

Course syllabus

Termodynamik och strömningslära Thermodynamics and Fluid Mechanics

MMVF01, 11 credits, G2 (First Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED M

Date of Decision: 2023-04-11

General Information

Main field: Technology.

Compulsory for: M2, MD2

Language of instruction: The course will be given in Swedish

Aim

The purpose of the course is to provide basic knowledge and skills in engineering thermodynamics and fluid mechanics, with application mainly within the energy sector.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be able to define and/or clarify in short certain basic concepts, principles and phenomena in thermodynamics and fluid mechanics
- be able to shortly account for basic relations considering properties of pure substances, mass and energy conservation, entropy generation and momentum balance, with a basic understanding of limitations and applicability
- be able to derive and account for certain technical important relations within the scope of the subject

Competences and skills

For a passing grade the student must

- be able to demonstrate a good engineering handling practice of property tables and diagrams and to be able to solve basic energy- and fluid-related problems
- be able to describe shortly, clarify and analyse certain thermodynamic processes of technical importance, with a quantitative assessment of its quality regarding the influence on the environment (entropy generation)
- be able to accomplish a complete dimensional analysis of a given dimensional problem
- be able to apply control volume analysis of the balances of mass, energy and linear momentum, for stationary flow with homogeneous in- and outlets
- be able to accomplish a basic fluid mechanical analysis of single pipe systems at stationary incompressible flow conditions, and isentropic compressible flow in nozzles

Judgement and approach

For a passing grade the student must

- be able to produce written communication, on problem-solving and the lab-report, that is well-structured and illustrative, with clear references to external sources, attention to limitations and accuracy, and which demonstrate understanding of the subject

Contents

Thermodynamics: basic concepts of thermodynamics; properties of pure substances; energy transfer by heat, work and mass; the first law of thermodynamics; the second law of thermodynamics; entropy, irreversibility and entropy generation; exergy; gas power cycles; vapor and combined power cycles; refrigeration cycles; thermodynamic property relations; phase equilibrium; gas mixtures; gas-vapor mixtures and air-conditioning

Fluid Mechanics: viscosity; basic fluid statics; the Bernoulli equation; fluid kinematics; finite control volume analysis; basic differential analysis of fluid flow; similitude, dimensional analysis, and modelling; viscous flow in pipes; flow over immersed bodies; one-dimensional isentropic compressible flow through nozzles

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Two written tests, mainly theory; individual problem assignments; laboratory work; and a final written examination on problem-solving. The course mark is determined from a weighted total sum, which consists of the result from the passed written examination including bonus points from approved problem assignments (if given) and the two passed tests. The graduation is determined from a special formula.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0122. **Name:** Thermodynamics.

Credits: 6,5. **Grading scale:** UG. **Assessment:** Written test, theory and basic problem-solving (approx. 5 hours); individual home assignments (problem-solving). **Contents:** Written test: basic concepts; properties of pure substances; energy transfer by heat, work, and mass; first law of thermodynamics; energy; second law of thermodynamics; entropy; irreversibility and entropy generation; exergy; thermodynamic relations; phase equilibrium; gas and vapor power cycles; refrigeration cycles; ideal-gas mixtures; air conditioning. Home assignments: applications of the basic laws of thermodynamics; gas power cycles, vapor power cycles, refrigeration cycles.

Code: 0222. **Name:** Fluid Mechanics.

Credits: 4,5. **Grading scale:** UG. **Assessment:** Written test on theory (approx. 5 hours); individual home

assignments (problem-solving). **Contents:** Written test: basic concepts; fluid statics; Bernoulli equation; kinematics; finite volume analysis; basic differential analysis; similitude, dimensional analysis and modelling; viscous flow in pipes; immersed bodies; compressible flow, basic concepts. Home assignments: air-conditioning; applications of basic fluid mechanics, e.g., calculation of anchoring forces and flow/pressure losses in simple pipe systems.

Code: 0322. **Name:** Laboratory Work.

Credits: 0. **Grading scale:** UG.

Admission

Assumed prior knowledge: FMAA01 Calculus in One Variable. FMA420/FMAB20 Linear Algebra, FMA430/FMAB30 Calculus in Several Variables

The number of participants is limited to: No

Reading list

- Çengel, Y. A., Boles, M. A., Kanoglu, M.: Thermodynamics – An Engineering Approach, Ninth Edition in SI Units. McGraw-Hill, 2020, ISBN: 978-981-3157-87-3. Previous editions in SI units work well (5th to 8th).
- Andrew L. Gerhart, John I. Hochstein and Philip M. Gerhart: Munson, Young, and Okiishi's Fundamentals of Fluid Mechanics - International Adaptation, 9th edition. John Wiley & Sons, 2021, ISBN: 978-1-119-70326-6. Previous editions can not be used.
- Supplementary material can be purchased from university book shop (KFS).

Contact and other information

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