Syllabus

Course title: Machine Construction and Design
Course code: 42153
Scientific sector: ING-IND/14
Degree: Bachelor in Industrial and Mechanical Engineering
Semester: II
Year: 3
Academic Year: 2021-22
Credits: 6
Modular: Yes

Total lecturing hours: 36
Total lab hours: 24
Total exercise hours: 24
Attendance required
Prerequisites: None
Course page: [Course page](https://www.unibz.it/de/faculties/sciencetechnology/bachelor-industrial-mechanical-engineering/course-offering/?academicYear=2021)

Specific educational objectives:
In a first part the course provides a basic introduction to the method of finite elements (FEM) and its application to the structural analysis in the field of machine design, with beam and plane elements. The second part of the course deals with machine elements and their application in mechanical systems.

Lecturer:
Prof. Gorla Carlo

Scientific sector of the lecturer: ING-IND/14
Teaching language: English
Office hours: 18

Teaching assistant (if any):

Office hours

List of topics covered:

Part 1: FEM
- Introduction to Finite Element Method
- 2D Bar and Beam Element
- Shape Functions, Stiffness matrix. Loads and boundary conditions
- Structural Plane Problems Plane Elements

Part 2: Machine Elements
- Mechanical Springs. Types, classification, Properties, Stiffness, Leaf Springs, Helical Springs, Stresses, Assessment
- Transmission Shafts
• Shaft-Hub Connection
• Basics on Gears
• Rolling Bearings: Types, Properties, Application, Calculation of Life, Mounting conditions
• Design Application: Gearbox
• Pressure vessel design. Cylindrical shell and spherical end, Bolts, Flange, Gasket

Teaching format
Frontal lectures, exercises, Design Application with a Written report.

Learning outcomes (ILOs)
The learning outcomes are referred to the Dublin Descriptors:

Knowledge and understanding
1. Knowledge of the basics of the Finite Elements Method
2. Fundamental machine elements and parts.

Applying knowledge and understanding
3. Application of FEM to simple cases
4. Design and assessment of a practical application consisting in a mechanical gearbox

Making judgements
5. Conditions of applicability of the tools for structural analysis, analysis of a complex mechanical systems and identification of the required assessments and their criticality

Communication skills
6. Writing of a report of a design application

Ability to learn
7. Ability to identify the requirements of deeper investigations in a practical application

Assessment

<table>
<thead>
<tr>
<th>Form</th>
<th>Length /duration</th>
<th>ILOs assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise on FEM</td>
<td>2 x 2 hours</td>
<td>3</td>
</tr>
<tr>
<td>Exercise on machine elements</td>
<td>10 x 2 hours</td>
<td>4,6</td>
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<tr>
<td>with design application</td>
<td></td>
<td></td>
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and written report

**Summative assessment**

<table>
<thead>
<tr>
<th>Form</th>
<th>%</th>
<th>Length/duration</th>
<th>ILOs assessed</th>
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<tr>
<td>Written Questions</td>
<td>50%</td>
<td>90 min</td>
<td>1,2</td>
</tr>
<tr>
<td>Oral Exam: discussion of the report</td>
<td>50%</td>
<td></td>
<td>5,7</td>
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**Assessment language**

English

**Evaluation criteria and criteria for awarding marks**

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<thead>
<tr>
<th>Form</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Written Questions</td>
<td>Correct Answers (100%)</td>
</tr>
<tr>
<td>Oral Exam: discussion of the report</td>
<td>Report (40 %) Correctness of the Results (30%) Critical Discussion (30%)</td>
</tr>
</tbody>
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**Required readings**

Lecture notes and documents for exercise, that will be available on the course site

**Supplementary readings**

- COOK, R.D., Finite Element modeling for stress analysis, L Wiley & Sons, 1995 (ENG)
- P. DAVOLI, M. FILIPPINI, C. GORLA, A. LO CONTE, Lezioni sugli organi di macchine, Politecnica (ITA)
- Shigley's Mechanical Engineering Design, McGraw-Hill (ENG)
- G. NIEMANN, H. WINTER, Maschinenelemente, Springer (GER)