University of Hawaii at Manoa
Department of Mechanical Engineering

ME 422 – Heat Transfer
Fall 2009

Instructor

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Prerequisites

- ME 322 – Mechanics of Fluids
- ME 360 – Computer Methods in Engineering (or MATH 405 or PHYS 307)

Course description

This course introduces basic concepts of heat transfer. All three principal heat transfer modes, i.e., conduction, convection and radiation, are covered. Focuses are on the physical mechanisms of these heat transfer modes and their engineering applications.

Course objectives

By the end of this course, the students are expected to

- Have a basic understanding and appreciation of the big picture of transport phenomena and their correlations with thermodynamics. Specifically, be aware of the mathematical similarity of different transport phenomena, i.e., transport of momentum (fluid mechanics), transport of heat, and transport of mass.
- Learn the fundamental principles, formulations and mathematical techniques to quantify heat transfer problems.
- Be able to solve simple heat transfer problems, such as the problems involving constant thermophysical properties, simple geometries, etc.
- Develop the ability to identify and analyze heat transfer problems in engineering practices and a broad range of interdisciplinary studies.

Textbook

Introduction to Heat Transfer, 5th Ed., by F. P. Incropera, D. P. DeWitt, T. L. Bergman, and A. S. Lavine, Wiley, 2006 (Note that the same material is also in the book *Fundamentals of Heat and Mass Transfer, 6th Ed.*, by the same authors.)

Topics

- Introduction Ch. 1
  - Heat transfer
  - Heat transfer and thermodynamics
  - Heat transfer and fluid mechanics
- Conduction
  - Introduction Ch. 2
  - 1D steady-state conduction Ch. 3
  - 2D steady-state conduction Ch. 4
  - Transient conduction Ch. 5
- Convection
  - Introduction Ch. 6
  - External flow Ch. 7
  - Internal flow Ch. 8
  - Free convection Ch. 9*
  - Boiling and condensation Ch. 10*
  - Heat exchanger Ch. 11
- Radiation
  - Introduction Ch. 12
  - Radiation exchange Ch. 13
- Special topic
  - Bioheat transfer

* will be covered only if time permits.

Course schedules

Monday, Wednesday, Friday 9:30-10:20 am at MSB100

Course website

PDF files of lectures, solutions of homework, handouts are available at Laulima.

Other online resources

http://bcs.wiley.com/he-bcs/Books?action=index&itemId=0471457272&bcsId=3117#
(Answers to selected exercises and Supplemental sections)

Exams and Grading

- Homework 20%
- Two in-class close-book exams
  - Oct. : conduction 20%
  - Nov.: convection 20%
- Final exam 40%
  - Dec 18th (9:45-11:45 am): conduction, convection, and radiation