CHE 313 Heat Transfer Operations **Date**: 27/April/2006

Instructor: Malik Al-Ahmad **Total credits**: 3 Lecture Cr: 3 Lab Cr: 0 Tutorials Cr:1

Pre Req(s): CHE 202, CHE 312 **Co Req(s):**

Contribution to professional component: Math and Basic science Cr:2 Engineering Cr: 1 General Education Cr:

Catalog Data: Consideration of thermal energy transfer problems which occur in the process industry. Conduction, convection and radiation, heat tansfer with change in phase , heat exchange equipment and their design. .

Textbook: Geankoplis, G.J: Transport Processes and Unit Operations, Allyn and Bacon, fourth edition; F.kreith and M.S Bohn,"Principle of Heat Transfer " , PWS Pub. company, 5th ed., Boston ,1997.

Topics covered

1. Introduction and mechanisms of heat transfer (2 classes).
2. Steady state heat transfer by conduction. (8 classes)
3. Individual coefficients of heat transfer, overall coefficients, scale resistance, mean temperature difference for parallel, counter-current and mixed flow arrangements. (6 classes83).
4. Heat Transfer correlation in convection (development by dimensional analysis) and its different forms for different actual situation such as heating and cooling inside tubes in turbulent, transition and laminar flow, heating and cooling outside tubes and tube bundles, heat transfer in agitate vessels. (6 classes).
5. Natural convection . (3 classes).
6. Radiation through non- absorbing and absorbing media. (6 classes).
7. Heat transfer with change equipment design. (4 classes).
8. Application to heat exchange equipment design. (5 classes).
9. Selected topics(extended surface, temperature measurement equipment, heat pipe, compact heat exchangers, packed and fluidized systems). (5 classes).
10. Tests: (3 classes)

Objectives	a	b	c	d	e	f	g	h	i	j	k	L	M
1. Mechanisms of heat transfer: Heat transfer by conduction, convection and radiation,													
2. Heat transfer by conduction: Fourier's Law of heat conduction, thermal conductivity, conduction through flat slab or wall, hollow cylinders and hollow spheres. Conduction through solids in series and parallel. Critical thickness of insulation, conduction with internal heat generation.													
3. Heat transfer coefficients:Convective heat transfer coefficient, combined convection and conduction and overall coefficients.													
4. Heat Transfer correlation in forced convection: Dimentionless numbers, Forced convection inside pipes; laminar, turbulent and transition regions, liquid metal heat transfer coefficients. Forced convection outside various													

geometries: flat plates, cylinders, single spheres, bank of tubes, heat transfer for flow in packed beds.														
5. Natural convection: Natural convection from various geometries.														
6. Radiation heat transfer: Thermal radiation, Stefan-Boltzman law, concept of gray body, view factors for different geometries.														
7. Heat exchangers: Types of heat exchangers, log mean temperature difference correction factor, Heat exchanger effectiveness, Fouling factor and typical overall U values.														
8.Selected topics(extended surface, temperature measurement equipment, heat pipe, compact heat exchangers, packed and fluidized systems).														

b. Ability to design and construct experiments.
c. Ability to design a system, component, or process.
d. Ability to function on multi-disciplinary teams.
e. Ability to identify, formulate, and solve engineering problems.
f. Understanding of professional and ethical responsibility.
g. Ability to communicate effectively.
h. …broad education … to understand the impact of eng. solutions in a global and societal context.
i. Recognition of the need for and ability to engage in life-long learning.
j. Knowledge of contemporary issues.
k. Ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
L. Quickly contribute in their focus area.
M. Team contributors.

Key: 3 : strong 2: moderate 1: weak