

**Module title:** Heat Transfer 1

**Module code:** 24-14-218-01

**Module credit:** 3

**Module objectives**

This course is intended for undergraduate students in Mechanical Engineering. The general goal of this course is to create the ability for students to formulate and solve heat transfer problems by the general and particular laws of transport phenomena.

**Term:** Second Term

**Lecturer:** Dr. Faramarz Sarhaddi

Associate Professor

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**Assessments:**

30% mid-term exam

60% final exam

10% quiz and home works

**Reference:**

Fundamentals of Heat and Mass Transfer (7th Edition), T. L. Bergman, A. S. Lavine, F. P. Incropera, D. P. Dewitt, ISBN-13: 978-0470917855; ISBN-10: 0470917857

**Module subjects:**

**1<sup>st</sup>. week:** Introduction

- Physical Origins and Rate Equations
- Relationship to the First Law of Thermodynamics
- Analysis of Heat Transfer Problems: Methodology

**2<sup>nd</sup>. week:** Introduction to Conduction

- The Conduction Rate Equation
- The Thermal Properties of Matter
- Boundary and Initial Conditions

**3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> weeks:** One-Dimensional, Steady-State Conduction

- The Plane Wall
- Radial Systems
- Conduction with Thermal Energy Generation

- Heat Transfer from Extended Surfaces

**6<sup>th</sup> week:** Two-Dimensional, Steady-State Conduction

- The Method of Separation of Variables
- Finite-Difference Equations

**Mid-term Exam**

**7<sup>th</sup> and 8<sup>th</sup> weeks:** Transient Conduction

- The Lumped Capacitance Method
- Spatial Effects
- The Semi-Infinite Solid
- Finite-Difference Methods

**9<sup>th</sup> week:** Introduction to Convection

- The Convection Boundary Layers
- Boundary Layer Similarity: The Normalized Boundary Layer Equations
- Physical Interpretation of the Dimensionless Parameters
- Boundary Layer Analogies

**10<sup>th</sup> and 11<sup>th</sup> weeks:** Heat Exchangers

**13<sup>th</sup> and 14<sup>th</sup> weeks:** Radiation: Processes and Properties

- Radiation Heat Fluxes and Intensity
- Blackbody Radiation
- Emission from Real Surfaces
- The Gray Surface
- Environmental Radiation

**15<sup>th</sup> and 16<sup>th</sup> weeks:** Radiation Exchange between Surfaces

- The View Factor
- Blackbody Radiation Exchange
- Radiation Exchange Between Opaque, Diffuse, Gray Surfaces in an Enclosure
- Multimode Heat Transfer
- Radiation Exchange with Participating Media

**Final Term Exam**