



Course number: WPB 15010

Heat Transfer

Study level: Bachelor /  
Undergraduate

Prof. Dr. Ludwig Eicher

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%