COURSE DESCRIPTION CARD - SYLLABUS

Course name
Theory of plasticity

Course

Field of study
Material Engineering

Year/Semester
1/1

Area of study (specialization)

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
15	15	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr Dariusz Kurpisz

dariusz.kurpisz@put.poznan.pl

Faculty of Mechanical Engineering

Piotrowo 3 Street, 60-965 Poznan

Responsible for the course/lecturer:

Prerequisites

Basic knowledge in range of physics, mathematics, technical mechanics, strength of materials. The ability to solve elementary problems in technical mechanics and strength of materials based on the acquired knowledge, the ability to obtain information from indicated sources. Understanding the need to expand your competences, readiness to cooperate within the team

Course objective

1. Knowing the theoretical and practical problems connected with the using of theory of plasticity in constructions analysis. Handing over to students the basic knowledge in range of theory of plasticity according to curriculum content appropriate for the field of study.

2. Developing students' skills in solving basic problems and modeling simple structural elements in the field of elastic-plastic and analysis of results based on the acquired knowledge.

3. Cultivation at students the ability to team work.

Course-related learning outcomes

Knowledge

1. Modeling and analysis the basic construction's elements in plastic range according to curriculum content appropriate for the field of study, interpretation of obtained results. [K_W05]

2. Formulating and explaining basic plasticity assumptions and theories according to curriculum content appropriate for the field of study, determination the boundary conditiones and range of them application and giveing some examples of using them. [K_W05]

3. Explaining the aim and meaning of the simpified models in engineering practice of plastic working process and construction design. [K_W04, K_W05]

Skills

1. Selecting the right plastic conditions and theories of plasticity and creating the simplified models by solving of simple problems according to curriculum content appropriate for the field of study [K_U09]

2. Investigating the influence of model simplification on precision of obtained results [K_U09]

3. Quantitative and qualitative analysis of numerical results [K_U08]

4. Formulating conclusions basing on obtained results of numerical simulations [K_U08]

5. Using with understanding by selected sources of knowledge (index of basic literature) and collecting the knowledge by other sources [KU_02]

Social competences

1. Actively engaging in solving the posed problems, independently developing and expanding one's competences - [K_K01]

2. Collaboration within the team, fulfilling the duties entrusted as part of the division of labor in the team, responsibility for own work and co-responsibility for the results of the team's work - [K_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Colloquium from theoretical basis of theory of plasticity

Assesment criterion: dst-50%-70%, db 70.1%-90%, bdb 90.1%-

Reports from laboratory exercises, oral and written answers

Assesment criterion: dst-50%-70%, db 70.1%-90%, bdb 90.1%-

Programme content

The stress and strain state, direction and similarity tensor. Linear elastic material physical relations, stress state tensor, strain state tensor an connections between them (Hook’s law), deformations

continuity equations. Schematization the plots of uniaxial tension process, growth of material. Measures of plastics deformations. Work of plastic deformation, plasticity conditions of Tresca St. Venant and HMH. Nadai-Hencky-Iliuszyn deformation theory of plasticity. Levy-Mises and Prandtl-Reuss J2 increment theory of plasticity. Planar state of stress and strain in ideal plastic solid, sliding lines.

Elasto-plastic torsion of rods and beams. Introduction to limit carrying theory of roads constructions.

Laboratory exercises: Material plasticity measures obtained in static uniaxial tension process. Growth index. Influence of stretching velocity. Influence of height of compressed specimen on compression plot. The relation between tensile strength and hardness.

Huber hypothesis verification on the ground of comparison between the limit of plasticity obtained in uniaxial tension and torsion tests. Approximation the tension curve by the using of power curve. The influence of tension velocity on plastic properties. The influence of the initial measuring length on percentage elongating after snagging. Influence of contact surface friction on compression curve. MES analysis of neck initiation phenomenon in tension specimen with plastic materials. MES analysis of plastic swivels under bending load.

Teaching methods

1. Lecture: multimedial presentation, presentation illustrated by the using of examples presented on the blackboard.

2. Labor exercises: practice exercises, making experiments, discussion, work in team.

Bibliography

Basic

1. Życzkowski M., Obciążenia złożone w teorii plastyczności, PWN, Warszawa, 1973

2. Olszak W., Sawczuk A., Perzyna P., Teoria plastyczności, PWN, Warszawa,1965.

Additional

1. Chakrabarty J., Theory of Plasticity, McGraw-Hill, 1987

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	35	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	15	1,0

[1] delete or add other activities as appropriate