Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Fizyka**
Name in English: **Physics**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **university-wide**
Subject code: **FZP001068**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20	10	10		
Number of hours of total student workload (CNPS)	90	60	30		
Form of crediting	Examination	Crediting with grade	Crediting with grade		
Group of courses					
Number of ECTS points	3	2	1		
including number of ECTS points for practical (P) classes		2	1		
including number of ECTS points for direct teacher-student contact (BK) classes	2.0	1.0	1.0		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Competences in subjects Mathematics and Physics with Astronomy for graduate of the Secondary School.

SUBJECT OBJECTIVES

C1. C1. Gain basic knowledge from selected areas of classical and modern Physics.
C1.1. Principles of kinematics, dynamics and law of conservation of impulse, energy and momentum.
C1.2. Vibration and wave motion.
C1.3. Basics of Phenomenological and Statistical Physics.
C1.4. Electrostatics, Magnetostatics and Electromagnetic Induction.
C1.5. Special theory of relativity.
C1.6. Quantum physics, physics of the atom, physics of the atomic nucleus.
C2. C2. Gain skills on qualitative understanding of selected principles and laws of Classical and Modern Physics as well as quantitative analysis selected phenomena from this area of knowledge.
C3. C3. Acquire experience of basic measurements methods and techniques of selected physical quantities and gain skills in:
C3.1. Performing basic measurements of physical quantities.
C3.2. Numerical analysis and processing of experimental data with evaluation of measurement uncertainties.
C3.3. Preparation of written report from performed measurements with application of used software.
C4. C4. Development of social competences including emotional intelligence involving the ability to work in a student group. Fixation of sense of responsibility and honesty in academe and society.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - PEK_W01 knows: a) basics of the vector calculus in the Cartesian coordinate system, c) basics of the unit analysis, the physical quantity concept and the rules of instant estimation of values; the importance of physics in the surrounding world and the everyday life as well as discoveries and achievements of a selected classical and modern physics for the progress of the civilization,
PEK_W02 - has a basic knowledge on the dynamics of the progressive movement, has a knowledge on: a) the conception of the mass and force, b) the condition of applicability of the Newton laws and the correct writing of the equations of motion, c) the formulation of the second law of dynamics using the concept of momentum, d) the formulation of the momentum conservation law.
PEK_W03 - has a knowledge on fields of conservative forces, is able to determine the following physical quantities: the work and the power of a mechanical force, the kinetic and potential energies; knows: a) the law of work and kinetic energy, b) relationship between conservative forces and the potential energy, c) is able to formulate the law of conservation of the mechanical energy.
PEK_W04 - is able to define: the torque, the angular momentum and the moment of inertia for the material points, the system of the material points and the rigid body, the kinetic energy of the system of the material points and the rigid body in the rotary movement, knows the second law of the dynamics for the rotation of a rigid body about a fixed axis, is able to formulate and prove the law of the angular-momentum conservation for: the single particle, the system of the material points, and the rigid body.
PEK_W05 - has a knowledge on the dynamics of the periodic motion, and the detailed knowledge of: a) the harmonic motion of the simple and physical pendula, the particle performing the harmonic oscillations in the vicinity of the balanced state, b) the damped oscillations, c) the forced oscillations and the mechanical resonance.
PEK_W06 - has a knowledge of the wave motion and has the detailed knowledge of: a) basic properties of the mechanical waves (including the sound) and their sources, b) the monochromatic plane wave equations and basic physical quantities of the wave motion, c) velocities connected to the wave motion, d) relations between the wave velocity (including the sound) and the elastic properties of the medium, the mechanical energy transported by the waves, e) the transportation of the mechanical energy by the waves, f) the dependence between the wave intensity and the distance from the wave source, g) the Doppler effect, h) the acoustic-wave interference and the clumping.
PEK_W07 – has a basic knowledge on the principles of the phenomenological thermodynamics, knows basic thermodynamic concepts, the heat transportation and its description, the functions of the thermodynamic state, the thermodynamic processes (the ideal gas, the ideal gas equation), has detailed knowledge on; a) the

thermodynamic temperature scale, b) the conversions of the ideal gas, c) the internal energy and the entropy of the system, d) the work made by gas and the heat exchange in thermodynamic processes of the ideal gas, e) methods of evaluation of the changes of the entropy of the ideal gas, f) the thermodynamics of the heat engines and their efficiency in the direct and reverse cycles, g) the Bolzmann-Planck entropy (the statistical interpretation of the entropy), h) the Bolzmann (barometric formula) and Maxwell distribution functions, i) the average square velocity of the particles of the ideal gas, the microscopic interpretation of the temperature and pressure of the ideal gas; the principle of the equal partition of the heat energy.
PEK_W8 - knows basic mathematical tools of the vector-field analysis: the operators of gradient, divergence, rotation, knows the Gauss-Ostrogradskii and Stokes theorems.
PEK_W9 - has a basic knowledge on the properties of the gravitational and electro-magnetic fields, has a knowledge on the generation of the gravitational, electrostatic, and magnetostatic fields; has a knowledge on the magnetostatics particularly in; a) the impact of the magnetic field on the electric charges and the current carrying conductors (the Lorentz force), b) the Biot-Savart and Ampere laws and their applications for determining the intensity and induction of the magnetic fields of the selected sources (linear and circular current-carrying conductors, coil), c) the definition of unit of the magnetic field intensity; is able to describe quantitatively the potential energy of the magnetic dipole and the torque acting on the magnetic dipole in an external magnetic field; has a knowledge on the energy and the energy density of the electromagnetic field. Furthermore, he/she has a knowledge on the electromagnetic induction phenomenon (knows the Faraday law and the Lenz rule), has a knowledge on the Maxwell equations (the integral form of them) and the material equations.
PEK_W10 has a basic knowledge on the properties of the electromagnetic waves (including the light) and their applications, in particular, knows the concept of the flat monochromatic electromagnetic wave and: a) the wave spectrum, b) the dependence of the refration index on the relative electric and magnetic permeabilities of the medium; has knowledge on the energy and momentum transportation with the waves, the Poynting vector, the interaction of the incident wave with a surface; has a basic knowledge concerning: a) dispersion phenomena, the total internal reflection, method of polarizing the light, the Malus law, b) the light interference in thin film systems, c) the light diffraction, d) the resolution efficiency of the optical systems (the Reyleigh criterion), e) aberrations in the optical systems and animal (human) eyes and correction methods.
PEK_W11- has a knowledge on the special theory of relativity and its applications. In particular he/she knows and understands the Einstein's postulates, the Lorentz transformations and resulting consequences (time dilation, length contraction). Has a basic knowledge on the relativistic dynamics, in particular, knows the concepts of the relativistic momentum of the particle, the relativistic kinetic an total energies, knows the relativistic equation of motion and the relativistic momentum and energy relationship, the equivalence of the mass and the energy and the need to apply the results of the special theory of relativity in the global positioning systems.
PEK_W12- has a basic knowledge on the fundamentals of the quantum physics, the physics of the atom, the solid state physics and some applications; has a detailed knowledge on: a) the black-body radiation, b) the Bohr model of the Hydrogen atom (the energy and angular momentum quantization) and quantum energy levels of the electron in the atom (Franck-Hertz experiment), c) the fotoelectric and Compton effects, d) the interaction of the light with the matter and the fundamentals of the laser working, e) particle-wave duality of the light and the elementary particles (de Broglie hypothesis, the matter waves), f) the Heisenberg uncertainty principle, g) the wave function and its interpretation, h) the (stationary and time dependent) Schrodinger equations, i) the Schrodinger equation of the particle in the infinitely-deep potential wall, j) the quantum tunelling and its applications, k) spin and spin magnetic moment of the electron (Stern-Gerlach experiment), m) the Pauli exclusion principle, quantum numbers of the electrons in the atoms, electronic configurations of the elements of the Mendeleev table, n) specific properties of solids
PEK_W13- has a knowledge on the fundamentals of the physics of the atomic nucleus, in particular, knows indicators that characterize the nucleus and the nuclear forces, has a knowledge concerning a) the bound energy of the nucleons and its importance for the nuclear energy generation, nuclear synthesis b) the laws of the the radiative decay, c) date determination using the isotopes, d) physical principles of the imaging with nuclear magnetic resonance.
PEK_W14- has a knowledge on the basics of the elementary-particle physics and astrophysics, in particular, knows: a) the basic types of the fundamental interactions, b) the standard model of the elementary particles

(leptons, quarks, hadrons, Higgs Boson); c) the structure and types of the matter in the Universe and the standard model of the Universe expansion (the big band, the Hubble law, the cosmic background radiation, the dark matter, the predictable future of the Universe).

II. Relating to skills:

PEK_U01 - PEK_U01 - is able to: a) efficiently apply vector calculus used in physics, b) define and use the conceptions of the instantaneous velocity, the tangential, radial and total acceleration and the orientations of them in the space.

