

The University of Texas at Dallas – Course Syllabus
MECH 3320.001 – Heat Transfer
Department of Mechanical Engineering

Course Information:

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| <i>Course Number/Section</i> | MECH 3320.001 |
| <i>Course Title</i> | Heat Transfer |
| <i>Term</i> | 2025 Spring |
| <i>Days & Times</i> | Monday & Wednesday: 4:00 – 5:15 pm |
| <i>Meeting Place</i> | ECSW 3.210 |

Professor Contact Information:

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| <i>Professor</i> | Shuang (Cynthia) Cui |
| <i>Office Phone</i> | 972-883-4150 |
| <i>Email</i> | Shuang.Cui@utdallas.edu |
| <i>Office Location</i> | ECSW 4.150 C |
| <i>Office Hours</i> | Wednesday: 2:30 – 3:30 pm |

Teaching Assistant:

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|------------------------|---|
| <i>Name</i> | Abdullahi Olapojoye |
| <i>Email</i> | Abdullahi.olapojoye@UTDallas.edu |
| <i>Office Location</i> | ECSW 4.150, Desk D3 or Teams https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjdiMmJhZDgtNGQ1NS00NTdjLTkzYzQtNDlhZWMIYWE2NjU5%40thread.v2/0?context=%7b%22Tid%22%3a%228d281d1d-9c4d-4bf7-b16e-032d15de9f6c%22%2c%22Oid%22%3a%22587820fb-8c7b-42a4-9aef-22d199a410d9%22%7d |
| <i>Office Hours</i> | Monday: 2:00 pm – 3:00 pm |

Course Pre-requisites: MECH 3310, Thermodynamics; MECH 3315, Intro to Fluid Mechanics

Course Description:

This course focuses on steady-state and time-dependent conduction in one- and two-dimensions; forced convection, internal and external flows; heat exchangers; introduction to radiation; elements of thermal system design.

Course Learning Outcomes:

1. CLO 1 Be able to solve problems of one-dimensional steady-state heat conduction
2. CLO 2 Be able to formulate engineering problems of internal and external forced convection for both laminar and turbulent flows in applications such as heat exchangers
3. CLO 3 Be able to apply the basic theory for radiation heat transfer

Required Textbook:

Fundamentals of Heat and Mass Transfer, 8th Edition, Wiley

By Theodore L. Bergman and Adrienne S. Lavine

ISBN: 978-1-119-72248-9

<https://www.wiley.com/en-us/Fundamentals+of+Heat+and+Mass+Transfer%2C+8th+Edition-p-9781119722489>

Suggested Readings/Texts:

Yunus Cengel, Afshin Ghajar, Heat and Mass Transfer: Fundamentals and Applications (5th edition), 2014.

Technical Requirements

In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the [Getting Started with eLearning](#) webpage.

Homework Assignment Due & Exam Dates:

- To be submitted before class start on the due date.
- **Late Homework: late submissions will be penalized with a 10% grade reduction for each day late.**
- Exam 1: 3/3/2025
- Exam 2: 4/9/2025
- Final Exam: UTD Final Exam Schedule

Grading & Course Policies:

- Grades will be determined based on a fixed-point scale and a weight average of assignments and exams.
- Homework assignments: 25%.
- Suggestions on problem-solving approach:
 - Present all work in a clean and neat manner.
 - Show all the steps in your analysis.
 - Check to see that the result is correct dimensionally - units.
 - Please underline or circle answers.
 - Go through this checklist before handing in each assignment.
- Class attendance: 5% - Students are expected to attend all class sessions, complete reading assignments, and participate in class discussions. If a student misses a class, it is his/her responsibility to make up the missed class.
- Exam 1: 20%.
- Exam 2: 20%.
- Final examination: 30% (Comprehensive).
 - **Make-up assessment - No makeup assessment will be given unless you have a written certification (health problems, commitment with UTD-academic/athletic event, or personal emergency, etc.)**
 - Exams will be open book and open notes. You will need a calculator, pencil(s), an eraser, and a ruler for help when drawing systems. The use of PDAs, Droids/i-Phones (or other smart phones), Blackberries, cell phones, laptop computers, i-Pads or any other sources of communication (wireless or otherwise) are strictly prohibited during examinations.
 - Final grading will be based on the following scale
 - A+ (above 97%), A (93.1-97%), A- (90.1-93%)

- B+ (87.1-90%), B (83.1-87%), B- (80.1-83%)
- C+ (77.1-80%), C (73.1-77%), C- (70.1-73%)
- D (60.1-70%)
- F (below 60%)

Grade Disputes: Grade disputes are welcome for one week following the return of each assessment piece. Please reach out to TA and CC the instructor. After this time, no grades will be discussed but the instructor will gladly discuss content.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.

