Course Syllabus and Guidelines [Fall 2024]
ME 407-003 – Heat Transfer
Monday 08:30 AM – 11:20 AM
TIER 113

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It is the responsibility of the student to read and understand this course syllabus. This syllabus is subject to change and may be updated throughout the semester.

Course Description: Basics of conduction, convection, and radiation, Understanding steady and unsteady heat conduction, Thermal resistance concepts and heat transfer from extended surfaces, Analytical and numerical solutions to heat conduction problems, Fundamental principles governing convection for internal and external flows, Fundamentals of thermal radiation and radiative properties, Applications to engineering systems

Credit Hours: 3
Prerequisite: Math 222 Differential Equations (PDE) or equivalent, ME304 Fluid Mechanics; ME 311 Thermodynamics I
Lecture: 1 day per week at 170 minutes

Textbook: Fundamentals of Heat and Mass Transfer, 8th edition. John Wiley & Sons 2017
Author(s): Frank Incropera and David DeWitt
Amazon URL: https://tinyurl.com/2ha7vxfd

Course Outcomes:
At the completion of this course, students will be able to:
1. Gain a thorough understanding of the three modes of heat transfer: conduction, convection, and radiation.
2. Understand the physical mechanisms and mathematical descriptions of heat transfer processes.
3. Apply mathematical techniques and analytical methods to model and solve heat transfer problems, including steady and unsteady conduction, forced and natural convection, and radiative heat exchange.
4. Understand and use differential and integral forms of heat transfer equations.
5. Calculate radiative heat transfer in enclosures using view factors and solve problems involving radiation exchange between surfaces.
6. Incorporate the effects of absorbing, emitting, and scattering media on thermal radiation in industrial applications.

7. Understand and apply the principles of heat transfer in engineering applications.

Course Topics:

The following topics will be covered in this course:

1. Introduction to heat transfer modes: conduction, convection, and radiation
2. Steady-state heat conduction equation and solutions
3. Thermal resistance concept and composite walls
4. Transient heat conduction
5. Forced convection: internal flow, external flow, boundary layer
6. Natural Convection
7. Radiative Heat Transfer

Course Policies:

- Assignments
  - Homework will be assigned weekly and is due a week later before the class starts.
  - *Unless the assignment specifies otherwise, you must work in teams of four or five, handing in one team solution per assignment.* The instructor will designate the teams.
  - *Team Roles*. On each group assignment, your team should designate a coordinator to organize work sessions, make sure everyone knows where and when to meet and understands who is supposed to be doing what. A recorder to prepare and turn in the final solution set, and two or more checkers to check the solution for correctness and verify that everyone in the group understands both the solutions and strategies used to obtain them. The team roles must rotate on every assignment—once a team member has carried out a role, he/she may not do it again until everyone else on the team has done it.
  - Homework format. Each completed homework should be written and submitted by the recorder. Put the names and roles (coordinator, recorder, checker) of participating group members and the problem set number and date on the outside. *If a student's name appears on a solution set, it certifies that he/she has participated in solving the problems*.
  - Late homework. Completed assignments should be turned in at the beginning of class on the due date. Solution sets will be accepted up to one week after the due date. Late assignments will receive a maximum grade of 50%. *However, once a group hands in several late assignments, they will no longer be accepted.*
  - Posted solutions. *Problem set solutions will not be posted*. The burden is on you to make sure you find out how to solve the problems by getting help before they are due and/or asking about them in class after they have been handed in.
  - Individual effort assessments for team homework. All students will be periodically asked to submit evaluations of how well they and their teammates performed as team members. These evaluations will be incorporated into the assignment of homework grades. *If repeated efforts to improve team functioning (including faculty intervention) fail, a non-participant may be fired by unanimous consent of the rest of the team,*

similarly a team member essentially doing all the work of the team may quit. Individuals who quit or are fired must find a team of two or three unanimously willing to accept them; otherwise they will receive zeros for the remainder of the homework.

- Quizzes
  - There will be quizzes every week except week one and the weeks of midterms.
  - The quizzes will be taken from lecture and textbook readings and at the beginning of every class.
  - Quizzes will cover text material from previous weeks.
  - All quizzes will be closed notes and closed book.
  - Only non-programmable calculators are allowed during quizzes. *Mobile phones, smart watches, programmable calculators, and similar electronic devices are expected to remain out of sight — the sight of a mobile phone, smart watch, or programmable calculator* during a quiz results in a grade of F for the class.

