Heat Transfer

EML4140 (12175) Section 261H
Class Periods: M, W, F | Period 6 (12:50 PM - 1:40 PM)
Location: FLG 0280
Academic Term: Fall 2025

Instructor:
Jingjing Shi, shi.j@ufl.edu
Office Hours: M, W, F, 2:00 PM – 3:00 PM, NEB 231

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
- Henry Stophel, henry.stophel@ufl.edu,
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Course Description
Steady-state and transient analysis of conduction and radiation heat transfer in stationary media. Heat transfer in fluid systems, including forced and free convection. Credits:3

Course Pre-Requisites / Co-Requisites
MAP2302 with minimum grade C, EAS4101 or EGN3353C

Course Objectives
This course provides an intermediate level coverage of thermal transport processes via conduction, convection, and radiation heat transfer. It stresses fundamental engineering science principles applied to thermal analysis. Students will learn to apply the conservation of energy to control volumes and express the conservation of energy through mathematical formulations, including both steady state and transient analyses, with emphasis on the fundamental physics and underlying mathematics associated with heat transfer. Upon completion of this course, students are expected to understand basic heat transfer solution techniques, coupled with a strong foundation and appreciation for the physics of heat transfer.

Relation to Program Outcomes (ABET):
EML4140 supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical and Aerospace Engineering. Specific ME program outcomes supported by this course include: (1) Using knowledge of chemistry and calculus-based physics with depth in at least one of them (ME Program Outcome M1); (2) Using knowledge of advanced mathematics through multivariate calculus and differential equations (ME Program Outcome M2); (3) Being able to work professionally in the thermal systems area (ME Program Outcome M4). Professional Component: Mathematical Sciences (15%), Physical Sciences (15%), Engineering Sciences (70%)
This course achieves the following ABET outcomes:

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
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	High
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	Medium

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 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	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Recommended Materials

- Fundamentals of Heat and Mass Transfer, T.L. Bergman, A.S. Lavine, F.P. Incropera, and D.P. DeWitt
- 7th or 8th Edition

Course Schedule

The lecture and assignments schedule are provided on page 4 of the syllabus.

Important Dates

09/22/2025, Monday	Midterm Exam 1 (8:20 PM – 9:50 PM, FLI Keene-Flint Hall 0050)
10/22/2025, Wednesday	Midterm Exam 2 (8:20 PM – 9:50 PM, FLI Keene-Flint Hall 0050)
12/11/2025, Thursday	Final Exam (12:30 PM - 2:30 PM, FLG 0280)

Exam policy

Exams are closed book. You can bring 1 sheet of paper (8.5" x 11.5") with your hand-written notes on both the front and back for midterm exams and 3 sheets of papers (8.5" x 11.5") for the final exam. If you cannot attend exams due to non-emergency events (e.g. conflicts with official university activities), you must contact the instructor at least 1 week prior to the exam and provide documentation. Make-up exams will only be given in rare instances (e.g. medical emergencies) with documentation and pre-approval by the instructor.

Attendance

All attendance will be recorded. Unless specially approved, you are allowed to miss seven lectures (no reasons needed). You will loss one point for each additional absence up to five points.

Evaluation of Grades

Homework:	20%	(Based on 7 highest scores out of 8 assignments)
Attendance:	5%	(See above, 1 point = 1%)
Midterm exams:	45%	(each midterm will be graded on 100 base) (0.25*highest + 0.2*lowest score)
Final exam:	30%	(0.30*final score on 100 base)

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33

73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive 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.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu

Tentative Schedule

A tentative schedule is posted on the next page. Please note key due dates. Any changes of the due dates will be announced in advance.

# of week	Date	Day	Topics	Due

Week 1	8/22	Fri	(L01) Introduction: what is HT and relevance of HT	
Week 2	8/25	Mon	(L02) Introduction: rate equations	
Week 2	8/27	Wed	(L03) Conduction 1: energy balance & Fourier's law	
Week 2	8/29	Fri	(L04) Conduction 2: heat diffusion equation	
Week 3	9/1	Mon	Holiday, no class	
Week 3	9/3	Wed	(L05) Conduction 3: 1D s.s. HT in plane wall, thermal resistance	HW #1
Week 3	9/5	Fri	(L06) Conduction 4: 1D s.s. HT in radial system	
Week 4	9/8	Mon	(L07) Conduction 5: 1D s.s. HT with heat generation	
Week 4	9/10	Wed	(L08) Conduction 7: 1D s.s. HT in extended surface 1	
Week 4	9/12	Fri	(L09) Conduction 8: 1D s.s. HT in extended surface 2	HW #2
Week 5	9/15	Mon	(L10) Conduction 9: HT in extended surface 3 & 2D s.s. conduction 1	
Week 5	9/17	Wed	(L11) Conduction 10: 2D s.s. conduction 2	
Week 5	9/19	Fri	(L12) Conduction 11: transient conduction 1 (lumped capacitance)	
Week 6	9/22	Mon	**Midterm exam 1, 8:20 PM to 9:50 PM**	
Week 6	9/24	Wed	(L13) Conduction 12: transient conduction 2 (Biot number)	
Week 6	9/26	Fri	(L14) Conduction 13: transient conduction 3 (spatial effect)	HW #3
Week 7	9/29	Mon	(L15) Convection 1: Midterm 1 & Dimensionless	
Week 7	10/1	Wed	(L16) Convection 2: boundary layer & governing equations	
Week 7	10/3	Fri	(L17) Convection 3: similarity and dimension analysis	
Week 8	10/6	Mon	(L18) Convection 4: external flow 1 (flat plate)	HW #4
Week 8	10/8	Wed	(L19) Convection 5: external flow 2 (other geometry)	
Week 8	10/10	Fri	(L20) Convection 6: internal flow 1	
Week 9	10/13	Mon	(L21) Convection 7: internal flow 2	
Week 9	10/15	Wed	(L22) Convection 8: internal flow 3	HW #5
Week 9	10/17	Fri	Homecoming, no class	
Week 10	10/20	Mon	(L23) Convection 9: internal flow 4	
Week 10	10/22	Wed	**Midterm exam 2, 8:20 PM to 9:50 PM**	
Week 10	10/24	Fri	(L24) Convection 10: heat exchanger 1	
Week 11	10/27	Mon	(L25) Convection 11: heat exchanger 2	HW #6
Week 11	10/29	Wed	(L26) Radiation 1: radiation basics	
Week 11	10/31	Fri	(L27) Radiation 2: radiation intensity	
Week 12	11/3	Mon	(L28) Radiation 3: blackbody radiation	
Week 12	11/5	Wed	(L29) Radiation 4: real surface	HW #7
Week 12	11/7	Fri	(L30) Radiation 5: absorption, reflection, transmission	
Week 13	11/10	Mon	(L31) Radiation 6: Kirchoff's law	
Week 13	11/12	Wed	(L32) Radiation 7: environmental radiation	
Week 13	11/14	Fri	(L33) Radiation 8: view factor	
Week 14	11/17	Mon	No class	
Week 14	11/19	Wed	No class	
Week 14	11/21	Fri	No class	HW #8
Week 15	11/24	Mon	Holiday, no class	
Week 15	11/26	Wed	Holiday, no class	
Week 15	11/28	Fri	Holiday, no class	
Week 16	12/1	Mon	(L34) Radiation 9: black surface HT	
Week 16	12/3	Wed	(L35) Radiation 10: grey surface HT and multimode HT	
Week 16	12/5	Fri	Reading day, no class	
Week 17	12/11	Thu	**Final Exam, 12:30 PM to 2:30 PM**	