UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
DEPARTMENT OF MECHANICAL SCIENCE AND ENGINEERING

ME 420: INTERMEDIATE HEAT AND MASS TRANSFER

COURSE INFORMATION
Fall Term 2014

I. CREDIT AND CONTENT

ME 420 is a 4 credit graduate level subject serving as the Mechanical Science and Engineering department's core graduate course in heat and mass transfer. This course is open to students from all areas of engineering, although an undergraduate background in heat transfer will be assumed. This class is an appropriate preparation for the doctoral qualifying exam.

Topics to be covered include: diffusion kinetics, conservation laws, some heat conduction, laminar and turbulent convection, mass transfer including phase change or heterogeneous reactions, and basic thermal radiation. Problems and examples will include theory and applications drawn from a spectrum of engineering design and manufacturing problems.

II. CLASSES

Lectures: Tuesday and Thursday from 8:00 AM to 9:50 AM in 260 Everitt Lab

Tutorials: None

Lecturer: Professor N. Miljkovic, nmiljkov@illinois.edu, MEL 2136, 617-981-9247

T.A.: None

Office Hours: T.B.A.

Textbook: Heat Transfer (2nd Edition) by A.F. Mills (Prentice Hall, 1998)

III. EXAMS AND GRADING

The course grade will be based on two midterm exams (25% each) and a final exam (50%). The tests will be open book unless otherwise announced.

The exam dates are as follows:

Quiz 1: Thursday, October 9

Quiz 2: Thursday, November 13

Final Exam: December 12-23 final exam period, time and place TBA.

Homework Problems:

A set of ten homework problems will be assigned during the course. In addition, three sets of review questions will be handed out before the exams. You should work all of these problems carefully as they are essential aid to learning the material.

IV. PREREQUISITES

Students entering this course should have had undergraduate classes in heat transfer, thermodynamics, and fluid mechanics corresponding to ME 310 and ME 320. A graduate level background in mathematics will be assumed. Some specific areas you should have seen previously include:

Mathematics: Vector calculus, first and second-order ODEs, linear PDEs solved *via* separation of variables and Fourier series.
Heat Transfer: One-dimensional steady and unsteady heat conduction, fins, elementary laminar and turbulent convection, natural convection and condensation, heat exchangers, simple blackbody and gray body radiation.
Fluid Mechanics: Elementary viscous flow including Couette flow, boundary layers and tube flows, transition Reynolds number and concepts of turbulence; skin friction and pressure drop calculations.
Thermodynamics: Concept of an equation of state; first law, phase transitions.

Note however that if you have gaps in these areas, it shouldn't prevent you from doing well in this class.

V. COURSE GOAL

The goal of the course is to introduce you to graduate material in heat and mass transfer, and to aid your transition from undergraduate work into advanced graduate courses on heat transfer, energy sciences, and fluid mechanics.

VI. COLLABORATION

You may collaborate on the optional homeworks. You may not collaborate on the quizzes and final exam.

VII. REFERENCE MATERIALS

Heat Transfer, A. F. Mills, 1998 (Prentice Hall). TJ260.M52

Heat and Mass Transfer, A. F. Mills, 1995 (R.D. Irwin, Boston). TJ260.M517

A Heat Transfer Textbook, J. H. Lienhard, 2nd edition, 1987 (Prentice Hall, Englewood Cliffs). TJ260.L445

Introduction to Physical Gas Dynamics, Vincenti & Kruger, (Kiley & Sons). QC168.V775

Viscous Fluid Flow, F.M. White, 2nd edition, 1991 (McGraw Hill, NYC). QA929.W48

Convective Heat and Mass Transfer, W.M. Kays and M.E. Crawford, 3rd edition, 1993 (McGraw Hill, NYC). QC327.K37

Convective Heat Transfer, A. Bejan, 1984 (John Wiley & Sons). QC327.B48

Radiation Heat Transfer Notes, D.K. Edwards, 1981 (Hemisphere: Washington). TJ260.E318

Conduction Heat Transfer, V.S. Arpaci, Abridged Edition, 1991 (Ginn Press, Nedham Heights, MA). TJ260.A772

VIII. PHYSCIAL PROPERTIES AND UNITS

Useful Physical Constant for ME 420

Stefan-Boltzmann constant, σ	5.6697×10^{-8} W/m^{2}K^4
Ideal gas constant, R^o	8314.3 J/kmol·K
Boltzmann constant, k_B	1.38×10^{-23} J/K
Avogadro's Number, N_A	6.022×10^{26} molecules/kmol