emergencies, military obligation, religious holidays, participation in official university activities, etc.) as listed in the undergraduate catalog. It is required that, whenever possible the student notifies the instructor about the situation prior to the exam, preferably at least two weeks in advance.
  https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx
- Students arriving late for a exam will be given only the balance of time remaining to complete their work unless an acceptable reason (see above) is provided.

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework*	15%
Exam 1**	25%
Exam 2**	25%
Final Exam**	35%

* Only one problem on each homework will be graded. The lowest homework grade will be dropped.
** All assessments are cumulative

Grading Policy

Final grades will be assigned using the standard deviation (σ) method. The scale for the course will be as follows:

Percent	Grade	Grade Points
Mean – σ < Score	A	4.00
Mean + 0.67σ < Score ≤ Mean + σ	A-	3.67
Mean + 0.33σ < Score ≤ Mean + 0.67σ	B+	3.33
Mean < Score ≤ Mean + 0.33σ	B	3.00
Mean – 0.33σ < Score ≤ Mean	B-	2.67
Mean – 0.67σ < Score ≤ Mean - 0.33σ	C+	2.33
Mean – σ < Score ≤ Mean - 0.67σ	C	2.00
Mean – 1.33σ < Score ≤ Mean - σ	C-	1.67
Mean – 1.67σ < Score ≤ Mean – 1.33σ	D+	1.33
Mean – 2σ < Score ≤ Mean – 1.67σ	D	1.00
Mean – 2.33σ < Score ≤ Mean – 2σ	D-	0.67
Score ≤ Mean – 2.33σ	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Instructor may lower the threshold for attaining the letter grades specified above (to the benefit of the students), but will not raise the threshold.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) 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 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/.

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/policies/student-honor-code-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
• 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@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: http://www.counseling.ufl.edu/cwc, 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 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://care.dso.ufl.edu.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.