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| **Thermal and Fluid Machines II.** |

**Code:** **MFHOG32G03-EN**

**ECTS Credit Points: 3**

**Evaluation: exam**

Year, Semester: 3rd year/1st semester

Number of teaching hours/week:

Lecture: **2**

Practice: **1**

**Prerequisites: Thermodynamics and Fluid Mechanics II. MFHOA32G05-EN**

**Topics:**

It reviews the basic relationships of thermodynamics and fluid mechanics. Representations of the construction and operation of fluid machines. Fitting the suitable pumps, fans to the system characteristics. Calculating energy consumption. Fluid machines connected in series and parallel. Representations of system components.

**Literature:**

1. T. Wright: Fluid Machinery: Performance, Analysis, and Design, ISBN 978-0849320156, CRC Press 1999.
2. I. J. Karassik, J. P. Messina, P. Cooper, C. C. Heald: Pump Handbook, ISBN 978-0070340329, McGraw-Hill Professional 2000.

**Schedule**

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| **1st week:**  **Lecture:** System components, system classification,basic relationships of thermodynamics, fluid flow, laminar flow, turbulent flow.  **Practice:** basic relationships of thermodynamics | **2nd week:**  **Lecture:** Basic relationships of fluid flow, continuity, Bernoulli equation, major and minor losses, friction coefficient, roughness, sudden enlargement and contraction, exit and entrance losses, gradual enlargement and contraction. Valves and Kvs values.  **Practice:** basic relationships of fluid flow. |
| **3rd week:**  **Lecture:** Centrifugal pumps, construction of pumps, pump operation, wet and dry runner pumps, materials.  **Practice:** Choosing regulating valves, turbo machinery system components. | **4th week:**  **Lecture:** Pump curves, shut-off Head, maximum flow. Flat and steep characteristic curves. System characteristics. A duty point. Open systems, closed systems.  **Practice:** Pump choosing. Calculating the mass flow. |
| **5th week:**  **Lecture:** Pump efficiency, efficiency curves. Resistances connected in series and parallel. Pumps connected in series and parallel. Non-return valve.  **Practice:** Pump choosing in case of open and closed systems (a heating system, a cooling tower system) | **6th week:**  **Lecture:** Adjusting pump performances. A throttle control, a bypass control, modifying an impeller diameter, a speed control  **Practice:** Exercises on connected pumps. |
| **7th week:**  **Lecture:** Laws of affinity. Cavitations. NPSH. Review selection of pumps.  **Practice:** Compare the methods of adjusting pump performance. | **8th week:**  **Lecture:** Centrifugal and axial fans. Forward curved impellers, radial impellers, backward curved impellers.  **Practice:** Calculating energy consumption Affinity laws. |
| **9th week:**  **Lecture:** Tube axial fans, vane axial fans. Fan selections. Fan curves. Fans connected in series and parallel.  **Practice:** Fan selections. Calculating a duty point. | **10th week:**  **Lecture:** Fan laws. Fan installation and maintenance. A standard drive. Noises.  **Practice:** Exercises in connected fans. |
| **11th week:**  **Lecture:** Gas turbines. The gas turbine cycle. Performance and efficiency. Engine sections. Inlet, compressors, diffuser, combustor.  **Practice:** Elaborating the homework. | **12th week:**  **Lecture and Practice:** Visitation of the Sustainable Building EnergeticIinformation Centre. Introduction of the building. |
| **13th week:**  **Lecture:** The current situation in energetics.  **Practice:** Elaborating the homework. | **14th week:**  **Lecture:** Submitting the homework.  **Practice:** End-term test. |

**Requirements**

**A, for a signature:**

Attending **lectures** is recommended, but not compulsory.

Participation at **practice classes** is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, being discussed with the tutor.

Students have to **submit the homework** as scheduled minimum at a sufficient level.

During the semester there is one test in the 14th week. Students have to sit for the test.

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**B, for a grade:**

The course ends in an **exam grade**. The semester grade is based on the result of the test and the examt. The grade is calculated as an average of them:

* the grade of the end-term test
* the exam grade.

The minimum requirement for the end-term test is 50%. The grade for the test is given according to the following table:

Score Grade

0-50 fail (1)

51-60 pass (2)

61-70 satisfactory (3)

71-80 good (4)

81-100 excellent (5)

If the score of the test is below 50%, the student once can take a retake test of the whole semester material.

The examination consists of two parts:

1. Two exercise tests during the semester.
2. A 20-minute theory test.

The grade for the exam is given in the same way as given for the end-term test. (the table above)