Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Fundamentals of Machine Construction and Design
Course code	42152
Scientific sector	ING-IND/14
Degree	Bachelor in Mechanical Engineering
Semester	1
Year	*III*
Academic year	2020/21
Credits	6
Modular	*no*

Total lecturing hours	64
Total lab hours	
Total exercise hours	30
Attendance	required
Prerequisites	
Course page	

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. - Stress and strain field definitions: tensors and Mohr's circle description. Elastic constitutive relations: Hooke's Laws. Elasto-plastic behavior of ductile materials under simple loading conditions. - 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: <u>Knowledge and understanding</u> 1. Handle the analysis methods used in structural design of mechanical systems. <u>Applying knowledge and understanding</u> 2. Know how to face a new project of a mechanical system starting from its functional design. <u>Making judgements</u> 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. <u>Communication skills</u> 5. Oral communication skills (technical language) <u>Ability to learn</u> 6. Ability to autonomously extend the knowledge acquired during the study course by reading and understanding

Assessment

Formative assessment

Form	Length /duration	ILOs assessed
In class exercises	15 X 120 minutes	2, 3, 4

Summative assessment

Form	%	Length /duration	ILOs assessed
Written exam – exercises	50%	3/4 exercises (2.5 hours)	2, 3, 4
Oral exam – theory	50%	open-ended questions - 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%)	1, 5, 6

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	ISSLER L., RUOß H: HÄFELE P., Festigkeitslehre – Grundlagen, Springer (GER) BERNASCONI A., FILIPPINI M., GIGLIO M., LO CONTE A., PETRONE G., SANGIRARDI M., Fondamenti di costruzione di macchine, McGraw-Hill (ITA) + 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)