Convective Heat Transfer

EML 6155
Class Periods: MWF Period 7 (1:55 PM – 2:45 PM)
Location: NEB 0201
Academic Term: Spring 2026

Instructor:
Youngsup Song
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352-392-0831
Office Hours: MW 3 – 4 PM at NEB 227

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- TBA

Course Description
This course covers the fundamentals of momentum and heat transfer in laminar and turbulent flows, with emphasis on analytical solutions of the governing equations and key transport properties.

Course Pre-Requisites / Co-Requisites
Undergraduate-level fluid mechanics, heat transfer, or any relevant thermal-fluid courses.

Course Objectives
This course provides a fundamental treatment of fluid flows controlled by viscous or turbulent stress gradients and the subsequent heat transfer between fluids and solid surfaces. Analytical solutions to the momentum and energy conservation equations for both laminar and turbulent flows will be considered. Students will be expected to derive appropriate transport equations, apply transport equations to convective transport problems, and evaluate appropriate transport properties such as friction factors and Nusselt numbers. The fundamental conservation principles covered in this course provide a solid foundation for the engineering practitioner engaged in single-phase convective thermal transport; a solid foundation is also provided for further studies in multi-phase convective transport.

Materials and Supply Fees
N/A

Required Textbooks and Software
N/A

Recommended Materials

- Convective Heat Transfer by Louis C. Burmeister, 2nd ed., Wiley-Interscience
- Convective Heat and Mass Transfer by W. M. Kays et al., 4th Ed., McGraw-Hill
- Convective Heat Transfer by A. Bejan, 3rd Ed., John Wiley & Sons
- Boundary Layer Theory by Schlichting, 7th Ed., McGraw-Hill
- A Heat Transfer Textbook by J. H. Lienhard V and J. H. Lienhard IV (https://ahtt.mit.edu/)

Required Computer
Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Course Schedule

- Available on the last page

Important Dates

- **2/23 Exam 1,** 8:20 PM – 10:10 PM, LAR Larsen Hall 0330
- **3/30 Exam 2,** 8:20 PM – 10:10 PM, LAR Larsen Hall 0330
- **4/30 Final Exam,** 3:00 PM – 5:00 PM, NEB 0201

Evaluation of Grades

Assignment	Percentage of Final Grade
Homework Sets	15%
Midterm 1	25%
Midterm 2	25%
Final Exam	35%
Total	100%

Grading Policy

Percent	Grade	Grade Points
94.0 - 100	A	4.00
90.0 - 93.9	A-	3.67
85.0 - 89.9	B+	3.33
80.0 - 84.9	B	3.00
75.0 - 79.9	B-	2.67
70.0 - 74.9	C+	2.33
65.0 - 69.9	C	2.00
60.0 - 64.9	C-	1.67
55.0 - 59.9	D+	1.33
50.0 - 54.9	D	1.00
40.0 - 49.9	D-	0.67
0 – 39.9	E	0.00

Any regrade requests must be submitted to Dr. Song within three days of the grade being posted. After the final class session has concluded, no corrections, late submissions, or additional work will be accepted to adjust final grades. Final grades will not be modified based on proximity to a grade threshold or subjective considerations. Active participation in class discussions may earn up to 1-2% bonus credit at the instructor's discretion.

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 by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate 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

Detailed Course Outline

1. *Fundamentals*
    a. *Heat Transfer Modes (Rate Equations)*
    b. *Key Parameters and Units*
    c. *Conservation Laws*
    d. *Rules of Scale Analysis*

2. *Laminar Boundary Layer Flows*
    a. *Concept of Boundary Layers*
    b. *Boundary Layer Equations*
    c. *Scale Analysis*
    d. *Similarity Solutions*
    e. *Integral Solutions*

3. *Laminar Duct Flows*
    a. *Entrance Length*
    b. *Fully Developed Flow*
    c. *Hydraulic Diameter and Pressure Drop*
    d. *Developing Flow*

4. *Natural Convection*
    a. *Boundary Layer Equations*
    b. *Scale Analysis*
    c. *Similarity Solution / Integral Solution*
    d. *Thermal Stratification*
    e. *Combined Natural and Forced Convection*

5. *Turbulent Flows*
    a. *Transition to Turbulence*
    b. *Turbulent Boundary Layer Flow*
    c. *Turbulent Duct Flow*

6. *Convection with Phase Change*
    a. *Condensation*
    b. *Boiling*