

Fluid Dynamics

Subject area: Mechanical Engineering

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| University: | CTU |
| Level: | BA2, BA3, BA4, MA all years |
| Teaching mode: | hybrid: some students participate online, other students attend real-life |
| Instructor(s): | Ing. Navid Aslfattahi, PhD. Ing. Petr Jančík |

Short description

The first course in Fluid Mechanics designed to provide the fundamental tools necessary to analyse a fluid systems and predict its behaviour.

Full description

01. Hydrostatics. Pascal's law. Basic equations. Archimedes' law. Absolute and relative balance. Euler equation of hydrostatics and its integration.
02. Wall forces. Methods of calculation. Determining location and direction.
03. Basic equation of fluid dynamics - equation of continuity, motion equations and energy. Link with concepts in the subject of Thermomechanics.
04. Flow of perfect fluid. Outflow from vessels. Real fluid discharge. Overflow. Flow through a flooded hole.
05. Flow of the perfect fluid through the pipe. Basic equations. Real fluid flow. Local and frictional losses.
06. Unsteady flow. Water stroke. Absolute and relative flow.
07. Dynamic effects of fluid flow. Propulsion power. Euler's pump and turbine equation.
08. Laminar flow, flow in circular tube. Analytically solvable cases of laminar flow. Turbulent flow. Turbulence characteristics. Flow around a flat plate, boundary layer. Drag.
09. Flow around cylindrical body, spherical body, wing section. Lift and drag. Flow separation. Aerodynamic characteristics of the wing.
10. Fundamentals of the theory of similarity. Dimensional analysis. Similarity numbers and laws.
11. Compressible fluid flow. One dimensional isotropic flow. Outlet and maximum speed. The speed of sound. Mach number. Critical conditions. Hugeniot's theorem.
12. Perpendicular adiabatic shock wave. Nozzle and diffuser flows. Flow under non-design conditions. Aerodynamic choking.

More informations about the course is available on the following link:

<https://kos.fs.cvut.cz/synopsis/course/E121502>

Learning outcomes

Understanding of the basic principles of Fluid Mechanics, ability to solve basic Fluid Mechanics problems.

General information

Contact hours per week: Lectures 3 hours (135min), Tutorials 2 hours (90min)

Total workload: 125 (in student hours for the whole course)

ECTS credits: 5

Language: English

Course start date: 19 September 2022

Course end date: 15 January 2023

Add. info about start date: Start course date refers to start of the semester at CTU. Schedules will be available 1-2 weeks before semester starts. Lectures are taken place from 19.9.2022 until 15.1.2023. Examination period from 16.1.2023 until 19.2.2023.

Weekly teaching day/time:

Time zone: CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

Further information:

Prerequisites: Fundamentals of university Mathematics and Physics.

Activities and methods: Lectures, Lab-work, Self-study, Tutorial sessions

Presence on campus:

Final examination

Form: written and oral exam

Date:

Location/format:

Re-sit possibility:

Transcript available: end of semester

Add. info/requirements: - assessment based on attendance at tutorials and development of lab protocols.

- exam - the written part consists of two examples and 10 short theoretical questions. This is followed by an oral part with additional questions if necessary.

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

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| Number of places: | 15 |
| Minimum participants: | 5 |
| Internal course code: | E121502 |
| Contact: | micchal.schmirler@fs.cvut.cz |

This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit www.euroteq.eu or get in touch with the above-mentioned point of contact.