

ME-302

Mechanical design principles

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Cursus	Sem.	Type
Mechanical engineering	BA5	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	1 weekly
TP	1 weekly
Number of positions	

Summary

We will study the working principles and physics of essential mechanical components for diverse applications in engineering mechanics. The course will serve as a vehicle to introduce and synthesize new mechanisms to strengthen the often-intuitive design processes.

Content

1. Introduction. Course outline. Standards, Engineering codes, Probability, Reliability, Design factor, Eco-pod project description
2. Structural analysis, Simple truss, Project requirements + Biblio/ citation rules
3. Exercises / Project definitions and task management
4. Simple joints: Zero force members method of sections space trusses, linkages
5. Friction elements I: Internal forces In rigid bar, cables, angle of friction, wedges
6. Fixed joints: Bolts and threads (« self-locking » or not?), Joint fixations (bolted and welded)
7. Power transmission: Flat power belts /cable tension
8. Brakes: Gears, Bearings, Collar bearing, Disk brakes
9. Compliant mechanisms, Springs
10. Moving joints I: Virtual work, kinetics of bars
11. Moving joints II: Planar kinematics of a rigid body
12. Relative motions, last report check w/ RG
13. Course overview I, presentation 15 min (group 1-8)
14. Course overview II, presentation 15 min (group 9-16)

Learning Outcomes

By the end of the course, the student must be able to:

- Use experimental and numerical analysis tools with ease and fluency, CP2
- Model the defined problem based on the geometric, kinematic / dynamic, material assumptions while choosing suitable numerical and analytical tools followed by the experimental validation, CP6
- List the functions of an existing or new product based on the specifications, CP4
- Choose the main design solution based on the required functional components and other quantifiable design parameters (i.e. mechanical performance, manufacturing costs, development time, available technology), CP5
- Identify the main- and sub-functions of a mechanical system and corresponding main- and sub-systems in a complete mechanical system / machine to classify the required constitutive elements, CP11
- Design a system based on engineering specifications utilizing suitable numerical and analytical tools for optimizing the design parameters, CP10

Assessment methods

1. Midterm exam (40% of grade)
2. First report (0 %)
3. Semi-final report (0 %)
4. Final report (30% of grade)
5. Presentations (30 % of grade)

Resources

Ressources en bibliothèque

- [Shigley's mechanical engineering design / Budynas](#)

Moodle Link

- <https://moodle.epfl.ch/course/view.php?id=14898>