

Course number: WPB 15010

**Heat Transfer** 

Study level: Bachelor /

Undergraduate

Prof. Dr. Peter Stein

Language of instruction: English

**ECTS Credits: 8** 

## **Objectives:**

- 1. Identify the three modes of heat transfer: conduction, convection and radiation for a given energy system
- 2. Analyze physical heat transfer problems by reducing them to workable mathematical models
- 3. Solve heat conduction problems in steady-state and transient conditions through application of rate equations and the conservation of energy law
- 4. Solve convective heat transfer problems by determining convective heat transfer coefficients and the corresponding heat transfer rate for forced and natural, external and internal convective heat transfer problems
- 5. Design heat exchangers and analyze their performance
- 6. Solve radiation heat transfer problems incorporating surface radiative properties
- 7. Utilize suitable numerical techniques and computer tools in the formulation and solution of open-ended heat transfer design problems in a project team setting

## **Contents:**

- Conduction, convection, radiation basics; rate equations; energy balance and the control volume and control surface concepts
- 1-dimensional steady-state conduction, plane and radial geometries; heat diffusion equation; boundary and initial conditions
- Thermal resistance models, heat generation problems; design of fins
- 2-dimensional steady-state conduction; numerical methods
- Transient conduction problems
- Dimensionless analysis; forced external convection problems
- Forced internal convection problems, natural convection problems
- Heat exchanger fundamentals; U-factor calculation;  $\varepsilon$  -NTU methods
- Heat exchanger design and analysis; phase-change heat exchangers
- Radiation heat transfer design; effects of surface properties; view factors
- Final examination and team design project

## **Assessment:**

Homework: 20%

Examinations & Quizzes: 40%

Project Report: 15% Final Examination: 25%

Total: 100%