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

ME 521: CONVECTIVE HEAT TRANSFER
COURSE INFORMATION

I. CREDIT AND CONTENT

ME 521 is a 4 credit graduate level subject serving as the Mechanical Science and Engineering department's advanced graduate course in convective heat and mass transfer. This course is open to students from all areas of engineering, although a graduate (or advanced undergraduate) background in heat transfer will be assumed. This class is an appropriate preparation for pasts of the heat transfer doctoral qualifying exam. For a more complete preparation, please take ME 420.

Topics to be covered include: conservation laws, scaling, dynamic similarity, laminar and turbulent convection, internal and external convection, external natural convection and natural convection in enclosures, convection with change of phase, convection in porous media, and mass transfer including phase change and heterogeneous reactions. Problems and examples will include theory and applications drawn from nature and a spectrum of engineering applications.

II. CLASSES

Lectures:	Twice a week for 1 hour and 50 minutes each
Tutorials:	None
Lecturer:	Professor N. Miljkovic, nmiljkov@illinois.edu, MEL 2136, 617-981-9247
T.A.:	None
Office Hours:	T.B.A.
Textbook:	Convective Heat Transfer (4th Edition) by A. Bejan (Wiley, 2013)

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.

Homework Problems:

A set of ten homework problems will be assigned during the course. You should work all of these problems carefully as they are essential aid to learning the material. The problems are written at a higher level of difficulty in order to prepare you for the quizzes and final. The higher difficulty level of the homework is also why it is not graded. In general, if you complete the majority of the homeworks and understand the solutions, you will do great in the class.

IV. PREREQUISITES

Students entering this course should have taken ME 420 or an equivalent advanced heat transfer class, thermodynamics, and fluid mechanics. 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, elementary laminar and turbulent convection, natural convection and condensation, heat exchangers.
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, second 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 convective 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. LEARNING STRATEGY

To learn the material effectively, you will need attend lectures, participate in class, and ask questions when confused. Staying engaged in class is key to doing well. Also, the homework problems will prepare you above and beyond for the quizzes and final exam.

VIII. 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