PEK_U02 - can: a) prove the law of the momentum conservation, b) correctly formulate the vector equation of motion and its scalar version in the Cartesian coordinate system, c) solve (ie determine time dependence of basic kinematic quantities) scalar equations of motion taking into account the initial conditions, d) solve problems concerning the collision dynamics using the principle of the momentum conservation.

PEK_U03 - is able to; a) verify the conservative nature of the forces, b) derive and apply the law of conservation of the mechanical energy, c) apply the law of conservation of the mechanical energy to solve problems, d) calculate the mechanical work and the power of the fixed and variable forces, the kinetic and potential energies, changes in the kinetic energy of the particle / body with the theorem on the work and the kinetic energy, e) determine the force vector knowing the analytic form of the potential energy.

PEK_U04 – can derive the law of conservation of momentum of the system of material points, correctly write and solve the equation of the rotational motion with fixed rotation axis and of the translational-rotational motion of the rigid body. Can determine: a) torque, b) angular momentum of single particles and rigid bodies, c) kinetic energy of the rotational motion, work and power in the rotational motion, e) change of the kinetic energy of the rotational motion using the theorem on the work and the kinetic energy; moreover can apply the law of the conservation of the angular momentum to writing and solving specific problems in the rigid-body dynamics.

PEK_U05 - is able to properly describe and analyze equations of periodic motion of: a) pendulums: mathematical, physical as well as particles under potential force, performing small oscillations around the position of equilibrium, b) damping oscillations, c) sinusoidal driving force oscillations. Can determine: periods of vibration, time dependencies of kinematic and dynamic quantities of periodic vibrations, characterize the phenomenon of mechanical resonance and explain its importance (positive and negative) in mechanical elements.

PEK_U06 - can: a) write the wave equation for the monochromatic mechanical plane wave, b) determine values of the basic physical quantities of the wave motion (length and frequency, wave vector, repetition rate, phase velocity, velocity of media particles), c) quantitatively characterize the energy transported by the mechanical waves, and the Doppler, interference and beats phenomena, d) interpret and calculate the loudness level of the sound sources.

PEK_U07 – is able to use the first and the second law of thermodynamics for quantitative and qualitative description of different processes of ideal gas and determine values: a) the heat added to the system, the work done by the ideal gas, changes of the internal energy in gas processes, b) the efficiency of the heat engines working in the direct or reverse cycle. Can: analyze and draw graphics representing processes of the ideal gas, derive the Mayer formula and the equation of the adiabatic process, calculate the heat transfer between materials. He/she can: a) evaluate the dependence of the pressure on the height using the Bolzmann distribution function, b) derive the mean square value of the velocity of the particles in an ideal gas, c) derive the state equation of the ideal gas, d) apply the principle of the equal partition of the heat energy, e) explain the microscopic nature of the temperature and pressure of the ideal gas.

PEK_U08 – can efficiently use mathematical tools of the vector-field analysis to solve simple problems of the electromagnetism.

PEK_U09 – is able to: a) point out the sources of the gravitational and electromagnetic fields, b) derive the Newton and Coulomb laws from the Gauss laws and show the potential character of the gravitational/electrostatic field, c) apply the knowledge of the gravitational field for quantitative and qualitative characteristics of the field, produced by the mass or the system of masses. In particular has skills enabling the calculation of the vectors of the gravitational field intensity for the spherically symmetric mass distribution and the gravitational potential energy, the potential energy of electric/magnetic dipole and torque that acts on the dipole in an external electromagnetic field, the density of energy of the electromagnetic field, on the basis of the Gauss law. He/she is able to describe: a) the magnetostatic field quantitatively (determine the magnetic induction and intensity using the Biot-Savart and Ampere laws) for specific sources of the field (linear and circular current carrying conductor, the coil), b) the motion of the electric charges in the magnetic field (the cyclotron, a selector of the particle velocity, the mass spectrometer), c) determine the force that acts on the conductor with the current placed in the magnetic field, d) to determine the unit of the electric current intensity; has skills enabling the application of the knowledge on the electromagnetic induction to the qualitative and quantitative characterization of the current generators; is able to clarify the non-potential character of the electric field induced by the variable magnetic field; to explain the

meaning of the Lenz rule and to characterize the phenomenon of the electromagnetic induction in the context of the energy conservation law; is able to correctly and precisely explain the meaning of the Maxwell equations (in the integral form) and material equations.
PEK_U10 – is able to apply the knowledge on the physics of the electromagnetic waves and optics (the laws of the geometric optics) to explain and quantitatively analyze specific optical phenomena (the total internal reflection, the interference, the diffraction, the polarization, the dispersion) as well as to quantitatively characterize the resolution ability of optical instruments, wave field, and the energy transportation by waves.
PEK_U11 – is able to apply the knowledge of the special theory of relativity for interpretation of its consequences, in particular to characterize relationships between kinematic and dynamic quantities, measured in two moving relative to each other inertial frames of reference. In particular can a) explain longitudinal, relativistic Doppler effect, b) explain the physical meaning of the formula E = mc2, c) quantitatively analyze the kinematics and dynamics of the linear motion of body under influence of constant force, d), justify the need of applying the special theory of relativity in the global positioning satellite systems.
PEK_U12 – can apply the knowledge on the fundamentals of the quantum physics to the analysis of simple problems and to the quantitative interpretation of specific topics and physical effects which take place on the nanometer or subnanometer scale of the lengths. In particular he/she is able to: a) present the quantization of the energy levels in the Bohr model of the Hydrogene atom, b) explain the importance of the fotoelectric effect and of the experiments by Compton, Franck-Hertz, Stern-Gerlach in the development of the quantum mechanics, c) explain the particle nature of the light, d) explain the particle-wave duality of the light and of the elementary particles, e) explain the wave-function interpretation, f) solve one-dimensional stationary Schrodinger equation of the particle in an infinite potential wall, g) point out the applications of the tunneling effect.
PEK_U13 – can: a) explain physics of the energy generation in the nuclear reactors and tokomaks on the basis of the nucleon-bounding energy, b) indicate and characterize positive and negative aspects of the nuclear energetics, c) characterize the types of the radiative decays, d) characterize the fusion of light nuclea insight the Sun, e) estimate the age of the materials on the basis of the radiative decay law, f) explain physical aspects of imaging the tissues and organs using the magnetic resonance
PEK_U14 – can characterize: a) types of the fundamental interactions, b) the standard model of the elementary particles, c) structure and types of the matter in the Universe, e) the standard model of the expanding Universe.
PEK_U15 – can use simple apparatus to measure values of physical quantities and perform simple and complex measurements of physical quantities using the manual of the test-bench.
PEK_U16 – can elaborate the results of measurements, perform the analysis of the measurement uncertainties

and edit the report of the measurements made in the Laboratory of the Fundamentals of Physics using the knowledge PEK_W01 - PEK_W14, skills PEK_01 - PEK_U14, and computational tools (the text editors, office packages, computational environments).

III. Relating to social competences:
PEK_K01 - PEK_K01 – Searching and objective and critical analysis of information or arguments, rational explanation and justification of their point of view using the knowledge of physics.
PEK_K02 – understanding the need for self- assessment and self-education, including improvement of attention concentration on important issues, developing the capacity for self-knowledge and acquired skills and ability to self- assessment, self-control and responsibility for the results of actions taken.
PEK_K03 – independent and creative thinking
PEK_K04 – work in a team and relying on improving methods for the selection of a strategy to optimally solve the tasks assigned to the group.

