ME 762 Applied Multimode Heat Transfer
3 Credits

Instructor

Instructor: TBD
Email: firstname.lastname@ndsu.edu
Office: Dolve 101A
Office Hours: TBD

Course Location and Times

Time: Lecture meets for 50 minutes, three times per week
Location: TBD

Text

No Text is required for this course.
However, the following are suggested reference materials:

- Bergman, Lavine, Incropera, and Dewitt, **"**Fundamentals of Heat and Mass Transfer" by 8th ed. Wiley
- Howell, J.R, Menguc, M.P, Siegel, R. "Thermal Radiation Heat Transfer" 6th Taylor&Francis, 2015
- Modest, M. "Radiative Heat Transfer" 3rd ed. Academic Press, 2013
- Lienhard and Lienhard, "A Heat Transfer Textbook" (free e-book from MIT)

Course Description and Prerequisites

The course will expand on the heat transfer concepts covered undergraduate heat transfer courses. The focus is on radiative transfer and applying heat transfer principles to complex, multi-mode heat transfer relevant to current engineering problems.
Prerequisites: Graduate Student Standing.
Recommended: Completion of an undergraduate heat transfer course (ME 454 equivalent)

Course Objective

At the conclusion of this course, students will be able to:

- Explain the basic principles of radiative properties for non-gray materials and calculate effective radiative properties semi-gray materials
- Predict the radiative transfer between multi-surface environments for different kinds of surfaces, and analyze radiative exchange between surfaces with participating media between the surfaces
- Develop appropriate governing equations and mathematical models for multi-mode heat transfer in engineering situations.
- Apply appropriate solution models and methods to solve the governing equations and use the models to predict thermal behavior.

Grading

Course Grade
The course grade will be determined based on a weighted-average of assessments which include homework, a semester project, and three exams. The final course grade will be assigned per the following absolute scale:

A ≥ 90%
90 > B ≥ 80%
80 > C ≥ 70%
70 > D ≥ 60%
F < 60%

Category	Percent of final grade
Homework	20
Semester Project	20
Exam 1	20
Exam 2	20
Final Exam	20

Assessments

Homework:

Reading and homework assignments will be given during class lecture and posted to Blackboard. In general, homework problems will be due one week from the assignment date. Homework calculations must be in acceptable engineering format. Each student is expected to do their own work and must turn in their own homework set.

Project:

Each student will work on an open-ended design project. The goal of the project is to apply the heat transfer principles learned in the class to the solution of an open-ended problem such as one expected in industry or academic research. The design project will culminate with a formal written report presenting the design and supporting documentation.

Exams:

There will be two tests and a final. The tentative schedule is as follows:

- *Exam 1 – Week 6*
- *Exam 2 – Week 11*
- *Final Exam – Finals Week*

  The final exam will be comprehensive but weighted to the material presented after Exam 2

**This schedule is subject to change.

If you expect to miss an exam for an excused absence (e.g. University Sanctioned Event, Military Duties, Pregnancy or other Medical - see Policy 333), please talk with the instructor to make arrangements. Note: wanting to leave early for a vacation is not an excused absence.

Tentative Topic Schedule

Topic	# Weeks
Overview and review of basic heat transfer topics	1.5
Radiative Transport Radiative properties Specular and diffuse view factors Radiative transport between surfaces Radiative transport in participating mediums Radiative transport equation (RTE) Solutions to RTE (Optical thick and optically thin	5.5

solutions, approximations for gray, isotropic scattering medium)	
Multi-mode heat transfer for engineering problems General energy equation Multi-domain, coupled heat transfer Heat transfer in porous media Numerical techniques for heat transfer problems Modeling solid-liquid phase change. Conduction-Radiation problems Heat transfer in biological media (Bio-heat equation)	9

Assistance

AMERICANS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS

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 (www.ndsu.edu/disabilityservices) as soon as possible.

Veterans and Student Soldiers

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.

Communication

The primary methods by which course-related information will be communications during class, postings to the Blackboard page, and your NDSU email address. Check the Blackboard page regularly as it will be strongly relied upon.

Attendance

According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes (in-person) is expected. 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.

Academic Honesty

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.

Family Educational Rights and Privacy Act (FERPA)

Your personally identifiable information and educational records as they relate to this course are subject to FERPA.