Subject name:	**Structural materials**	**Code:**	**M150**
Type of subject:	**Basic**		
Field of studies:	**MBM / MTR / ETI/ IPEH**		
Degree of studies:	**I**		
Form of studies:	**full time studies**		
Form:	**45Lectures, 15Lab.**		

Lecturer:	**Jacek Senkara;prof. Daniel Debski; PhD; Robert Zalewski PhD DSc.**

Short outline	
Lecture:	1. Structure of metals and alloys - crystalline and amorphous materials, the basics of crystallography, polymorphism and anisotropy of crystalline materials, defects in the crystalline structure and their influence on the properties of metal alloys. Types of solid solutions, intermetallic phases, interstitial and complex structure . 2. The mechanical properties of etructural materials - the density, stiffness, elasticity, static strength, fatigue strength, hardness, toughness, abrasion and brittleness, resistance to creep. 3. Methods for hardening of plastic materials - hardening solution, precipitation, strengthening by the fragmentation of grains, deformation and recovery and recrystallization . 4. Phase equilibrium systems - Gibbs phase rule, the course of phase transformations in the solid state occurring during free cooling or heating of binary alloys individual and the mechanism and kinetics of phase transformations. 5. Iron - carbon alloys - technical mechanical properties of iron, a variety of crystallographic iron phase equilibrium system iron - carbon eutectoid transformation in alloys of iron with carbon, structural equilibrium system Fe - Fe3C phase transitions occurring in alloys of iron - carbon and its impact on the structure and properties of steel . 6. Effect of carbon and alloy additions on the structure and properties of alloys of the Fe -C. 7. Heat treatment of alloys of the Fe- C system . 8. Industrial iron alloys - classification, labelling steel, selection criteria, properties and application examples of industrial steel (structural steel, machine, tool, spring and corrosion resistant and heat-resistant). 9 Aluminium and its alloys - aluminum properties, methods of strengthening aluminum alloys, aluminum alloys division, designation, properties and application examples of aluminum alloys. 10. Copper and its alloys - copper properties, classification and labeling of copper alloys , properties and uses of bronzes and brasses. 11. Structure, properties and applications of ceramic materials - classification of ceramic materials, the technology of their manufacture, microstructure of ceramic materials and its influence on the properties of ceramics, design and operating rules for the application of ceramic to minimize the impact of defects in ceramic materials on the strength of exemplary species of special ceramics. 12. Structure, properties and applications of polymers - classification of polymers , structure of macromolecules and structure of the polymers and their effect on the mechanism of deformation of polymers, elastomers and plastomers characteristics, the use of polymers in the automotive industry, the types of materials, methods of marking. 13. Structure, properties and applications of composites - classification of composites, fiber reinforced composites, fiber-reinforced composites, structural components and their influence on the properties of fiber-reinforced polymer composites, composites reinforced with particles. 14 Surface Engineering - Essence of surface engineering , specify the following: coating, surface layer, surface layer, the distribution of surface engineering techniques, an overview of modern methods of surface engineering: Fluorescent processing, CVD and PVD processes, ion implantation, laser processing, structure and properties of the surface layers, examples of applications, multiplex techniques taking into account the thermal spray processes, detonation and chemical and electrochemical coatings, shaping the properties of structural and functional materials engineered on the surface of the examples for the automotive industry.

Laboratorium:	1. Tensile static testing of metals. Determination of basic mechanical properties. Analysis of fatigue fracture. 2. Measuring the hardness of metals. Performing the measurement BS / EN metal samples of different shape and hardness. 3. Impact testing of metals at room temperature PN / EN under conditions conducive to brittle cracking. Analysis of fatigue fractures. 4. Determination of different rubber hardness of the blend composition, vulcanization and abrasion resistance. 5 Ultrasonic testing. The use of non-destructive methods. Determination of material constants.