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1	Lec 1Organizational matters. Laws od dynamics. Equations of motion.(2h) Lec 2Work and mechanical energy. The laws of conservation of mechanical energy and momentum.(2h) Lec 3Kinematics and dynamics of rotational motion of the rigid body. The principle of conservation of the angular momentum. (2h) Lec 4Oscillations around stable equilibrium state. (2h) Lec 5 Basic properties of mechanical waves. Elements of acoustics. Wave energy.(2h) Lec 6First and second principles of thermodynamics. Ideal gas conversions. Entropy. Real gases (2h) Lec 7Gravitational and electrostatic interactions.(3h) Lec 8Magnetostatic field. Interaction of magnetic field with current currying conductor. Electromagnetic induction. Maxwell equations. Electromagnetic waves.(1h) Lec 9Elements of relativistic kinematics and dynamics. (2h) Lec 14Physics of the atom, atomic nucleus, elementary particles. Elements of astrophysics (2h)	20
		Total hours: 20
Form of classes – Classes		Number of hours
Cl1	Cl. 1Solving selected problems of dynamics of the linear, curvilinear, and rotary motion, with use of mechanical work, kinetic and potential energy, and laws of conservation of mechanical energy, momentum and angular momentum. (4h) Cl. 2Test - evaluation of educational effects relating to skills: PEK_U01, PEK_U06, PEK_K01, PEK_K03 (1h) Cl. 3Analyzing and solving problems of kinematics and dynamics of oscillations and wave movement. (1h) Cl. 4Solving problems of thermodynamics.(1h) Cl. 5Analyzing and solving problems of electrodynamics and special theory of relativity. Analyzing and solving problems of quantum physics. (1h) Cl. 6Test – evaluation of educational effects relating to skills: PEK_U07, PEK_U12, PEK_K01, PEK_K03 (2h)	10
		Total hours: 10

Form of classes – Laboratory		Number of hours
Lab1		10
		Total hours: 10

TEACHING TOOLS USED
N1. N1. Lecture with multimedia presentations (Power Point), demonstrations and showing physical phenomena. N2. Exercises - solving and discussing physical problems. N3. Laboratory exercises - performance and discussion of measurements. Processing of measurements results and estimation of their uncertainties. Evaluation of reports from performed laboratory measurements. N4. Own work - solving problems in frames of preparation to exercises. N5. Own work - preparation of laboratory experiments and measurements. N6. Own work - individual studies of material presented during lecture. N7. Consultations. N8. Laboratory exercises and problems solving - written tests.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W14, PEK_U01-PEK_U16, PEK_K01-PEK_K04	Written/oral exam.
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U16; PEK_K01-PEK_K04	Oral answers, discussions, written tests.
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U16; PEK_K01-PEK_K04	Oral answers, written tests and reports of laboratory exercises.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] D. Halliday, R. Resnick, J. Walker, Podstawy fizyki, tomy 1.2., Wydawnictwo Naukowe PWN, Warszawa 2003; J. Walker, Podstawy fizyki. Zbiór zadań, PWN, Warszawa 2005 i 2011.
[2] Paul A. Tipler, Ralph A. Llewellyn, Fizyka współczesna, Wydawnictwo Naukowe PWN, Warszawa 2012;
[3] I.W. Sawieliew, Wykłady z fizyki, tom 1. i 2., Wydawnictwa Naukowe PWN, Warszawa, 2003.
[4] W. Salejda, Fizyka a postęp cywilizacyjny (45,35 MB), Metodologia fizyki (1,1MB); available at http://www.if.pwr.wroc.pl/index.php?menu=studia&left_menu=jkf

SECONDARY LITERATURE

[1] J. Massalski, M. Massalska, Fizyka dla inżynierów, cz. 1. i 2., WNT, Warszawa 2008.
[2] J. Orear, Fizyka, tom 1. i 2., WNT, Warszawa 2008.
[3] Z. Kleszczewski, Fizyka klasyczna, Wyd. Politechniki Śląskiej, Gliwice 2001.
[4] L. Jacak, Krótki wykład z fizyki ogólnej, Oficyna Wydawnicza PWr, Wrocław 2001;
[5] K. Sierański, K. Jezierski, B. Kołodka, Wzory i prawa z objaśnieniami, cz. 1. i 2., Oficyna Wydawnicza SCRIPTA, Wrocław 2005; K. Sierański, J. Szatkowski, Wzory i prawa z objaśnieniami, cz. 3., Oficyna Wydawnicza SCRIPTA, Wrocław 2008.
[6] Witryna dydaktyczna Instytutu Fizyki PWr w zakładce Jednolite kursy fizyki znajdują się zalecane e-materiał dydaktyczne.

Supplementary literature in English

[1] H.D. Young, R.A. Freedman, SEAR'S AND ZEMANSKY'S UNIVERSITY PHYSICS WITH MODERN PHYSICS, Addison-Wesley Publishing Company, wyd. 12. z 2008 r.
[2] D.C. Giancoli, Physics Principles with Applications, 6th Ed., Addison-Wesley, 2005; Physics: Principles with Applications with MasteringPhysics, 6th Ed., Addison-Wesley 2009.
[3] R.A. Serway, Physics for Scientists and Engineers with Modern Physics, 8th Ed., Brooks/Cole, Belmont 2009;
[4] [4] P.A. Tipler, G. Mosca, Physics for Scientists and Engineers, Extended Version, W. H. Freeman 2007.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Physics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01÷PEK_W14	K1MBM_W02	C1, C2, C4		N1, N6

PEK_W07	K1MBM_W06	C1, C2, C4		N1, N6
PEK_W01÷PEK_W04	K1MBM_W07	C1, C2, C4		N1, N6
PEK_U01÷PEK_U14	K1MBM_U01	C1, C2		N1, N2, N4, N6, N7
PEK_U15÷PEK_U16	K1MBM_U12	C3		N3, N5, N6, N7, N8
PEK_U01÷PEK_U16	K1MBM_U04	C1, C2, C3, C4		N4, N5, N6
PEK_U01÷PEK_U05	K1MBM_U08	C1, C2		N2, N4, N6, N7, N8
PEK_U07	K1MBM_U10	C1, C2		N2, N4, N6, N7, N8
PEK_K01÷PEK_K04	K1MBM_K01, K1MBM_K02, K1MBM_K03, K1MBM_K04, K1MBM_K05, K1MBM_K06, K1MBM_K07	C4		N1÷N8
PEK_U06, PEK_U07	K1MBM_U06	C2		N2,N4,N7,N8
PEK_U09	K1MBM_U06	C2		N3,N5,N7,N8
PEK_K01-PEK_K08	K1MBM_K02	C1, C2, C3		N1-N7

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK KURSÓW HUMANISTYCZNYCH (Ochrona własności)**
Name in English:
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **HMH100035BK**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1		10
		Total hours: 10

TEACHING TOOLS USED

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	wg kart opracowanych przez SNH	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W	K1MBM_W28	wg kart opracowanych przez SNH		wg kart opracowanych przez SNH

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK JĘZYKI OBCE**
Name in English:
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **university-wide**
Subject code: **JZM042050BK, 2051BK**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					
Number of hours of total student workload (CNPS)					
Form of crediting					
Group of courses					
Number of ECTS points					
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

TEACHING TOOLS USED

N1.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01, PEK_U02	K1MBM_U03, K1MBM_U42, K1MBM_U44	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO
PEK_K01	K1MBM_K01	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO

SUBJECT SUPERVISOR

Prof. dr hab. inż. Antoni Gronowicz tel.: 71 320-27-10 email: antoni.gronowicz@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Algebra z geometrią analityczną**
Name in English: **Algebra and Analytic Geometry**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **university-wide**
Subject code: **MAP001095**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20	10			
Number of hours of total student workload (CNPS)	60	60			
Form of crediting	Examination	Crediting with grade			
Group of courses					
Number of ECTS points	2	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1.5	1.0			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		1
Lec7		3
Lec8		2
Lec9		2
Lec10		2
		Total hours: 20
Form of classes – Classes		Number of hours
Cl1		2
Cl2		2
Cl3		2
Cl4		2
Cl5		1
Cl6		1
		Total hours: 10

TEACHING TOOLS USED
N1. N2. N3. tutorials N4.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W3 PEK_K02	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U03 PEK_K01-PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Algebra and Analytic Geometry
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W01	C1-C4		N1, N3, N4
PEK_U01-PEK_U03	K1MBM_U05	C1-C4		N2, N3, N4
PEK_K01-PEK_K02	K1MBM_K01, K1MBM_K04	C1-C4		N1- N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Analiza matematyczna**

Name in English: **Mathematical Analysis**

Main field of study (if applicable): **Mechanical Engineering and Machine Building**

Level and form of studies: **I level, part-time**

Kind of subject: **university-wide**

Subject code: **MAP001096**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	20			
Number of hours of total student workload (CNPS)	150	90			
Form of crediting	Examination	Crediting with grade			
Group of courses					
Number of ECTS points	5	3			
including number of ECTS points for practical (P) classes		3			
including number of ECTS points for direct teacher-student contact (BK) classes	3.0	2.0			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		1
Lec3		2
Lec4		2
Lec5		1
Lec6		2
Lec7		2
Lec8		1
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		3
Lec14		2
Lec15		3
Lec16		1
		Total hours: 30
Form of classes – Classes		Number of hours
Cl1		5
Cl2		2
Cl3		1
Cl4		3
Cl5		2
Cl6		1
Cl7		2
Cl8		3
Cl9		1
		Total hours: 20

TEACHING TOOLS USED

N1.
N2.
N3. tutorials
N4.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03 PEK_K02	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U04 PEK_K01-PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mathematical Analysis
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W01	C1-C4		N1, N3, N4
PEK_U01-PEK_U04	K1MBM_U05	C1-C4		N2, N3, N4

PEK_K01-PEK_K02	K1MBM_K01, K1MBM_K04	C1-C4		N1 - N4

SUBJECT SUPERVISOR

doc. dr inż. Zbigniew Skoczylas email: zbigniew.skoczylas@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Proseminarium dyplomowe**
Name in English: **Thesis proseminar**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MM032208**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					10
Number of hours of total student workload (CNPS)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic engineering knowledge in the field of manufacturing technology, process equipment and materials science.
2. Ability to acquire the information from different sources also in foreign languages.
3. Can formulate and justify its views, participate in the discussion in the field of science and technology, prepare and discuss own presentation.

