

ME 761 – Advanced Heat Transfer Syllabus

North Dakota State University
Department of Mechanical Engineering

Basic Information

Course prefix, catalog number, and title: ME 761 Advanced Heat Transfer

Number of credits: 3

Term and year: Spring 2025

Instructor's name: TBD

Office location: TBD

Office hours: TBD

Phone Number: TBD

Email Address: TBD

Bulletin Description:

Advanced study of heat conduction and convection. Analytical, graphical, and numerical evaluations of the temperature field. Use of advanced mathematical methods in the solution of boundary value problems. Solutions to laminar and turbulent convective heat transfer problems. Analysis of boiling and condensation.

Course Objectives

At the conclusion of ME 761, students will be able to:

- Explain the physics of thermal conductivity
- Formulate heat transfer problems with the appropriate assumptions and boundary conditions
- Analytically and numerically solve 1-D and 2-D conduction problems
- Understand the physics underlying boundary layer theory and governing equations for convection
- Obtain the correct heat transfer coefficient for a particular heat transfer problem
- Analyze heat transfer in phase change configuration

Prerequisites

Graduate Student Standing.

Recommended: Completion of an undergraduate heat transfer course (ME 454 equivalent)

Textbook:

Textbook is not required. The following textbooks are recommended:

General Textbook:

- Bergman, Lavine, "Fundamentals of Heat Mass Transfer" 8th ed
- Lienhard and Lienhard, "A Heat Transfer Textbook" (free e-book from MIT)
- Cengel and Ghajar, "Heat and Mass Transfer: Fundamentals and Applications" 5th ed. McGraw-Hill education, 2014.

Conduction:

- Arpaci, V. "Conduction Heat Transfer" Pearson Publishing, 1991
- Ozisik, M.N., "Heat Conduction" 2nd ed. Wiley, 1993
- Carslaw and Jaeger, "Conduction of Heat in Solids" 2nd ed. Oxford, 1959

Convection:

- Burmeister, L.C. "Convective Heat Transfer" 2ed. Wiley Publishing, 1993

- Bird, R.B., Stewart, W.E., Lightfoot, E.N. "Transport Phenomena" 2nd ed., Wiley, 2006

Tentative Course Schedule

Weeks	Subject
~ 6 Weeks (Dates TBD)	1. Chapter 1: Introduction
	2. Chapter 2: Introduction to conduction
	3. Chapter 3: One-dimensional, steady-state conduction
	4. Chapter 4: Two-dimensional, steady-state conduction and Numerical Methods
	<i>Midterm 1 (date TBD)</i>
~ 6 Weeks (Dates TBD)	5. Chapter 5: Transient Conduction
	6. Chapter 6: Introduction to Convection
	7. Chapter 7-8: External and Internal Flow
	8. Chapter 9: Free Convection
	<i>Midterm 2 (date TBD)</i>
~ 4 Weeks (Dates TBD)	9. Chapter 10: Phase Change, Boiling
	10. Chapter 11: Phase Change, Condensation
	<i>Final exam (date TBD)</i>

Assessment:

Homework, Midterms, Project, Final Examination, and Class Participation, will be used for assessment for the given material during classes. The format of your solutions should be in acceptable engineering form.

(a) **Homework (HW) Assignments, Class participation:**

Homework assignments will be posted in Blackboard with instructions. Homework assignments will be due typically in a week after assignment in blackboard. Late papers will not be accepted without a valid excuse. Problems should be completed in acceptable engineering form including the given assumptions, the questions statements, and the drawings labeled (if applicable) of the system being considered or will not be graded.

(c) **Course Project.** Open-ended course projects will be assigned in the middle of the semester. A presentation will be required near the end of the semester. Stay tuned for detailed instructions.

(b) **Exams:**

During the semester there will be two 50-minute exams. Information and instructions will be provided on Blackboard one week before tests. The two-hour final exam will be given on the date and time specified by the University Finals Schedule.

Students who fall ill, or who know they will be missing an exam for a valid reason (e.g. family emergency) are encouraged to notify the instructor by phone or e-mail prior to the exam, if at all possible. Students missing the exam without a valid excuse will receive a grade of zero for that exam.

Grading Criteria:

The grades for this course will be determined as follows:

HW, Class Participation	25%
Midterms	25%
Project	25%
Final Exam	25%

Final course grades will be assigned according to the following scale:

- | | |
|------------------------|------------------------|
| A 90% or greater | D 60% to less than 70% |
| B 80% to less than 90% | F less than 60% |
| C 70% to less than 80% | |

Attendance Statement

According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Only the course instructor can excuse a student from course responsibilities. Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

Americans with Disabilities Act for Students with Special Needs Statement

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the [Disability Services Office](http://www.ndsu.edu/disabilityservices) (www.ndsu.edu/disabilityservices) as soon as possible.

Family Educational Rights and Privacy Act (FERPA) Statement

Your personally identifiable information and educational records as they relate to this course are subject to [FERPA](#).

Academic Honesty Statement

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](#) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the [Office of Registration and Records](#). Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

Copyrights of Course Materials

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