# MS ISEE Study Track: Heat and Power Engineering, Course Table: 2017/2018

1. **Year Aalto University:** School of Engineering, Dept. of Mechanical Engineering, Mika Järvinen
2. **Year Chalmers University of Technology:** Dept. of Energy and Environment, David Pallarès

**Study track focus and goal:**

This track meets the challenge set global warming and depletion of fossil fuel resources by providing state-of-the-art education in advanced technologies and systems for efficient, clean and competitive conversion, distribution and use of electricity, heating and cooling.

Training is provided in the use of optimization and modelling tools for design and planning on the technical plant level, including state-of-the-art technologies, at the same time that necessary knowledge on energy systems is given in order to gain perspective.

**Learning outcomes:**

- Students become skilled in analysis, optimization and design of combined heat and power plants and industrial heat processes, acquiring also state-of-the-art knowledge on technologies for fuel conversion with reduced or zero $CO_2$ emissions (biomass and waste conversion, Carbon Capture and Storage technologies).

- By acquiring complementary knowledge on an energy systems level, students are trained to approach problem-solving in an interdisciplinary way.

- Students are prepared for a professional career within the energy industry and power generation companies.

## Course table

| 1. Semester | 2. Semester | 3. Semester | 4. Semester |
|---|---|---|---|
| *Aalto University* | | *Chalmers University of Technology* | |
| *Bioenergy I, EEN-E2005, 5 ECTS* | *Combustion Technology, EEN-E2002, 5 ECTS* | *Heat and Power Systems Engineering, MEN120, 7.5 ECTS* | Thesis , 30 ECTS |
| *Bioenergy II, EEN-E2006, 5 ECTS* | *Advances in New Energy Technologies, PHYS-E0483, 5 ECTS* | *Industrial Energy Systems, KVM013, 7.5 ECTS* | |
| *Energy, Environment and Emission Control, EEN-E2007, 5 ECTS* | *Exercises in Energy Technology, EN-E3005, 5 ECTS* | | |
| | *Energy and Environmental Economics, 31E01310, 5 ECTS* | | |
| | *District heating and cooling, EEN-E3004, 5 ECTS* | | |
| *Elective courses from list 1* | *Elective courses from list 2* | *Elective courses from list 3* | |
| **= 25 ECTC** | **= 35 ECTS** | **= 30 ECTS** | **= 30 ECTS** |

**Elective course list 1**

- AAE-E1000 Introduction to Advanced Energy Solutions (5 ECTS)
- EEN-E3006 Energy Markets (5 ECTS)
- EEN-E9010 Energy Project (5 ECTS)
- PHYS-E6572 Advanced Wind Power Technology (5 ECTS) (alternate years, not lectured autumn 2015)
- PHYS-C6370 Fundamentals of New Energy Sources (5 ECTS)

**Elective course list 2**

- PHYS-E6570 Solar Energy Engineering (5 ECTS) (alternate years, lectured in spring 2016)
- EEN-E2001 Computational Fluid Dynamics (5 ECTS)
- PHYS-C1380 Multi-disciplinary energy perspectives (5 ECTS)
- CHEM-E5145 Materials for Renewable Energy P (5 ECTS)

**Elective course list 3**

- Introduction to nuclear reactors, TIF215, 7.5 ECTS
- Sustainable Electric Power Systems, ENM125, 7.5 ECTS
- Turbomachinery, TME210, 7.5 ECTS
- Sustainable Energy Futures , FFR170, 7.5 ECTS
- Computational fluid dynamics (CFD), MTF072, 7.5 ECTS
- Multiphase flow, TME160, 7.5 ECTS
- Gas turbine technology, MTF171, 7.5 ECTS
- Sustainable power production and transportation ENM095, 7.5 ECTS

## Research areas for projects / master thesis

## First and main supervisor at Chalmers University, 2nd year

| Professors at Chalmers | Research area |
|---|---|
| Prof. Filip Johnsson, Chalmers University, Energy and Environment | Fluidized bed processes |
| David Pallarès, Chalmers University, Energy and Environment | Fluidized bed processes |
| Fredrik Norrmann | Oxyfuel combustion, flue gas treatment |
| Mathias Gourdon | Optimization of industrial energy use |
| Magnus Rydén | Chemical looping combustion |

**Co-supervisors for master thesis supervision at Aalto University (i.e. 1st year university)**

| Professors at Aalto | Research area |
|---|---|
| prof. Mika Järvinen, Aalto University, department of Mechanical Engineering | Combustion and gasification, fuel spraying and modeling |
| prof. Martti Larmi, Aalto University, department of Mechanical Engineering | Biofuel production and combustion |
| prof. Risto Lahdelma, Aalto University, department of Mechanical Engineering | Energy: Modeling, simulation and optimization |
| Prof. Pekka Ahtila, Aalto University, department of Mechanical Engineering | Industry, energy technology and power plant engineering |

**Degree requirements for admission process**

**A BSc degree corresponding to a minimum of 180 ECTS credits in the following fields: Mechanical Engineering, Chemical Engineering, Chemistry and Physics.**

Applicants must document that they have fulfilled the following minimum requirements: The applicant's qualifications must include a strong working knowledge of mathematics and energy/thermal engineering. Applicants must document that they have fulfilled the following minimum requirements:

- Mathematics: 21.5 ECTS including linear algebra, calculus and differential equations
- Thermodynamics: 6 ECTS
- Mass and/or heat transfer: 6 ECTS
- Fluid mechanics: min. 5 ECTS