SUBJECT OBJECTIVES

C1. Acquire the abilities of developing the editorial and substantive skills in editing master thesis.
C2. Acquiring the abilities to develop research results and to formulate conclusions and to present own work.
C3. Preparing students for the final master exam. The replay of selected information from the field of studies.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - Can in a transparent and communicative way prepare and give a presentation, discuss the plan to achieve the master thesis.
PEK_U02 - Can easily carry on a discussion on master thesis and on topics related to field of study.
PEK_U03 - Can develop and discuss the topics on the diploma examination and answer to questions.

III. Relating to social competences:

PEK_K01 - Has a sense of responsibility for its own work and its impact on the functioning of the company.
PEK_K02 - Understands necessity of critical discussion of results of the done teamwork.
PEK_K03 - Understands the need for lifelong learning and development the professional and social skills.

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1	Presentation of the program, the purpose and scope of activities. Overview of the principles of writing master thesis. Distribution of questions to self-develop in the field of the final exam. Determination of the order of master's thesis presentations.	1
Sem2	Discussion of the diploma examination questions by the students in the group A Discussion of the diploma examination questions by the students in the group B Discussion of the diploma examination questions by the students in the group C	4
Sem3	Presentation of theses implementation plan. Discussion.	4
Sem4	A summary of the seminar. Discussion. Pass.	1
		Total hours: 10

TEACHING TOOLS USED

N1. multimedia presentation
N2. problem discussion
N3. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement

F1	PEK_U01, PEK_U02	Rating the presentations, discussion and active participation skills.
F2	PEK_U03	Rating of the prepared questions for the final exam
P = (0,7F1 + 0,3F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Baranowski B.; Metody twórczego rozwiązywania problemów inżynierskich. Wielkopolska Korporacja Techniczna NOT, Poznań 1999

SECONDARY LITERATURE

Wiszniewski A.; Sztuka pisania. Videograf II, Katowice 2003

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Thesis proseminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01, PEK_U02	K1MBM_TSW_U01, K1MBM_TSW_U02, K1MBM_TSW_U03, K1MBM_TSW_U05, K1MBM_U01, K1MBM_U12	C1, C2		N1, N2
PEK_U03	K1MBM_U01, K1MBM_U04	C3		N1, N3
PEK_K01-PEK_K03	K1MBM_K01, K1MBM_K04, K1MBM_K06, K1MBM_K09	C1, C2		N1 - N3

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Elektronika**
Name in English: **Electronics**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMD032001**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of physics, electrical engineering and chemistry at the high school level.
2. Ability to measure the basic electrical quantities.

SUBJECT OBJECTIVES

C1. Understanding the physical phenomena occurring in semiconductors.
C2. Understanding the construction's principles and applications of selected semiconductor devices and integrated circuits
C3. Understanding the construction's principles and applications of basic electronic devices (power supplies, amplifiers, analog to digital converter, digital to analog converter, digital oscilloscope).
C4. Usage of the acquired knowledge, presented during the lecture, for solving technical issues.
C5. Learning how to study the technical literature and to prepare the student for self-education.
C6. Acquiring the ability to choose the active and passive electronic elements for specified applications (for construction of sensors used in mechanics).

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student has expertise in the field of physics, including mechanics, thermodynamics, optics, electricity and magnetism, nuclear physics and solid state physics, including the knowledge necessary to understand the basic physical phenomena occurring in electronic components and circuits and in their environment/surrounding.

PEK_W02 - The student understands the physical basis of the operation of semiconductor devices and the importance of their parameters.

PEK_W03 - The student has knowledge of the digital logic systems.

II. Relating to skills:

III. Relating to social competences:

PEK_K01 - The student understands the need for the use of new techniques and technologies in engineering activities and is able to identify goals and anticipate the effects of undertaken experimental work.

PEK_K02 - The student can work independently and in a team.

PEK_K03 - The student is able to select the priorities for fulfillment of the given task.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Development trends in electronics.	2
Lec2	Signals applied in electronics: analog and digital (description of the fundamentals of the signals).	2
Lec3	Description of the electronic components. Resistors, capacitors, semiconductor sensors (thermistors and photo-resistors).	2
Lec4	Physical principles of semiconductor electronic components.	2
Lec5	P-N junction: the mechanism of the formation of the junction, the direct current I-V characteristics of the diode.	2
Lec6	Bipolar transistors: design, operation principles, configurations, static characteristics, small-signal parameters.	2
Lec7	Thyristor - the semiconductor switching device: construction, operation principles, switching methods, static I-V characteristics, dynamic operation of the thyristor.	2
Lec8	Unipolar transistor: Field Effect Transistor, Junction Transistor - PNFET: the principle of operation, I-V characteristics, parameters.	2
Lec9	Digital Circuits: Basic logic functions, parameters. Logic gates of TTL and CMOS family: construction and parameters.	2
Lec10	Final test	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Static characteristics of the bipolar transistor.	3
Lab2	The measurements of unipolar transistors: JFET and MOSFET transistors	3
Lab3	Additional term.	1

	Total hours: 7

TEACHING TOOLS USED

N1. Traditional lecture (Power Point presentation)
N2. Self-study
N3. Consultations
N4. Repetition of the presented material as a preparation for the laboratory classes.
N5. Assessment of the laboratory classes: test regarding the knowledge about the topic of the exercise, report from the realized work during the classes.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03, PEK_K01-PEK_K03	Test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02	Marks from tests and reports from realized exercise
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

P. Hempowicz, R. Kiełsznia, A. Piłatowicz, J. Szymczyk i inni, Elektrotechnika i elektronika dla nieelektryków, WNT, 2004
A. Świt, J. Pułtorak, Przyrządy półprzewodnikowe, WNT, 1984
W. Marciniak, Przyrządy półprzewodnikowe i układy scalone, WNT, 1984

SECONDARY LITERATURE

Ch. A. Schuler, Electronics. Principles & Applications, McGraw-Hill, 2008
M. Rusek, J. Pasierbiński, Elementy i układy elektroniczne w pytaniach i odpowiedziach, WNT, 1991
G. Rizzoni, Fundamentals of Electrical Engineering, McGraw-Hill, 2010

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Electronics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03 PEK_K01-PEK_K03	K1MBM_K04, K1MBM_W33	C1 - C3	Lec1 - Lec10	N1 - N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **PRAKTYKA**
Name in English:
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032000**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					
Number of hours of total student workload (CNPS)				180	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				6	
including number of ECTS points for practical (P) classes				6	
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

TEACHING TOOLS USED

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U	K1MBM_U02, K1MBM_U38, K1MBM_U40			
PEK_K	K1MBM_K03, K1MBM_K04			

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Chemia materiałów**
Name in English: **Materials chemistry**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032002**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. high school level

SUBJECT OBJECTIVES

C1. Introduction with chemistry sections usable over study of related courses (meterial scicnce, metallurgy, polymers)
C2. Introduction with basic chemical knowledge enabling of chemical rules and physicochemical properties of technical materials particularly metals, alloys and polymers

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student should have basic chemical knowledge associated with structure of matter, states of matter.

PEK_W02 - The student should have basic inorganic knowledge associated with the structure of metals, alloys, electron conductivity as well as basic organic knowledge associated with fuels and polymers

PEK_W03 - The student should have basic knowledge associated wit physicochemical characterization techniques of construction materials

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The structure of matter, elements, periodic table, compounds	2
Lec2	Chemical bonds, molecules	2
Lec3	The states of matter	2
Lec4	Metals and alloys, solid state band theory, electrochemistry, corrosion	2
Lec5	Basic crystallography, unit cell, symmetry elements, crystallographic defect	2
Lec6	Ceramic materials	2
Lec7	Selected topics of organic chemistry	2
Lec8	Polymers chemistry	2
Lec9	Selected methods of solid materials characterizations	2
Lec10	Qualifying class -test	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. tutorials
N3. self study - self studies and preparation for examination
N4. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Chemical Principles, Atkins Peter William, Jones Loretta, Palgrave Macmillan

SECONDARY LITERATURE

Chemistry, Michell J. Sienlo and Robert A. Plane, both of Cornell University, Ithaca, New York.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Materials chemistry
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W03, K1MBM_W06, K1MBM_W11, K1MBM_W13	C1, C2, C3	Lec1- Lec9	N1-N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologie informacyjne**
Name in English: **Information technology**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032003**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. none

SUBJECT OBJECTIVES

C1. The harmonization of terminology in the field of information technology, presenting the origins, history and current state of development of computer
C2. Strengthening the knowledge on the functioning of computers and provide general principles for constructing algorithms (computer)
C3. General guidance on the preparation of publications and technical presentations
C4. Internet and privacy on the Internet, adherence to good customs online, law on the web

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student knows the basic principles of construction of modern computers, knows the rules of binary arithmetic (integer and non-integer), understand the causes of errors in the numerical calculations.
PEK_W02 - The student knows the basic principles of designing algorithms.
PEK_W03 - The student knows the basic principles of editing technical documents (style, including illustration, making presentations).

