Syllabus

Course description

<table>
<thead>
<tr>
<th>Course title</th>
<th>Fundamentals of Machine Construction and Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course code</td>
<td>42152</td>
</tr>
<tr>
<td>Scientific sector</td>
<td>ING-IND/14</td>
</tr>
<tr>
<td>Degree</td>
<td>Bachelor in Mechanical Engineering</td>
</tr>
<tr>
<td>Semester</td>
<td>1</td>
</tr>
<tr>
<td>Year</td>
<td>III</td>
</tr>
<tr>
<td>Academic year</td>
<td>2020/21</td>
</tr>
<tr>
<td>Credits</td>
<td>6</td>
</tr>
<tr>
<td>Modular</td>
<td>no</td>
</tr>
<tr>
<td>Total lecturing hours</td>
<td>64</td>
</tr>
<tr>
<td>Total lab hours</td>
<td></td>
</tr>
<tr>
<td>Total exercise hours</td>
<td>30</td>
</tr>
<tr>
<td>Attendance</td>
<td>required</td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
</tr>
<tr>
<td>Course page</td>
<td></td>
</tr>
</tbody>
</table>

Specific educational objectives

The course aims to provide the tools and methods used in structural safe design of components present in any mechanical system. In particular, criteria for strength assessment are addressed, under static and time-varying loading conditions. The most common and widely used mechanical components are then analyzed. Modern software for structural design and analysis is introduced and used, to address some actual case studies.

Lecturer                           | Franco Concli, franco.concli@unibz.it             |
Scientific sector of the lecturer  | ING-IND/14                                       |
Teaching language                  | English                                          |
Office hours                       | By appointment                                   |
Teaching assistant (if any)        |                                                  |
Office hours                       | By appointment                                   |
List of topics covered             | The course will cover the following topics:      |
- Fundamentals of machine component design: general concepts about machine element damaging and failure.  
- Static mechanical behavior of materials and their assessment through the tensile test.  |
- Static design criteria: definition of equivalent, limit and admissible stresses. Meaning and use of the safety factor. Failure criteria for ductile and brittle materials. Comparison among the principal failure criteria.
- High-Cycle fatigue criteria: General description of cyclic loading and fatigue damage. Laboratory tests for materials fatigue assessment. Factors that affect fatigue behavior of materials and machine elements. Fatigue curves. Fatigue failure theories and design criteria.
- Cumulative damage: Palmgreen-Miner, Coffin-Manson damage rules.
- Design of principal machine components: shafts, slider and rolling-elements bearings, springs, threaded fasteners, power transmission and gear fundamentals, thin-walled pressure vessels.
- Introduction to Finite Element software: structural analysis.
- Exercises on actual design case studies.

**Teaching format**

Frontal lectures, exercises (Exercises, case studies and computer lab), excursions

**Learning outcomes**

**Intended Learning Outcomes (ILO)**

By the end of the course, students should be able to:

Knowledge and understanding

1. Handle the analysis methods used in structural design of mechanical systems.

Applying knowledge and understanding

2. Know how to face a new project of a mechanical system starting from its functional design.

Making judgements

3. Identify the critical zones and the corresponding stress states of all components of a mechanical system, under service loading conditions.
4. Choose the geometry and materials able to satisfy the requirements of each component in terms of strength, deformation, fatigue life, and so on and realizing the technical drawing of the system.

Communication skills

5. Oral communication skills (technical language)

Ability to learn

6. Ability to autonomously extend the knowledge acquired during the study course by reading and understanding
### Assessment

#### Formative assessment

<table>
<thead>
<tr>
<th>Form</th>
<th>Length /duration</th>
<th>ILOs assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>In class exercises</td>
<td>15 X 120 minutes</td>
<td>2, 3, 4</td>
</tr>
</tbody>
</table>

#### Summative assessment

<table>
<thead>
<tr>
<th>Form</th>
<th>%</th>
<th>Length /duration</th>
<th>ILOs assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written exam – exercises</td>
<td>50%</td>
<td>3/4 exercises (2.5 hours)</td>
<td>2, 3, 4</td>
</tr>
<tr>
<td>Oral exam – theory</td>
<td>50%</td>
<td>open-ended questions</td>
<td>1, 5, 6</td>
</tr>
</tbody>
</table>

- Theoretical knowledge (40%)
- Ability to provide examples/applications of the theoretical concepts (30%)
- Ability to establish relationships between topics (20%)
- Mastery of language (also with respect to teaching language) (10%)

### Assessment language

English

### Evaluation criteria and criteria for awarding marks

The final mark will be obtained combining the evaluations of the final written test and of the oral examination.

### Required readings

Lecture notes and documents for exercise will be available on the reserve collections

### Supplementary readings

- DAVOLI P., VERGANI L., BERETTA S., GUAGLIANO M., BARAGETTI S., Costruzione di macchine 1, McGraw-Hill (ITA)
- Shigley's Mechanical Engineering Design, McGraw-Hill (ENG)