

COURSE CARD

Course	Introduction to Elasticity Theory
Code	WMEMRCSI-IET
Academic year	2019/2020
Language	English
Profile of education	general-academic practical
Form of study	full-time study
Type of study	undergraduate (B.Sc.) postgraduate (M.Sc.)
Type of course	obligatory elective
Forms of teaching, number of hours / rigor, total number of hours, ECTS credits	Lectures: 24 / pass Problem-solving: - / - Laboratory: - / - Project: - / - Seminar: - / - Total: 24 ECTS credits: 2
Prerequisites	Mathematics: linear algebra, Euclidean geometry, multivariable calculus, differential equations General Physics: Newtonian mechanics, conservation laws of mass/momentum/energy, gravitation Engineering Mechanics: kinematics, dynamics, statics; force systems Strength of materials: stress and strain, constitutive relations, displacements
Programme	V semester / Mechanics and Machine Design / Computer Techniques in Mechanical Engineering
Author(s)	Andrzej Morka, Ph.D. Department of Mechanics and Applied Computer Science
Course contents	Introduction to tensor calculus, elasticity theory assumptions, stress and strain states, governing equations, example solutions
Course contents (extended description)	<u>Lectures / visual materials presentation:</u> <ul style="list-style-type: none"> • Introduction to tensor calculus (10h): metatheory and classification of science, elements of logic, set theory and number theory, linear algebra, eigenvalue problems, tensor calculus, classical field theory • Assumptions of elasticity theory (2h): continuum model, elasticity • Description of strain state (2h): selected strain measures, interpretation of components, principal values and directions • Description of stress state (2h): stress vector, Cauchy stress tensor, interpretation of tensor components, decomposition into spherical and deviatoric parts • Energy analysis (2h): elastic energy and work, specific energy • Equations of elasticity theory (2h): equilibrium equations, Hooke's law, formulation of elasticity problems, Lamé equations, Beltrami–Mitchell equations • Example solutions of elasticity problems (4h): plane problem – Airy stress function method, spherically symmetric and axisymmetric problems

Recommended reading	Literature: Basic: <ul style="list-style-type: none"> • Walczak J., <i>Strength of Materials and Fundamentals of Elasticity and Plasticity Theory</i>, PWN, 1977 • Bednarski T., <i>Mechanics of Plastic Flow</i>, PWN, Warsaw 1995 • Landau L., Lifshitz E., <i>Mechanics of Continuous Media</i>, PWN 1954 Supplementary: <ul style="list-style-type: none"> • McGinty B., continuummechanics.org • Bower A.F., <i>Applied Mechanics of Solids</i>, CRC Press, 2010
Learning outcomes and competences	<i>Symbol and number / learning outcome / reference to programme outcome</i> W1 / has knowledge of the fundamentals of elasticity theory with respect to strain and stress states, equilibrium equations and elasticity equations / K_W01, K_W09 U1 / is able to correctly formulate an elasticity theory problem and solve it in selected cases of plane or spherically/axisymmetric problems / K_U01 K1 / understands the need and possibilities of continuous learning; is able to inspire and organize the process of improving professional, personal and others' qualifications / K_K01
Learning methods	Lectures are conducted using multimedia presentations. Problem-solving based on multimedia presentations
Assessment criteria	The course is completed on the basis of a pass. Course completion is conducted in written form. The condition for passing is obtaining a positive grade from the written test. Achievement of outcomes W1, U1 – assessed based on theoretical knowledge of elasticity theory. Achievement of outcome K1 – assessed based on the written test. Grades (according to the opinion of the WIM Quality Assurance Committee): Very good: 91–100% Good plus: 81–90% Good: 71–80% Satisfactory plus: 61–70% Satisfactory: 51–60% Fail: ≤50% General grade “pass”: >50% General grade “fail”: ≤50%
ECTS calculation	ECTS balance (student workload) Activity / student workload in hours 1. Participation in lectures / 24 2. Individual study of lecture topics / 19 3. Participation in consultations / 3.5 4. Preparation for assessment / 10 Total student workload: 56.5 hours / 1.88 ECTS (rounded to 2 ECTS) Classes with teacher participation: 27.5 hours / 2 ECTS Practical classes: 0 hours / 0 ECTS

Valid from: 05/Apr/2017

Author(s)

Head of responsible Department/Institute

Roman MORKA, Ph.D.

Elżbieta SZYMCZYK, D.Sc., Prof. of MUT

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