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The program. Requirements. Outline of the history of the development of counting and computer systems.	2
Lec2	Elements of a computer system.	1
Lec3	Binary logic, basic arithmetic operations, computers calculations,	1
Lec4	The operating system and its role. Different types of software (operating system, utility, ...)	1
Lec5	Algorithms. The basic algorithmic structures (for review, the division of tasks, dynamic programming, recursion, ...).	4
Lec6	Correctness of algorithms, "difficult" task.	1
Lec7	Programming languages: simple examples.	1
Lec8	Interesting use of computers (engineering graphics calculations)	2
Lec9	General information about technical publications	3
Lec10	Internet and related problems. Law and Internet.	2
Lec11	Test	2
		Total hours: 20

TEACHING TOOLS USED

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01	Test
F2	PEK_W02	Test
F3	PEK_W03	Test
P = (F1+F2+F3+F4+F5)/5		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Janusz Biernat. Architektura komputerów. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2005. 2. David Harel. Rzecz o istocie informatyki: algorytmika. Klasyka informatyki. Wydawnictwa Naukowo-Techniczne, Warszawa, 2001, 2002.

SECONDARY LITERATURE

1. David Harel. Komputery-spółka z o.o.: czego komputery naprawdę nie umieją robić. Ludzie, Komputery, Informacja. Wydawnictwa Naukowo-Techniczne, Warszawa, 2002. 2. Witold Komorowski. Krótki kurs architektury i organizacji komputerów. Mikom, Warszawa, 2004. 3. James F. Kurose. Sieci komputerowe: od ogółu do szczegółu z internetem w tle. Wydawnictwo Helion, Gliwice, 2006. 4. Abraham Silberschatz. Podstawy systemów operacyjnych. Wydawnictwa Naukowo-Techniczne, Warszawa, 2006. 5. Niklaus Wirth. Algorytmy + struktury danych = programy. Klasyka informatyki. Wydawnictwa Naukowo-Techniczne, 2004. 6. Piotr Wróblewski. Algorytmy : struktury danych i techniki programowania: algorytmika nie tylko dla informatyków. Helion, Gliwice, 2003.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Information technology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W04	C1, C2	Lec 1,2,3,4	N1
PEK_W02	K1MBM_W04	C2	Lec 5,6,7,8	N1
PEK_W03	K1MBM_W04	C3	Lec9	N1

SUBJECT SUPERVISOR

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy zarządzania**
Name in English: **Essentials of management**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032004**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. No initial prerequisites are required.

SUBJECT OBJECTIVES

C1. Acquiring knowledge about basic trends and management concepts.
C2. Acquiring knowledge about the nature and mechanisms of an organization.
C3. Acquiring knowledge about the regularity and management tools, as well as the analysis of management problems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student is able to characterize different trends occurring in the evolution of organization and management theory, and to describe the most important concepts of both traditional and modern management.

PEK_W02 - The student is able to characterize basic mechanisms of organization, to distinguish between types of organizational structures, to list components of the organization and its environment.

PEK_W03 - The student is able to describe how to implement various functions in the organization and management style

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Management - its essence and meaning. The management process. Manager, managing at different levels and areas of the organization.	2
Lec2	Evolution of the management theory. The environmental context of management.	2
Lec3	Planning and decision making. The organizing process.	2
Lec4	The leading process. The controlling process.	2
Lec5	Test.	2
		Total hours: 10

TEACHING TOOLS USED

N1. Traditional lecture with the use of transparencies and slides.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	Test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Griffin R.W., Management. 11th Edition, South-Western Cengage Learning 2013
2. Coulter M., Robbins S.P., DeCenzo D., Fundamentals of Management. Global Edition. 8th Edition, Pearson, 2013
3. DuBrin A.J., Essentials Of Management. 9th Edition, South-Western Cengage Learning, 2012

SECONDARY LITERATURE

1. Kinicki A., Williams B.K., Management. A practical introduction. 5th Edition, McGraw-Hill, 2010
2. McKee A., Management. A Focus On Leaders, Prentice Hall, 2012
3. Hatch M.J., Cunliffe A.L., Organization Theory. Modern, Symbolic, And Postmodern Perspectives, Oxford University Press, 2013
4. Harvard Business Review. The Magazine.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Essentials of management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W31	C1-C3	Lec1-Lec5	N1

SUBJECT SUPERVISOR

dr inż. Mateusz Molasy tel.: 713202662 email: mateusz.molasy@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechanika I**
Name in English: **Mechanics I**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032010**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20	20			
Number of hours of total student workload (CNPS)	90	60			
Form of crediting	Examination	Crediting with grade			
Group of courses					
Number of ECTS points	3	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1.8	1.4			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Mathematics I (differenting, integrating)
2. Algebra, Linear algebra, (Matrix, Determinants)
3. Euklides geometry & Trigonometry

SUBJECT OBJECTIVES

C1. Solving technical problems on the basis of mechanics rules
C2. Making statical strength analysis of machines elements.
C3. Acquisition and consolidation of social skills including emotional intelligence relying ability to work in a group of students with
a view to effective problem solving. Responsibility, honesty and fairness in behaviour; observance of customs in academic community and society

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - He is able to define basic quantities in Mechanics (Force and momentum). He knows conditions of static equilibrium of forces system.

PEK_W02 - He knows the Centroid of Area, the center of Gravity of a Mass, Moments of inertia, Product of inertia, Parallel–axis theorem, Rotation transformation of Moments of inertia, Iinertia Tensor, inertia ellipsoid, the principal axes.

PEK_W03 - He is able to define key concepts in Kinematics, motion of particle, trajectory, one–dimensional model. Velocity and acceleration in natural coordinates. Rigid body, The Degrees of Freedom, Classification of motions, Velocity and acceleration in general motion.

II. Relating to skills:

PEK_U01 - He can solve typical engineering structures (Trusses, Beams & Frames) under statical loading. Conditions of static equilibrium of forces system. Plane forces system reduction.

PEK_U02 - He can calculate the Centroid of Area, the center of Gravity of a Mass, Moments of inertia, Product of inertia, He can use Parallel–axis theorem, Rotation transformation of Moments of inertia, Iinertia Tensor, inertia ellipsoid, the principal axes

PEK_U03 - He can calculate the velocity and acceleration in plane motion of a rigid body and in the relative motion of a point. He can derive the equations of motion of a free and constrained material point for time-varying dynamic loads using the Newton's second principle.

III. Relating to social competences:

PEK_K01 - He can search information and is able to review it critically.

PEK_K02 - He can objectively evaluate the arguments as well as rationally explain and justify the own point of view.

PEK_K03 - He can observe customs and rules of academic community

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Curriculum. Requirements. Literature.Theory of vectors algebra. Force and momentum. Principal vector and principal momentum of forces system. Statics. Conditions of static equilibrium of forces system.	2
Lec2	The change of momentum point. Concurrent forces system.Trusses. Method of Joints.	2
Lec3	Plane forces system. Reactions in the statically determinate systems (Beams, Trusses, Frames). Conditions of static equilibrium of forces system. Plane forces system reduction.	2
Lec4	Internal forces in Beams (analytical methods, diagrams).	2
Lec5	Internal forces in Frames (analytical methods, diagrams). Centroid of Area. The center of Gravity of a Mass.	2
Lec6	Moments of inertia. Product of inertia. Parallel–axis theorem. Rotation transformation of Moments of inertia, inertia tensor, inertia ellipsoid. The principal axes.	2
Lec7	Kinematics, motion of particle, trajectory, one–dimensional model. Velocity, acceleration. Velocity and acceleration in natural coordinates.	2

