

# MENG 4260

## Heat and Mass Transfer

### Catalog Description

MENG 4260. Heat and Mass Transfer (3) (S) 3 lecture hours per week. P: ENGR 3012. Three fundamental modes of heat transfer, conduction, convection and radiation, and mass transfer.

### *Required Texts:*

1. Incropera, Frank P. and David DeWitt. *Fundamentals of Heat and Mass Transfer, 5<sup>th</sup> Edition*, John Wiley & Sons, 2001
2. National Council of Examiners for Engineering and Surveying, *Fundamentals of Engineering Supplied-Reference Handbook (8th Edition)*, 2008, ISBN 978-1-932613-30-8.

### Course Objectives:

Upon completion of this course each student will be able to:

- Describe the fundamental principles of conduction, convection and radiation heat transfer.
- Formulate and solve one and two dimensional conduction heat transfer problems.
- Apply mathematical equations to describe basic heat transfer modes.
- Describe applications of heat transfer systems.
- Analyze elements of thermal design and external vs. internal convective flow systems
- Design basic heat exchangers through appropriate simplifying assumptions and applying the relevant governing principles and equations.
- Solve heat transfer problems using numerical techniques.
- Understand the fundamentals of the relationship between fluid flow, convection heat transfer and mass transfer.

### Topics Covered

- Introduction: modes of heat transfer, energy balances, problem solving methodology, units & dimensions
- Conduction: thermal properties, diffusion equation, one dimensional steady state, lumped capacitance transient conduction, semi-infinite solid transient conduction.
- Convection: boundary layer concept, dimensional analysis, heat & mass transfer analogy, evapora cooling, external flow convection, cylinders in cross flow, impinging jets, mention to pipe flow.
- Free convection: external free convection flows, free convection in channels, free convection in enclosures, mixed convection, convective mass transfer.
- Boiling and condensation: boiling modes, pool boiling, flow boiling, film condensation, dropwise condensation.
- Radiation: radiation intensity, black body radiation, surface emissivity, absorption, reflection, transmission, Kirchhoff's law, gray surfaces, view factors, black body radiation exchange, radiation exchange between surfaces, additional effects.
- Mass transfer: Fick's law, mass diffusion, equimolar counterdiffusion, evaporation.

### Grading Policy:

Students will be evaluated based on the combination of class activities (see below). The final grade will be assessed with the following criteria:

<b>Grading</b>		<b>Assessment</b>	
A	90% or better	Homework, Attendance and Quizzes	10%
B	80% or better	Tests 3 @ 20%	60%
C	70% or better	Final exam	30%
D	60% or better		

	Less than 60%	Total	100%
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