King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT
Fall Semester 2006-2007 (061)

ME 315 : Heat Transfer

Instructor: **Dr. S. Z. Shuja**   *Office:* **22-216**   *Phone:* **4465**

Catalog Data:

An introduction to heat transfer by conduction, radiation and convection. Steady-state analysis of heat transfer through composite plane, cylindrical and spherical walls with convection and radiation boundary conditions, internal energy generation and extended surfaces (fins). Significance of multi-dimensional effects. Unsteady heat transfer in plates, cylinders and spheres. Numerical solution of heat conduction problems. Practical analysis of convection with application to heat exchangers. Blackbody and graybody radiation systems.   **Prereq :** ME 311

Textbook:

Incropera, F. P. and DeWitt, D. P. **Fundamentals Of Heat And Mass Transfer.** John Wiley Publisher, 5th Ed. 2002.

References:

1) Thomas L. C. **Heat Transfer: Professional Version**. CapStone PCl, 2nd Edition 1999.
2) Cengel Y. A. **Heat and Mass Tra**nsfer, McGraw-Hill Publisher, 3rd Ed. 2007.

Course Breakdown:

Classes (50 min)	Topics
3	Introduction: Basic modes of heat transfer, conservation of energy.
2	The conduction equation
8	One dimensional steady state heat conduction and extended surfaces
2	Two dimensional steady state conduction, conduction shape factor.
3	Numerical analysis of conduction
4	Transient conduction: Lumped analysis, Heisler charts, Multidimensional effects
2	Introduction to convection heat transfer.
1	External flow: Flow over a flat plate, cylinders, spheres: Applications
4	Internal flows: Convection correlations for laminar and turbulent flows. Practical thermal analysis: Applications.
2	Tube banks.
1	Natural convection heat transfer and boiling and condensation.
5	Heat exchangers: Types, overall heat transfer coefficient, fouling, LMTD method, effectiveness method and numerical method.
3	Thermal radiation, blackbody radiation, radiation properties.
3	Shape factor, radiation exchange for blackbody and graybody surfaces.

ME Dept. mission statement: The Department is committed to providing highest quality education in mechanical engineering, conducting world-class basic and applied research, addressing the evolving needs of industry and society, and supporting the development of more competitive and new industry in the Kingdom of Saudi Arabia.

Evaluation:

Exam 1	**Oct. 30, 2006**	**7-9 pm**	15%
Exam 2	**Dec. 10, 2006**	**7-9 pm**	20%
Quizzes			15%
Homework			10%
Design Problem			5%
Design Project			5%
Final Exam			30%

Objectives and Outcomes of the course:

Objectives:	*Outcomes*
To provide students with the basic principles required for understanding conduction, radiation and convection heat transfer.	Students will demonstrate understanding of the use of analytical and numerical finite difference formulation concepts involving the first law of thermodynamics and particular laws of conduction, convection and radiation in the analysis of practical problems involving heat transfer.
To enable students to be able to apply the basic principles of heat transfer in the analysis and design of engineering systems.	Students will demonstrate understanding of the significance of modeling assumptions and the accuracy of both analytical and numerical solutions results.

HW Assignments & Design Problems:

A Homework will be assigned at the beginning of each week and is due a week later. Late homework will not be accepted. In addition, a design problem will be assigned to enhance the understanding of design alternatives in thermal design.

Attendance:

Attendance will be strictly observed and each absence will result in a deduction of 0.5 point of the final grade.

Design Projects:

A design project will be suggested 5 weeks into the course. Students are supposed to work on or come up with their project idea. Team work is allowed provided each member shows his contribution.

Computer usage:

Students will use the computer for homework assignments and design problems.

Dr. S. Z. Shuja   **9th Sept. 2006**