EEN-E2002 Combustion Technology, 2018-2019, 5cr

Status of the Course: Energy Technology, Advanced Studies
Level of the Course: Master's studies
Teacher in Charge: Professor Martti Larmi
Teachers: Ossi Kaario, Tuomas Paloposki, Mika Järvinen, Cheng Qiang, Yuri Kroyan, Michal Wojcieszyk, Otto Blomstedt
Teaching Periods III-IV – see the more detailed schedule
Estimated workload: Lectures 24 h, Exercises 24 h, Excursion 10 h, Learning exercise homework 48 h, Personal studying 24h, Examination 3 h = 134 h

Learning Outcomes: The student should be able to understand the basics of combustion and gasification processes and to be able to recognize how they influence the design and operation of practical equipment such as boilers and engines.

Main Content: Today’s and future combustion technologies and combustion regimes in power plants and engines; design and operational considerations. Application of combustion to furnaces and boilers, spark ignition engines, diesel engines, gas engines and gas turbines. Fundamentals of gasification.

Topics of lectures: Basics of flame and combustion. Premixed charge flame propagation process and mixing controlled compression ignition combustion in internal combustion. Internal combustion and work done by the gases. Internal combustion technologies on fuel admission and air management. Properties of power plant combustion fuels, especially biomass and solid fuels, and significance of fuel properties for combustion processes. Heat and mass balances in boilers and furnaces. Fuel, air, flue gas and ash flows and their arrangement in practical systems. Ignition and flame stabilization. The role of energy feedback from the flame. Considerations on operational efficiency and safety.

Assessment Methods and Criteria: Learning exercises. All learning exercises should be passed with at least 50% of points.

The course comprises lectures and six learning exercises (including lab exercises and demos and industrial excursion.)

Text books: G. L. Borman & K. W. Ragland, Combustion Engineering. McGraw-Hill, 1998. ISBN 0-07-115978-9. C. Higman & M. van der Burgt, Gasification, 2nd ed. Elsevier, 2009. ISBN 978-0-7506-8528-3. Internal Combustion Engine Handbook by Richard van Basshuysen and Fred Schäfer, Chapters 2, 3, 10-15.