Lec8	Rigid body, The Degrees of Freedom, Classification of motions, Velocity and acceleration in general motion.	2
Lec9	Plane motion and rotation over permanent axis. Planar motion of rigid body, velocity, center of circulation.	2
Lec10	Centroids, acceleration in a planar motion of rigid body. Relative motion. Kinematics in a general motion of rigid body. The Coriolis' acceleration.	2
		Total hours: 20
Form of classes – Classes		Number of hours
Cl1	Vectors algebra. Trusses. Method of Joints. Analytical methods of trusses solving.	2
Cl2	Reactions in the statically determinate plane systems. Analytical methods. Reactions in the statically determinate space systems. Analytical methods. Analytical methods of trusses solving. The Ritter's methods.	2
Cl3	Internal forces in beams (analytical methods, diagrams).	2
Cl4	Internal forces in beams (analytical methods, diagrams). Beams with Joints. Internal forces in Frames (analytical methods, diagrams).	2
Cl5	Centroid of Area. The center of Gravity of discrete Multi-mass structures. Centroid of Area. The center of Gravity of continue-mass structures.	2
Cl6	Moments of inertia & inertia products. Parallel–axis theorem. Rotation transformation of Moments of inertia, inertia tensor, inertia ellipsoid. Principal axes.	2
Cl7	Kinematics of particle in orthogonal coordinates.	2
Cl8	Kinematics of rigid body. Plane motion and rotation over permanent axis.	2
Cl9	Velocity in a plane motion.	2
Cl10	Test	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. calculation exercises
N3. tutorials
N4. Homeworks

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03 ,	Test

P = F1

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01-PEK_K03	Test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. B. Gabryszewska, A. Pszonka: „Mechanika", cz. I, Statyka, PWr, 19882. J. Zawadzki, W. Siuta: „Mechanika ogólna", PWN, Warszawa 19713. J. Misiak : „Mechanika ogólna. Statyka i kinematyka". Tom I, WNT, Warszawa 19934. M. Kulisiewicz, St. Piesiak: „Dynamika układów mechanicznych w zadaniachtechnicznych" część I : „Podstawy Kinematyki", PWr, 20025. Cz. Witkowski, „Zbiór zadań z mechaniki". Część I. „Kinematyka". PWr. 19996. Z. Jaśniewicz, „Zbiór zadań ze statyki", PWr. 1996

SECONDARY LITERATURE

1. J. Giergiel : „Mechanika ogólna", WNT, Warszawa 19802. B. Skalmierski: „Mechanika" PWN, Warszawa 19773. J. Leyko : „Mechanika ogólna", WNT, Warszawa 19804. S. Piasecki, J. Rżysko: „Mechanika" WNT,Warszawa 1977,5. W. Siuta: „Mechanika techniczna", WNT, Warszawa 1968MACIERZ POWIĄZANIA EFEKTÓW KSZTAŁCENIA DL

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechanics I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W07	C1,C2,C3	Lec1-Lec10	N1,N3
PEK_U01, PEK_U02, PEK_U03	K1MBM_U05, K1MBM_U07	C1, C2, C3	Cl1-Cl9	N2,N4
PEK_K01-PEK_K03	K1MBM_K03, K1MBM_K04	C3	Cl1-Cl9	N2 - N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Równania różniczkowe zwyczajne**
Name in English: **Ordinary differential equations**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032011**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10	10			
Number of hours of total student workload (CNPS)	30	60			
Form of crediting	Crediting with grade	Crediting with grade			
Group of courses	X				
Number of ECTS points	1	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	0.6	1.4			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows the differential and integral calculus of function of one variable and other branches of mathematics used in this calculus, particularly linear algebra.
2. Student is able to calculate derivatives of functions of one variable, indefinite and definite integrals using methods by parts and by substitution.
3. Student is able to calculate determinants, eigenvalues and eigenvectors of matrix.

SUBJECT OBJECTIVES

C1. To gain basic knowledge about first-order and second-order ordinary differential equations, and systems of differential equations.
C2. To learn how to choose the appropriate method of solving ordinary differential equations and systems of differential equations.
C3. To develop and consolidate the ability to access information and its analysis.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has theoretical knowledge of differential equations and knows methods of their solving.
PEK_W02 - Student has knowledge of methods of solving of systems of differential equations.
PEK_W03 - Student has knowledge about applying differential equations as the mathematical model for a physical phenomenon.

II. Relating to skills:

PEK_U01 - Student is able to formulate theorems and definitions of differential equations in oral and written, friendly manner.
PEK_U02 - Student is able to solve first-order and second-order differential equations.
PEK_U03 - Student is able to solve systems of differential equations.

III. Relating to social competences:

PEK_K01 - Student understands the necessity of systematical work on all tasks and can estimate time needed for solving the exercise.
PEK_K02 - Student knows the scope of his/her knowledge and abilities, is able to identify lack of knowledge and complete it using the literature.
PEK_K03 - Student acts ethically and understands the importance of intellectual honesty.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	First-order differential equations: the basic definitions. Issues from various fields leading to differential equations. First-order differential equations: the equations with separated variables and homogeneous equations.	2
Lec2	First-order linear homogeneous and heterogeneous differential equations.	2
Lec3	Reducible second-order equations. Second-order linear homogeneous differential equations with constant coefficients.	2
Lec4	Second-order linear heterogeneous differential equations with constant coefficients. Method of undetermined coefficients. Homogeneous linear system of equations with constant coefficients. Method of elimination.	2
Lec5	Final test.	2
		Total hours: 10
Form of classes – Classes		Number of hours
Cl1	Solving first-order differential equations with separated variables and homogeneous equations.	2
Cl2	Solving first-order linear homogeneous and heterogeneous differential equations.	2
Cl3	Solving reducible second-order differential equation. Solving second-order linear homogeneous differential equations with constant coefficients.	2
Cl4	Solving second-order linear heterogeneous differential equations with constant coefficients with method of undetermined coefficients. Solving systems of equations by elimination.	2

Cl5	Final test (in case of evaluation on base of short tests, 2 hours are necessary to perform them during semester).	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture
N2. calculation exercises
N3. tutorials
N4. work on preparing for tests

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W05	final test
P = 2/3*F1(wykład/lecture) + 1/3*F1(ćwiczenia/classes), gdzie obie oceny F1>2,0 (both marks F1 > 2.0)		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U03, PEK_K01-PEK_K03	short tests or final test
P = (brak)		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. M. D. Greenberg, Ordinary differential equations, John Wiley & Sons, 2012.
2. R. Carlson, Linear ordinary differential equations, Society for Industrial and Applied Mathematics, Philadelphia 1997.
3. R. E. O'Malley, Thinking about ordinary differential equations, Cambridge University Press, 1997.
4. A. Jeffrey, Linear algebra and ordinary differential equations, CRC Press, 1993.
5. G. Birkhoff, G. C. Rota, Ordinary differential equations, John Wiley & Sons, 1989.
6. R. M. M. Mattheij, J. Molenaar, Ordinary differential equations in theory and practice, John Wiley and Sons, 1996.
7. R. K. Miller, A. N. Michel, Ordinary differential equations, Academic Press, 1982.

SECONDARY LITERATURE

1. J. H. Hubbard, B. H. West, Differential equations: a dynamical systems approach, Cambridge University Press, Cambridge 2003.
2. N. Finizio, G. Ladas, Ordinary differential equations with modern applications, Wadsworth Publ. Co., 1989.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Ordinary differential equations
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W01	C1	Lec1 - Lec4	N1
PEK_U02-PEK_U03	K1MBM_U08	C2, C3	Cl1 - Cl4	N2, N4
PEK_K01, PEK_K03	K1MBM_K03, K1MBM_K04	C1, C3	Cl1 - Cl4	N2, N3

SUBJECT SUPERVISOR

dr inż. Dorota Aniszewska tel.: 320-27-90 email: dorota.aniszewska@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Ekologia w produkcji przemysłowej**
Name in English: **Ecology in industrial manufacturing**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032012**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)					
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points					
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has systematized secondary school knowledge of biology, chemistry and physics; knows the principles of engineering drawing; can interpret the basic relationship between human activity and the behaviour of living organisms and the whole environment; understands the necessity of developing industry and implementing novel solution in the construction, operation and modernization of machines in accordance with the principles of sustainable development and the protection of natural resources and the environment.

SUBJECT OBJECTIVES

C1. The student is to learn about the structure and functioning of living nature, the effect of ecotoxins, and the greenhouse effect; to acquaint herself/himself with the hazards arising from the escalation of human industrial activity and with the legal regulations concerning environmental protection; to understand the environmental management systems, the ISO 14000 standard.
C2. The student is to acquaint herself/himself with the hazards involved in and the ways of acquiring energy from conventional and renewable sources and the principles of waste management – waste minimization and recycling, the LCA method.
C3. The student is to acquaint herself/himself with the principles of constructing, operating and modernizing machines, conducive to the protection of natural resources and the environment.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student knows and understands the hazards arising from the greenhouse effect, the development of technology, energy acquisition and waste production and recycling.

PEK_W02 - The student understands the necessity of introducing environmental regulations; knows the environmental management systems; has knowledge relating to the implementation of ISO 14000.

