module title: **Mechanics of materials**		
field of study: **Mechanical Engineering**	type of study: **full-time**	course code: **B5_13**
course: **Computer Modelling & Simulation**	degree: **Bachelor (BSc)**	year: **II** semester: **IV**
type of classes: **lecture, laboratory**	hours per semester: **30LE, 30Lab**	No of ECTS credits: **5**

MODULE DESCRIPTION

TARGETS

T1. Basic knowledge about mechanics of materials.
T2. Ability to designate strength indicators of constructional materials needed to design machine parts.
T3. Numerical modelling of selected materials mechanics problems using engineering software
T4. Knowledge of mechanics (knowledge of the state of stress and deformation) for elements and construction systems exposed to thermal effects.

PREREQUISITES & ADDITIONAL REQUIREMENTS

R1. Knowledge of mathematic, physics and basics of numerical modelling.
R2. Basic knowledge of mechanics and strength of materials. Basics of material science and material engineering.
R3. Knowledge of basics of theory of elasticity.
R4. Ability to use engineering software used in the computer laboratory
R5. Ability to use of different sources of information and technical drawings.
R6. Ability to work independently and in a group.
R7. Ability to interpretation and presentation of obtained results.

LEARNING OUTCOMES

LO1. Theoretical knowledge in terms of mechanics of materials.
LO2. General knowledge in terms of thermomechanics and theory of elasticity.
LO3. Calculate factors determining mechanical properties of materials and can properly interpret obtained results.
LO4. Define proper calculation model for chosen issues of mechanics of materials.
LO5. Perform computer simulations of chosen issues of mechanics of materials using engineering software.

TEACHERS

- Prof. dr hab. inż. Wiesława Piekarska - piekarska@imipkm.pcz.pl
- Dr inż. Marcin Kubiak - kubiak@imipkm.pcz.pl
- Dr inż. Tomasz Domański – domanski@imipkm.pcz.pl

MODULE CONTENT

LECTURE	hours
L 1-2 – Mechanical properties of materials, isotropy and anisotropy.	2
L 3-4 – Structure of a material, polycrystalline body.	2
L 5-6 – Research of mechanical and thermomechanical properties, methods for determination of stress and strain.	2
L 7-8 – Elastooptics methods, measurement of stress state.	2
L 9-10 – Creep phenomenon - theory of viscoelastic bodies.	2
L 11-12 – Description of nonmechanic impact.	2
L 13-14 – Linear and nonlinear elasticity and plasticity of a body.	2
L 15-16 – Principles of thermomechanics and continuum mechanics. Energy conservation and classical models of continuum body.	4
L 17-20 – Heat transfer issues.	2
L 21-22 – Phenomena of thermoelasticity.	2
L 23-24 – Thermal stress in bars and plates.	2
L 25-26 – Examples of calculations of thermal stress in elastic and elastic-plastic range.	2
L 27-28 – Destruction - scrap of polycrystalline body.	2
L 29-30 – Effect of some factors on fatigue strength. Effect of the notch on the stress distribution, the notch effect in the conditions of constant and variable loads.	2
total	**30**

LABORATORY	hours
Lab 1-2 – Determination of basic strength properties of constructional materials.	2
Lab 3-4– Elastooptic method for measurement of stress state.	2
Lab 5-6 – Determination of strain and stress in bars using tensometers.	2
Lab 7-8 – Determination of the influence of heat loads on the mechanical properties of the material. Dilatometric tests.	2
Lab 9-10 – Accelerated fatigue determination methods.	2
Lab 11-14– Numerical modelling of displacement in mechanically loaded bars.	4
Lab 15-18 – Numerical simulations of strain and stress generated by thermal and mechanical loads.	4
Lab 19-22 – Determination of the influence of load state of construction element on its stress state.	4
Lab 23-26 – Analysis of stress state in spatial bar systems.	4
Lab 27-30 – Numerical modelling of load-bearing systems in the elastic-plastic range using stress-strain curves.	4
total	**30**

TEACHING TOOLS

1 - lecture with the use of multimedia presentations.
2 – laboratories equipped with measuring apparatus
3 – laboratories equipped with computers and computer software

SOURCE LITERATURE

1. Boley B.A., Weiner J.H.: Theory of Thermal Stresses, Dover Publications, New York 1997
2. Bachmacz W., Werner K., Wytrzymałość materiałów - studium doświadczalne. Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2002.

3.	Gawęcki A., Mechanika materiałów i konstrukcji prętowych. Wyd.Pol.Pozn., Poznań 2003.
4.	Dobrzański L.A., Materiały inżynierskie i projektowanie materiałowe. Podstawy nauki o materiałach i metaloznawstwo. WNT, Warszawa 2006
5.	Dyląg Z., Jakubowicz A., Orłoś Z., Wytrzymałość materiałów. WNT, Warszawa 1999.
6.	Herman J., Rafalski Z., Wybrane techniki wytwarzania wyrobów metalowych. Wydawnictwa Pol. Śląskiej, Gliwice 2004.
7.	Hyla I., Sleziona J., Kompozyty. Elementy mechaniki i projektowania, Wydawnictwo Politechniki Śląskiej, Gliwice 2004.
8.	Rusiński, E., Metoda Elementów Skończonych. System COSMOS/M. WKŁ, Warszawa 1994.
9.	Skarbka W., Mazurek A., Podstawy modelowania i zapisu konstrukcji. Helion 2005.
10.	Nowacki W.: Termosprężystość, Ossolineum, Wrocław 1972
11.	Sprężystość – pod redakcją M. Sokołowskiego, PWN, Warszawa 1978
12.	Bąk R., Burczyński T., Wytrzymałość materiałów z elementami ujęcia komputerowego. WNT, Warszawa 2001.