### Course title
Machine Construction and Design

### Course code
42153

### Scientific sector
ING-IND/14

### Degree
Bachelor in Mechanical Engineering

### Semester
II

### Year
3

### Academic Year
2020-21

### Credits
6

### Modular

### Total lecturing hours
36

### Total lab hours

### Total exercise hours
24

### Attendance
required

### Prerequisites

### Course page
https://www.unibz.it/de/faculties/scienctechnology/bachelor-industrial-mechanical-engineering/course-offering/?academicYear=2019

### 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

### 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
### 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 with design application</td>
<td>10 x 2 hours</td>
<td>4,6</td>
</tr>
</tbody>
</table>
and written report

**Summative assessment**

<table>
<thead>
<tr>
<th>Form</th>
<th>%</th>
<th>Length/duration</th>
<th>ILOs assessed</th>
</tr>
</thead>
<tbody>
<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>
</tr>
</tbody>
</table>

**Assessment language**

English

**Evaluation criteria and criteria for awarding marks**

<table>
<thead>
<tr>
<th>Form</th>
<th>Weight</th>
</tr>
</thead>
<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>
</table>

**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)