

Module Title: Heat Transfer 1

Module Code: 24-18-206-01

Module Credit: 3

Term: First Term 1397-98

Lecturer: Prof. Farhad Shahraki
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Lecturing time: Sat. (18:00-20:00)
Mon. (18:00-20:00)

Assessments: 40% mid-term exam
40% final exam
10% Quiz
10% home works

Class attendance: REGULAR ATTENDING IS IMPORTANT
AND EACH SESSION YOUR ATTENDANCE WILL BE CHECKED

References: Heat Transfer (10th edition)
by Jack P. Holman
McGraw-Hill Series

Fundamentals of Heat and Mass Transfer (6th Edition)
by Frank P. Incropera, D. P. DeWitt, T. L. Bergman, A. S. Lavine
Wiley

1st week: Introduction

- Conduction Heat Transfer
- Thermal Conductivity
- Convection Heat Transfer
- Radiation Heat Transfer

2nd and 3rd weeks: Steady-State Conduction One Dimension

- The Plane Wall Insulation
- Radial Systems
- The Overall Heat-Transfer Coefficient
- Critical Thickness of Insulation
- Heat-Source Systems
- Cylinder with Heat Sources
- Conduction-Convection Systems
- Fins and Extended Surfaces
- Thermal Contact Resistance
- **Quiz**

4th and 5th weeks: Steady-State Conduction Multiple Dimensions

- Mathematical Analysis of Two-Dimensional Heat Conduction
- Graphical Analysis
- The Conduction Shape Factor
- Numerical Method of Analysis
- **Quiz**

6th and 7th and 8th weeks: Unsteady-State Conduction

- Lumped-Heat-Capacity System
- Transient Heat Flow in a Semi-Infinite Solid
- Convection Boundary Conditions
- Multidimensional Systems
- **Mid-term Exam**

9th, 10th and 11th weeks: Principles of Convection

- Viscous Flow
- Inviscid Flow
- Laminar Boundary Layer on a Flat Plate
- Energy Equation of the Boundary Layer
- The Thermal Boundary Layer
- The Relation Between Fluid Friction and Heat Transfer
- Turbulent-Boundary-Layer Heat Transfer
- Turbulent-Boundary-Layer Thickness
- Heat Transfer in Laminar Tube Flow
- Turbulent Flow in a Tube
- Heat Transfer in High-Speed Flow
- **Quiz**

12th and 13th weeks: Empirical and Practical Relations for Forced-Convection Heat Transfer

- Empirical Relations for Pipe and Tube Flow
- Flow Across Cylinders and Spheres
- Flow Across Tube Banks
- Liquid-Metal Heat Transfer
- **Quiz**

14th, 15th and 16th weeks: Natural Convection Systems

- Free-Convection Heat Transfer on a Vertical Flat Plate
- Empirical Relations for Free Convection
- Free Convection from Vertical Planes and Cylinders
- Free Convection from Horizontal Cylinders
- Free Convection from Horizontal Plates
- Free Convection from Inclined Surfaces
- Non-Newtonian Fluids
- Simplified Equations for Air
- Free Convection from Spheres
- Free Convection in Enclosed Spaces
- Combined Free and Forced Convection