

SYLLABUS FOR

Exergy Economics

7.5 ECTS CREDITS

COURSE CODE

TER721

DECISION

Approved 2009-09-16 by The Faculty Board at Gotland University.
Valid as from spring term 2010.

SUBJECT AND LEVEL

Energy engineering, Undergraduate level 300

LEARNING OUTCOMES

After completing the course the student should have:

- Ability to analyse and optimize real systems with respect to exergy use and total cost.
- Ability to judge results as above with respect to sustainable development.

COURSE CONTENTS

Course unit 1. Exergy Economics Fundamentals, 2.5 ECTS Credits.

Cost-benefit analysis including taxes and subsidies. Efficiencies of ideal and real processes. Optimization methods and their applications. Fundamental processes as heat exchanger and combustion.

Course unit 2. Exergy Economics Methods, 2 ECTS Credits.

Thermoeconomics and cost functions for important unitary processes, Exergy Economic Accounting (EEA) and Exergy Economic Optimization (EEO). Design optimization techniques, e.g., Pinch Technology and "Energy Utility Diagram". Sensitivity analysis.

Course unit 3. Individual Project Report, 3 ECTS Credits.

Exergy economic analysis of industrial processes.

ENTRANCE REQUIREMENTS

Specific entrance requirements: Exergy Analysis 7.5 ECTS Credits or equivalent knowledge.

TYPE OF TEACHING

The course is given as an Internet based university course in English. Exercises and assignments are submitted to the e-classroom on the Internet and participants get personal feedback from their tutors. A forum for discussion is also available.

EXAMINATION AND GRADES

Course units 1 and 2 are examined by exercises. Course unit 3 is examined by a written report. Course grades on all units are Pass with distinction (VG), Pass (G), and Fail (U). The grade Pass requires the grade Pass or higher on all course units. The grade Pass with distinction requires a minimum of two course units with the grade Pass with distinction (VG) together with Pass on the third course unit.

LITERATURE

Boyd, S. and Vandenberghe, L. *Convex Optimization* (2008) 730 p. Cambridge University Press, http://www.stanford.edu/~boyd/cvxbook/bv_cvxbook.pdf.

El-Sayed, Yehia M. "Thermodynamics and Thermoeconomics", Int.J. Applied Thermodynamics, Vol. 2 (No.1), pp.5-18, March-1999.
<http://www.icatweb.org/vol2/2.1/5-el-sayed.pdf>

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http://www.ebookee.com/The-Thermoconomics-of-Energy-Conversions_193404.html
- Gong, M. and Wall, G. *On Exergy and Sustainable Development, Part II: Indicators and Methods* (2001) 17 p. <http://www.exergy.se/ftp/gw2exij.pdf>.
- Quantities, Units and Symbols in Physical Chemistry* (1993) 165 p. Blackwell Science,
http://www.iupac.org/publications/books/gbook/green_book_2ed.pdf.
- The Exergoecological Portal, <http://www.exergoecology.com>.
- Wall, G. *Thermoeconomic optimization of a heat pump system*, Energy 11, 957-967 (1986) and International Journal of Refrigeration 14, 336-340 (1991)
<http://www.exergy.se/ftp/paper4a.pdf> and
<http://www.exergy.se/ftp/paper4b.pdf>.
- Wall, G. and Gong, M. *Exergy Analysis versus Pinch Technology* (1996), presented at ECOS'96, Efficiency, Costs, Optimization, Simulation and Environmental Aspects of Energy Systems, June 25-27, 1996, Stockholm, Sweden, publ. P. Alvfors et al Eds., ISBN 91-7170-664-X, pp. 451-455
<http://www.exergy.se/ftp/eavpt.pdf>.
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- Wall, G. *Exergetics* (2009) 151 p. <http://www.exergy.se/ftp/exergetics.pdf>.