MECH 3320 - Heat Transfer Class Contents to Be Covered:

1. Conduction

- Fourier's Law
- Newton's Cooling Law
- Thermal Resistance
- Insulated Pipe
- Internal Heat Generation
- Biot Number
- Fins
- 3-D Conductive Heat Transfer
- Temperature Dependence of k
- Multi-D, Steady-State, Heat Transfer – Numerical Method
- Unsteady (Time-Dependent) Conduction
 - Graphical Method
 - Numerical FDM

2. Convection

- Fluid Mechanics
- Nusselt Number
- Laminar, External Flow
 - Assumed Velocity Profile
 - Exact Solution
- Natural Transition from Laminar to Turbulent
- Imposed Turbulence
- Various Shapes in Cross Flow
- Tube Bundles
- Fully Developed Internal Flow – Laminar
- Circular Tube Flow – Laminar
- Non-Circular Tubes
- Fully Developed Internal Flow – Turbulent
- Thermal Entrance Region
- Heat Exchangers
- Natural Convection
- Heat Transfer Coefficient Measurements

3. Radiation

- Emission
- Absorption
- Reflection
- Transmission
- Radiation Heat Transfer
- Reciprocity Theorem
- View Factor Conservation Theorem
- Non-Isothermal, Black Body Enclosure
- Non-Black Surface (Radiosity)
- Non-Isothermal, Gray Body Enclosure

MECH 3320 Course Schedule

***The exact topics are subject to slight modification due to time limitations and student understanding of the material**

| Lecture | Date | Topics |
|---------|----------------|---|
| 1 | 1/22/2025 | Introduction of heat transfer |
| 2 | 1/27/2025 | Applications of Heat Transfer Laws |
| 3 | 1/29/2025 | Heat Conduction Equation |
| 4 | 2/3/2025 | 1D steady-state conduction |
| 5 | 2/5/2025 | Invited lecture (TBD) |
| 6 | 2/10/2025 | 1D steady-state conduction for radial systems |
| 7 | 2/12/2025 | Conduction with internal heat generation |
| 8 | 2/17/2025 | Fin analysis |
| 9 | 2/19/2025 | Fin analysis and examples |
| 10 | 2/24/2025 | 2D steady-state conduction |
| 11 | 2/26/2025 | Review |
| 12 | 3/3/2025 | Exam 1 |
| 13 | 3/5/2025 | Transient conduction |
| 14 | 3/10/2025 | Transient conduction |
| 15 | 3/12/2025 | Introduction to convection |
| | 3/17/2025 | Spring break |
| | 3/19/2025 | Spring break |
| 16 | 3/24/2025 | External Convection |
| 17 | 3/26/2025 | External Convection |
| 18 | 3/31/2025 | Internal Convection |
| 19 | 4/2/2025 | Internal Convection |
| 20 | 4/7/2025 | Review |
| 21 | 4/9/2025 | Exam 2 |
| 22 | 4/14/2025 | Natural Convection |
| 23 | 4/16/2025 | Natural convection |
| 24 | 4/21/2025 | Heat exchangers |
| 25 | 4/23/2025 | Heat exchangers |
| 26 | 4/28/2025 | Radiation |
| 27 | 4/30/2025 | Radiation |
| 28 | 5/5/2025 | Radiation |
| 29 | 5/7/2025 | Review |
| 30 | 5/12-5/16/2025 | Final Exam (TBD) |

Class Materials

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course; however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class or uploaded to other online environments except to implement an approved Office of Student Access Ability accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Classroom Conduct Requirements Related to Public Health Measures

UT Dallas will follow the public health and safety guidelines put forth by the Centers for Disease Control and Prevention (CDC), the Texas Department of State Health Services (DSHS), and local public health agencies that are in effect at that time during the Spring 2022 semester.

Class Attendance

The University's attendance policy requirement is that individual faculty set their course attendance requirements. Regular and punctual class attendance is expected. Students who fail to attend class regularly are inviting scholastic difficulty. In some courses, instructors may have special attendance requirements; these should be made known to students during the first week of classes.

Class Participation

Regular class participation is expected. Students who fail to participate in class regularly are inviting scholastic difficulty. A portion of the grade for this course is directly tied to your participation in this class. It also includes engaging in group or other activities during class that solicit your feedback on homework assignments, readings, or materials covered in the lectures (and/or labs). Class participation is documented by faculty. Successful participation is defined as consistently adhering to university requirements, as presented in this syllabus. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Recordings

Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student Access Ability has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student Access Ability accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

NOTE: If the instructor records any part of the course, then the instructor will need to add the following syllabus statement:

The instructor may record meetings of this course. These recordings will be made available to all students registered for this class if the intent is to supplement the classroom experience. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law.

Off-campus Instruction and Course Activities

(Below is a description of any travel and/or risk-related activity associated with this course.)

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

Academic Support Resources

The information contained in the following link lists the University’s academic support resources for all students.

Please see <http://go.utdallas.edu/academic-support-resources>.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus. Please review the catalog sections regarding the credit/no credit or pass/fail grading option and withdrawal from class.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

Disability Services:

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union.

The contact information for the Office of Disability Services is:

The University of Texas at Dallas, SU 23

PO Box 830688

Richardson, Texas 75083-0688

(972) 883-2098 (voice or TTY)

Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.

It is the student’s responsibility to notify his or her professors of the need for such an accommodation.

Disability Services provides students with letters to present to faculty members to verify that the student

has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours. **It is the students' responsibility to notify faculty of accommodation needs at least three days prior to each assessment.**