

## Machine Elements II.

Code: MK3GEP2G05GX17-EN

ECTS Credit Points: 5

Evaluation: exam

Year, Semester: 3<sup>rd</sup> year, 1<sup>st</sup> semester

Its prerequisite(s): Machine Elements I

Further courses are built on it: Yes/No

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

### Topics:

The series of lectures review types of couplings, clutches and breaks and their sizing. It deals with classification and sizing of shafts, gives review of the components of drive chains, and the construction of a drive chain. Operation methods of a belt and a chain drive, mechanical relations of a sizing procedure. After that it deals with the types of gearing, gear tooth geometry, load capacity of gears, design of geared transmission. In the laboratory, connected to the lecture the machine elements are studied and tests of them are carried out. In seminars there are two design tasks to elaborate: an external long-shoes drum break, and a counterdrive containing a V-belt drive and a chain drive.

### 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

#### 1<sup>st</sup> week Registration week

##### 2<sup>nd</sup> week:

**Lecture:** Energy equilibrium of braking processes. A mechanical model of a winch crane.

**Practice:** Issuing task 1: Designing an external double-shoe thruster released a drum brake.

##### 4<sup>th</sup> week:

**Lecture:** Derivation of the braking moment capacity of an internal shoe drum brake, band brakes and disc brakes and clutches. A uniform wear model, a uniform pressure model.

**Practice:** A service diagram of a brake: maximum brake moment, maximum drum speed, checking for heat generation. Designing the brake spring, selecting the brake thruster.

##### 6<sup>th</sup> week:

**Lecture:** Couplings, rigid couplings, flexible couplings, universal joints. Supplementary loads on shafts having misalignment.

##### 3<sup>rd</sup> week:

**Lecture:** Calculation of an external shoe drum brake, a serviceable diagram. Designing a brake spring and choosing its thruster.

**Practice:** Scathing different constructions for brake actuation.

##### 5<sup>th</sup> week:

**Lecture:** Designing steps of an external shoe thruster released drum brake.

**Practice:** Constructing a brake assembly drawing.

##### 7<sup>th</sup> week:

**Lecture:** Belt drives. Flat, round, V and timing belts. Forces on a belt, optimal belt speed. Belt drive

**Practice:** Submitting a brake design. Issuing a counter drive designing task.

arrangements, selection procedure of a belt profile, designing a belt drive.

**Practice:** Designing the layout of a counter drive. Dividing the total speed ratio for a belt drive and for a chain drive.

#### 8<sup>th</sup> week: 1<sup>st</sup> drawing week

##### 9<sup>th</sup> week:

**Lecture:** A chain drive. Types and application fields of chains, chordal action. Designing a chain drive, selecting a chain from brand catalogue.

**Practice:** Designing a belt and a chain drive of a counter drive.

##### 11<sup>th</sup> week:

**Lecture:** Gears, types of gears. Nomenclature of a spur gear. Involving gears. A standard basic rack tooth profile.

**Practice:** Designing a counter shaft bearing. Selecting ball bearings.

##### 13<sup>th</sup> week:

**Lecture:** Definition of a modified gear's dimensions. Checking gears for crest width, contact ratio and undercut.

**Practice:** Elaborating an assembly drawing. Designing a chain drive chasing.

#### 15<sup>th</sup> week: 2<sup>nd</sup> drawing week

##### 10<sup>th</sup> week:

**Lecture:** A shaft and its associate parts. Designing a shaft and stressing against fatigue, plastic deformation, elastic deflection and critical speed.

**Practice:** Designing a counter shaft and its keyed joints. Stressing a shaft and checking against fatigue and plastic deformation.

##### 12<sup>th</sup> week:

**Lecture:** Unmodified, modified gear pairs, addendum modification.

**Practice:** Constructing an assembly drawing of a counter drive.

##### 14<sup>th</sup> week:

**Lecture:** Load bearing capacity of a gear. Resistance to pitting, tooth root bending.

**Practice:** Elaborating the shop drawing of the parts: a shaft, a pulley, a sprocket, a bearing house.

## 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 8<sup>th</sup> week and the end-term test in the 15<sup>th</sup> 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 good (3) and the average of the mid-term and end-term tests is at least good (3). The offered grade is the average of them.