- Exams
  - There will be two exams: one during the semester and another on the final exam day.
  - All exams are closed book and closed notes; single formula sheet only (Both sides of one sheet accepted) is acceptable.
  - Only non-programmable calculators are allowed during exams. *Mobile phones, smart watches, programmable calculators, and similar electronic devices are expected to remain out of sight — the sight of a mobile phone, smart watch, or programmable calculator* during an exam results in a grade of F for the class.
  - The exam materials consist of two documents, a question booklet, and an answer sheet. Please note the answer sheet is the only thing that will determine the grade, not what is in the exam booklet.
  - Failure to show for an exam results in a grade of zero, unless the dean of students contacts the instructor, and a decision is made otherwise. Employment is not considered a valid reason for missing an exam, and no makeup exams or finals will be given.

- Journal Clubs
  - There will be a journal club at the end of this semester.
  - Each student will pick an article for individual presentation and group discussion. The articles will cover a wide variety of heat transfer topics based on the student interests. The paper discussions will enhance the presentation, problem solving, and critical thinking skills of the student.
  - The students are required to read & review the article and discuss about/interpret the scientific data.
  - Grading will not be based on the publication chosen but will be subjective based on the student presentation (50%) and student discussions (50%).
  - *Students are required to submit the title of their final project by December 26.*

- Attendance and Absences
  - Attendance is expected and will be taken each session.
  - Students are responsible for all missed work, regardless of the reason for absence.
  - In the case that a student is absent (or expects to be absent) for an exam, the following actions are required in order for that exam grade to be non-zero:

1. The student should write an email to the professor indicating that he/she is going to contact the dean of students office about their absence from the exam. Those expecting official travel (i.e., athletes, academic conferences, etc.) must notify the professor and the dean of students office at least 2 weeks prior to the exam. In extreme cases (i.e., unforeseen sickness, death, etc.) the student must notify the professor and dean of students office within 48 hours after the originally scheduled exam time. In the email sent to the dean of students office, students should at a minimum include the following: (i) name; (ii) ID number; (iii) course and section; (iv) professor's name and email; (v) regularly scheduled exam time; (vi) evidence for absence.
2. Upon receiving notice from the dean of students office, the professor will contact the course coordinator and provide the relevant information.
3. Exams missed with certified medical excuse or prior instructor approval will be dealt individually. Since it is likely that multiple students are in a similar situation, the course coordinator will make a decision that is equitable to everyone involved.
4. If you miss an exam without either a certified medical excuse or prior instructor approval, you may take a makeup test at a designated time near the end of the semester. Only one makeup test will be given. *It will be fair but comprehensive and challenging!*

Grade Distribution:

The weights shown in the table will be used in the determination of the final course grade.

Quiz:	15%
Homework:	15%
Journal club:	10%
First Exam:	30%
Second Exam:	30%
Total	100%

Grading will be based on:

A:	90-100%
B+:	80-89%
B:	70-79%
C+:	60-69%
C:	50-59%

F:	0-49%

- **Gray areas between guaranteed letter grades**. There will be a gray area of several points below the specified numerical cutoff grades, within which a ± system will be used. Two people getting the same weighted average grade (say, 89) might therefore get different course grades (A and B+). If you are in one of these gray areas, whether you get the higher or lower grade depends on whether your test performance has been improving (your grade goes up) or declining (it goes down), whether your participation in group work has been good (up) or inadequate (down) and on your attendance.

Note: Any disagreement over grades must be brought to the attention of the instructor no later than the deadline specified by the instructor. Further, final grades are typically not discussed via email, an appointment should be made.

Academic integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found here.

Please note that it is the my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing, using any online software inappropriately, or other forms of dishonesty in academics will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Use of generative AI tools

This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.

Approximate Outline:

Week	Topic	Reading
1, 2	Introduction to Heat Transfer	**Ch.1**: 1.1-1.3
2, 3	Introduction to Conduction	**Ch.2**: 2.1-2.4
3, 4	One-Dimensional, Steady-State Conduction	**Ch.3**: 3-1-3.6
5	Two-Dimensional, Steady-State Conduction	**Ch.4**: 4.1-4.5
6	Transient Conduction	**Ch.5**: 5.1-5.6
7	Convection Heat Transfer	**Ch.6**: 6.1-6.3
8	1st Exam	**Ch. 1 – Ch. 5**
9	No class	
7, 10	External Flows	**Ch.7**: 7.1-7.4

10, 11	Internal Flows	Ch.8: 8.1-8.5
12, 13	Radiation Heat Transfer	Ch.12: 12.1-12.6
14	Radiation Exchange Between Surfaces	Ch.13: 13.1-13.3
Online Submission	Journal Club	
Final Exam Day	2nd Exam	Ch. 6 – Ch. 8, Ch.12 – Ch 13