Machine Elements I.

Code: MK3GEP1G05GX17-EN

ECTS Credit Points: 5

Year, Semester: 2nd year, 2nd semester

Its prerequisite(s): MK3SZILG04GX17, MK3CADRG04GX17

Further courses are built on it: Yes

Number of teaching hours/week (lecture + practice): 3+2

Topics:

The series of lectures are based on the topics of technical drawing and mechanics. It reviews the fundamental relations of the sizing procedure of machineries (stress analysis for static combined loads; dimensioning on strength at harmonically varying loads, fatigue and life of members) and the concept of manufacturing tolerance and fitting. After that it deals with connections between components (connection with force transmission by friction, positive connections, bolted joints, weldings), gaskets, elastic connections (metal springs, rubber springs) beds for machine eg. rolling bearings, plain journal bearings. In the laboratory, being connected with the lectures machine elements are studied and tests of them are carried out. In seminars there are two design tasks to elaborate: a welded machinery base, and a hydraulic cylinder.

Literature:

Compulsory:

- TIBA ZS.: Machine Drawing, Debrecen University Press 2010. ISBN 978-963-318-066-2,
- Joseph Shigley, Charles Mischke, Richard Budynas: Mechanical Engineering Design, 7th Edition Hardcover with access card, 1056 pages©2004, ISBN-13 9780072921939
- Ansel Ugural, NEW JERSEY INSTITUTE TECH: Mechanical Design: An Integrated Approach, 1st Edition Hardcover with access card, ©2004, ISBN-13 9780072921854

Recommended:

- Tiba Zsolt: Drivetrain Optimization, Lambert Academic Publishing, 2016. (ISBN:9783659859274)

Schedule

1st week Registration week	
2nd week: **Lecture:** Requirements against components, stressing theories. **Practice:** issuing task 1: Designing a welded machinery base.	**3rd week:** **Lecture:** Theory of a fatigue failure, designing a simple and a combined fluctuating load. Goodman diagram, Smith diagram. **Practice:** Scathing different constructions for a welded base. Measuring the dimension of parts, calculating the tolerance and fit dimensions.
4th week: **Lecture:** Power screws and fasteners. Free body diagrams of power screws, wrench torques. Fastener materials and stress. Lap joints from bolted joints. Bolt tightening of pressure vessel caps.	**5th week:** **Lecture:** Riveted joints. Welded joints, strength of a butt and lap joint subjected to a constant load, a fatigue load and an eccentric load. **Practice:** Constructing a welded base. Dimensioning the position of the frame parts, prescribing the welded

Practice: Design of welded constructions. Dimensioning a welded base. Determining the friction coefficient in a bolted joint by measurement.	joints. Dimensioning the hole system of the prime mover and machine. Dimensioning the hole system of the frame fixing to the floor.
6th week:	7th week:
Lecture: Positive and frictional torque transmitting connections. Torque capacity of keyed joints, spline joints, clamped joints.	**Lecture:** Seals, operation principles. Contacting and non -contacting seals and their application fields.
Practice: Submitting a welded base design. Issuing a hydraulic cylinder designing task.	**Practice:** Studying the operation method of a hydraulic cylinder, determining its main dimensions.
8th week: 1st drawing week	
9th week:	10th week:
Lecture: Springs, tasks and operation principles of springs. Stressing of bar springs, leaf springs, multi-leaf springs, Belleville springs.	**Lecture:** Helical springs, designing and stressing for a fatigue load.
Practice: Sketching different constructions for a piston, a cap and a cover regarding sealing.	**Practice:** Sketching different constructions for a piston, a cap and a cover regarding sealing, studying similar constructions.
	Determining a spring diagram by measuring.
11th week:	12th week:
Lecture: Rubber springs, features and spring diagrams. Designing and stressing block and cylindrical rubber springs for compression, shear and torsion load.	**Lecture:** Bearings, lubrication principles and methods. Heat balance and application fields of journal bearings.
Practice: Constructing the assembly drawing of a hydraulic cylinder.	**Practice:** Constructing the assembly drawing of the hydraulic cylinder.
13th week:	14th week:
Lecture: Rolling bearings, features of different types of bearings. Separable, non separable bearings, bearing clearances (initial, mounting, working).	**Lecture:** Bearing arrangements. Locating, non locating bearing arrangement. Cross located bearing arrangements with adjusted or floating bearings. Selection of ball and roller bearings for service life.
Practice: Elaborating the shop drawings of the parts: a piston, a piston rod, a head, and a cover.	**Practice:** Elaborating the records of stressing and design.
15th week: 2nd drawing week	

Requirements

A, for a signature:

Attendance at **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. A student can't make up any practice with another group. 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, to be discussed with the tutor. Students are required to bring the drawing tasks and drawing instruments of the course to each practice class. Active participation is evaluated by the teacher in every class. If a student's behavior or conduct doesn't meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Students have to **submit all the two designing tasks** as scheduled minimum on a sufficient level.

During the semester there are two tests: the mid-term test in the 8th week and the end-term test in the 15th week. Students have to sit for the tests.

B, for grade:

The course ends in an **examination**. Based on the average of the grades of the designing tasks and the examination, the exam grade is calculated as an average of them:

- the average grade of the two designing tasks
- the result of the examination

The minimum requirement for the mid-term and end-term tests and the examination respectively is 60%. Based on the score of the tests separately, the grade for the tests and the examination is given according to the following table:

Score	Grade
0-59	fail (1)
60-69	pass (2)
70-79	satisfactory (3)
80-89	good (4)
90-100	excellent (5)

If the score of any test is below 60, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

An offered grade: it may be offered for students if the average grade of the two designing tasks is at least satisfactory (3) and the average of the mid-term and end-term tests is at least satisfactory (3). The offered grade is the average of them.