PEK_W03 - The student knows and understands the hazards arising from the escalation of human activity; knows the principles and advantages of implementing the environment-friendly rules of constructing and operating machines.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, definitions, the importance of the problem, the requirements, literature, what everyone can do to protect the environment.	2
Lec2	The international conventions and the Polish laws relating to environmental protection; environmental management; environmental management systems, the current standards: BS, EMAS, ISO 14000	2
Lec3	The international conventions and the Polish laws relating to environmental protection; environmental management, environmental management systems.	2
Lec4	Environment-friendly methods and consequences of acquiring energy from conventional sources, and the current standard: BS, EMAS, ISO 14000 and other.	2
Lec5	Environment-friendly methods and consequences of acquiring energy from conventional sources, hazards, trends.	2
Lec6	Waste minimization, recycling, rational and eco-friendly methods of managing wastes; examples of recycling in selected branches of industry.	2
Lec7	Waste management, waste sources, waste processing, energy recovery, safe storage, waste management monitoring.	2
Lec8	Environment-friendly materials in machine operation – oils, lubricants, greases; biodegradability, toxicity, carcinogenicity and mutagenicity of lubricating media and consumable materials; polychlorinated biphenyls.	2
Lec9	New environment-friendly techniques in machine operation; sparing lubrication techniques, lubrication management in industry; seals and their effectiveness; the environmental aspects of the construction, use and modernization of machines; recyclability.	2
Lec10	Final test.	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - self studies and preparation for examination
N3. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	Written final test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Konspekty przekazane przez prowadzącego,
2. Lewandowski W: Proekologiczne odnawialne źródła energii, WNT W-wa 2010,
3. Mackenzie A., i inni: Ekologia, PWN W-wa 2009,
4. Nierzwicki W: Zarządzanie środowiskowe, Polskie Wyd. Ekonomiczne, W-wa 2006,
5. Rosik-Dulewska Cz: Podstawy gospodarki odpadami, PWN2007,
6. Gronowicz J: Niekonwencjonalne źródła energii, wyd. Instytutu Technologii Eksploatacji - PIB, Radom-Poznań 2008

SECONDARY LITERATURE

Czasopisma: "Czysta Energia", „Utrzymanie ruchu", „Recykling", „Nasze Środowisko" , "Ekotechnika"

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Ecology in industrial manufacturing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W03	K1MBM_W32	C1 - C3	Wy1 - Wy9	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Informatyka podstawy programowania (Matlab)**
Name in English: **Computer science – basics of programming (Matlab)**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032013**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				20	
Number of hours of total student workload (CNPS)				60	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes				1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge about structure of a computer and its components, as well as on operating systems and principles of algorithm structure.
2. Knowledge of mathematics, covering basic problems of algebra and analysis.
3. Ability to use basic IT tools of CAE class.

SUBJECT OBJECTIVES

C1. Getting acquainted with high-level programming in Matlab, intended for engineering and scientific calculations.
C2. Getting acquainted with integration of calculations, visualisation (2D and 3D graphics) and programming in Matlab environment.
C3. Getting acquainted with principles of modelling technical systems using the Simulink module.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - Ability to formulate a proceeding algorithm for mathematic calculations in the fields of algebra and analysis, covering, among others, matrix, differential and integral calculi, as well as problems related to solving systems of algebraic equations.
PEK_U02 - Ability to utilize possibilities of 2D and 3D graphics to visualize data and calculation results.
PEK_U03 - Ability to build a simple model of an object and to start simulation in the Matlab/Simulink system.

III. Relating to social competences:

PEK_K01 - Ability to search-out and use professional literature recommended for the course and to acquire knowledge independently.
PEK_K02 - Ability to make use of modern IT tools.
PEK_K03 - Understanding of the necessity of systematic and individual work on mastering the course content.

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	General characteristics of Matlab system (graphic interface, environment maintaining, organization of work, system syntax) – exemplary applications. Operations on files and folders, saving and executing basic mathematical operations (evaluating function values).	2
Proj2	Vector and matrix calculi (basic matrix and table operations, identifying elements, generating vectors and matrices)	2
Proj3	Two-dimensional and three-dimensional graphics in Matlab system – graphics generating functions, description of charts, window management.	2
Proj4	Basics of programming in Matlab system (operators; conditional, iteration and switch statements, compound statements; scripts and functions, creating M-files).	2
Proj5	Numerical methods: interpolation and approximation of functions.	2
Proj6	Function analysis (limits, derivatives, extrema).	2
Proj7	Solving equations and systems of equations – methods of solving.	2
Proj8	Simulink – introduction to modelling technical objects (terminology, principles of building models and starting-up simulations).	2
Proj9	Building a simulation model based on the Simulink module library – analysis of influence of initial conditions and simulation parameters on calculation results.	2
Proj10	Crediting the project.	2
		Total hours: 20

TEACHING TOOLS USED

N1. Auxiliary materials in form of instructions and multimedia presentations helpful at executing individual subjects.
N2. Tasks for checking knowledge within individual subjects.
N3. Self study - preparation for project class.
N4. Consultancies.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	Assessment of preparation for executing subsequent project subjects, checking gained knowledge on the ground of test tasks.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Prepared instructions and aids to individual subjects (unpublished).
Mrozek B., Mrozek Z.: Matlab and Simulink. Editorial Office Helion Warsaw, 2004 (in Polish).
Brzózka J., Dorobczyński L.: Matlab. Environment of scientific-technical calculations. Editorial Office Helion PWN, 2005 (in Polish).
Zalewski A., Cegieła R.: Matlab – Numerical calculations and their application. Editorial Office Nakom. Poznan, 1998 (in Polish).
Reichel W., Stachurski M.: Matlab for students – exercises, problems, solutions. Editorial Office WITKOM. Warsaw, 2009 (in Polish).

SECONDARY LITERATURE

Pratap R.: Matlab 7 for scientists and engineers. Editorial Office MIKOM, 2007 (in Polish).
Regel W.: Symbolic and numerical calculations in Matlab program. Editorial Office MIKOM, 2004 (in Polish).

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Computer science – basics of programming (Matlab)
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01 - PEK_U03	K1MBM_U05, K1MBM_U18	C1 - C3	Pr1 - Pr9	N1 - N4

PEK_K01 - PEK_K03	K1MBM_K04	C1 - C3	Pr1 - Pr9	N1 - N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Grafika inżynierska 3D**
Name in English: **3D Engineering Graphics**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032014**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				20	
Number of hours of total student workload (CNPS)				60	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes				1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Requirement of knowledge of the course "Engineering Graphics - Descriptive Geometry"
2. Requirement of knowledge of the course "Engineering Graphics: Engineering Drawing "
3. Requirement of handling skills of computer hardware

SUBJECT OBJECTIVES

C1. Knowledge and skills in the field of 3D modeling of the machines parts and assemblies
C2. Knowledge and skills in range of machinery and equipment research and analysis on the virtual models (virtual prototyping)
C3. Knowledge and skills in range of technical drawing based on 3D models

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - Students should be able to build 3D models of machine parts

PEK_U02 - Students should be able to build 3D models of the machines parts and assemblies and verify models and their parameters

PEK_U03 - Students should be able to make 2D technical drawing based on a 3D model

III. Relating to social competences:

PEK_K01 - Student gains the skills to take responsibility for their work

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Introduction to solid modeling - basic solid modeling operations, the rules of creation of a 2D sketch, fittings in the sketch (geometric and dimensional fittings)	2
Proj2	Basic solid modeling - Advanced operations on 2D sketches, solid modeling with extrude methods	2
Proj3	Solid Modeling Basics - operations on solids: chamfering, rounding, tilting walls, constructions (point, axis, plane), the creation of the ribs, the holes wizard, duplication of the solid operations	2
Proj4	The project of assembly: the concept,solid modeling with rotation, one and multibody modeling	2
Proj5	The project of assembly: solid operations - sweep, loft, split, scroll	2
Proj6	The project of assembly: parts assembling, parts editing in an assembly, a library of standard parts	2
Proj7	The project of assembly: parts modeling in the assembly environment, the adaptability of the parts	2
Proj8	The project of assembly: analysis of the functional correctness of the assembly(parameters analysis, kinematic analysis, analysis of collision) rectify design faults.	2
Proj9	The project of assembly: 2D technical drawings of parts - manufacturing parts drawings, assembly drawings	2
Proj10	Completion of the course: work during classes	2
		Total hours: 20

TEACHING TOOLS USED

N1. project presentation
N2. problem discussion
N3. self study - preparation for project class
N4. independent work on the computer under the tutor supervision

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03	test, participate in problem discussions
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
[1]Stasiak Fabian, Autodesk Inventor. START!, ExpertBooks 2008
[2]Stasiak Fabian, Zbiór ćwiczeń Autodesk Inventor 2012, ExpertBooks 2012

SECONDARY LITERATURE
[1]http://autodesk-inventor-pl.typepad.com/
[2]http://autodesk-inventor-pl.blogspot.com/

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
3D Engineering Graphics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01, PEK_U02	K1MBM_U21	C1, C2	Pr1 - Pr8	N1, N2, N3, N4
PEK_U03	K1MBM_U21	C3	Pr9	N3, N4
PEK_K01	K1MBM_K04	C2	Pr6, Pr8	N2

SUBJECT SUPERVISOR

dr inż. Tadeusz Lewandowski tel.: 71 320-24-65 email: tadeusz.lewandowski@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechanika płynów**
Name in English: **Fluid Mechanics**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032015**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20	10			
Number of hours of total student workload (CNPS)	60	60			
Form of crediting	Crediting with grade	Crediting with grade			
Group of courses	X				
Number of ECTS points	2	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1.2	1.4			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has a structured knowledge of mathematics, including algebra and analysis.
2. Student has a structured knowledge of physics, mechanics.
3. Student has a structured knowledge of basis of machine design.

SUBJECT OBJECTIVES

C1. Understanding the basic laws of mechanics in relation to flows of liquids and gases.
C2. Gaining ability to use basic laws of fluid mechanics in the construction and design of the machines.
C3. Gaining ability to use basic laws of fluid mechanics in the machinery operation.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student is able to define basic laws of fluid mechanics.

PEK_W02 - Student is able to explain the principles of machines operation and the phenomena utilized in their construction.

PEK_W03 - Student is able to Indicate the relationship between the fundamental laws of fluid mechanics and principles of operation of machines equipment.

II. Relating to skills:

PEK_U01 - Student is able to analyse the process of the phenomena associated with the flows in the machines operation.

PEK_U02 - Structured knowledge of machine design theory.

PEK_U03 - Student is able to combine law of fluid mechanics with the problems of machine design and operation.

III. Relating to social competences:

PEK_K01 - Student understands the legal aspects and effects of engineering activities.

PEK_K02 - Student understands and is aware of the non-technical aspects and impacts of engineering activities in machine design.

PEK_K03 - Student is aware of the necessity of individual and group activities that go beyond the engineering operation.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Properties of liquids and gases, forces and stresses in fluids. Newtonian and non-Newtonian fluids.	2
Lec2	Methods for fluid motion analysis, potential and rotational flow.	1
Lec3	The basic equations of fluid mechanics, the continuity equation, the conservation of momentum equation for the ideal and real fluids (Euler equation and Navier-Stokes equations).	2
Lec4	Hydrostatic equations, communicating vessels, the pressure forces of the liquid on the walls, buoyancy.	2
Lec5	Euler equation integrals - Bernoulli's equation, examples of applications: measurements of velocity, the flow of liquid through the holes, Venturi effect.	2
Lec6	The equations of momentum and moment of momentum equation, hydrodynamic reaction, principles of turbo-machinery.	2
Lec7	Classification of flows, laminar and turbulent flow, Bernoulli's equation for real fluids.	1
Lec8	The flow similitude , the dimensionless numbers in fluid Dynamics, examples of applications.	1
Lec9	Flow in axial-symmetric pipes - N-S equations, major losses, the principles of calculation of major looses, the effect of roughness, flows through the narrow gaps.	2
Lec10	Hydrodynamic theory of lubrication in bearings, flows through the narrow gaps.	1
Lec11	The theory of the boundary layer, laminar and turbulent layer, the phenomenon of flow separation.	1

Lec12	Flow around bodies, drag forces, hydrodynamic buoyancy, aerofoil theory, the hydrodynamic characteristics of profiles.	2
Lec13	Numerical methods in fluid mechanics.	1
		Total hours: 20
Form of classes – Classes		Number of hours
Cl1	The solution of the basic fluid properties problems.	1
Cl2	Exercises illustrating the application of the Euler equation and Pascal's law. Calculation of pressure forces on the walls.	2
Cl3	Application of the Bernoulli's equation and the continuity equation for calculating fluid flows and to measure flow velocity	2
Cl4	Calculation of the pressure loss in closed pipelines. Determination of pipeline characteristics	2
Cl5	Calculation of the flow through the narrow gaps	2
Cl6	Final Test	1
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. problem lecture
N3. calculation exercises

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	Final Test
P = 0.5*F1+0.5*FC		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01,PEK_K02,PEK_K03	Final Test

P = F1=FC

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Bukowski J., Kijkowski P.: Kurs mechaniki płynów. PWN Warszawa 1980.
Jeżowiecka-Kabsch K., Szewczyk H.: Mechanika płynów. Oficyna Wydawnicza PWr, Wrocław 2001.
Troskolański A.T.: Hydromechanika, WNT, Warszawa 1967.

SECONDARY LITERATURE

Prosnak W.J.: Mechanika płynów. Tom I. PWN, Warszawa 1970.
Burka S.E., Nałęcz T.J.: Mechanika płynów w przykładach. PWN, Warszawa 1994.
Zieliński A.: Wybrane zagadnienia z mechaniki płynów. Oficyna Wydawnicza PWr, Wrocław 2011.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fluid Mechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W02, K1MBM_W06, K1MBM_W08	C1	Lec1-Lec13	N1
PEK_U01 - PEK_U03	K1MBM_U05, K1MBM_U06, K1MBM_U09	C1	Cl1-Cl6	N2
PEK_K01 - PEK_K03	K1MBM_K08	C1	Cl1-Cl6	N2

SUBJECT SUPERVISOR

Prof. dr hab. inż. Jan Kulczyk tel.: 71 320-25-70 email: Jan.Kulczyk@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechanika II**
Name in English: **Mechanics II**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032018**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20	20			
Number of hours of total student workload (CNPS)	90	60			
Form of crediting	Examination	Crediting with grade			
Group of courses					
Number of ECTS points	3	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1.8	1.4			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. mathematical analysis (differentiation, integration), linear algebra, trigonometry
2. differential equations (ordinary, linear) in the variables separation methods and the characteristic equation areas
3. mechanics in range of statics and kinematics

SUBJECT OBJECTIVES

C1. Knowledge of analytical methods for the application of the principles of classical dynamics for typical mechanical systems (discrete systems: .massl particle, system of masses particles with holonomic constrains, rigid body).
C2. Resolving some technical problems of structure and mechanical systems under dynamic loads.
C3. Acquisition and consolidation of social skills including emotional intelligence relying ability to work in a group of students with
a view to effective problem solving. Responsibility, honesty and fairness in behaviour; observance of customs in the academic community and society.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - He is able to define key concepts in the dynamics of mechanical systems (momentum, angular momentum, force of inertia, work, kinetic and potential energy)

PEK_W02 - He knows the basic concepts in the field of free and forced vibration of mechanical system with one degree of freedom (natural frequency, frequency characteristics, resonance)

PEK_W03 - He knows the basic principles of dynamic (move of the center of mass, momentum, angular momentum, d'Alembert's principle). He is familiar with the term of conservative system and with energy conservation law. He knows the dynamics equations of rotational motion and plane motion of a rigid body. Dynamics of the rigid body rotation about a fixed point

II. Relating to skills:

PEK_U01 - He can calculate the velocity and acceleration in plane motion of a rigid body and in the relative motion and in the rotation about a fixed point. He can derive the equations of motion of a free and constrained material point for time-varying dynamic loads using the Newton's second principle.

PEK_U02 - It can calculate the frequency of free vibration for systems with one degree of freedom of the linear viscous damping and without damping. He can derive the equations of motion and calculate its parameters (angular velocity and acceleration) for rigid body loaded by torque and moves rotation.

PEK_U03 - He can determine the reaction force constraints under dynamic loads. It can calculate the kinetic and potential energy for complex mechanical systems. He is able to apply the energy conservation law to determine the differential equations of conservative system.

III. Relating to social competences:

PEK_K01 - He can search information and is able to review it critically.

PEK_K02 - He can objectively evaluate the arguments as well as rationally explain and justify the own point of view.

PEK_K03 - He can observe customs and rules of academic community.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Program, requirements, literature. The basic principles of classical mechanics. Kinematics and dynamics. Models of discrete and continuous dynamical systems in mechanics.	2
Lec2	A brief reminder of the kinematics of the material from the previous semester. Addendum: Kinematics of the rigid body rotation about a fixed point.	2
Lec3	The Newton's second law (applicable in the dynamics of the free and constrained point).	2
Lec4	The vibrations of the one-mass single degree of freedom system with the linear viscous damping and without damping. Complex notation. Free vibrations. Harmonically forced vibration, frequency characteristics, resonance. Dynamic and kinematic excitations.	2
Lec5	The forces of inertia and d'Alembert's principle. Momentum, and momentum principle. Angular momentum and angular momentum principle. The definition of work. Elementary work.	2

Lec6	The kinetic and potential energy. The principle of work and kinetic energy equivalence.The principle of conservation of energy. Conservative systems. Examples of applications.	2
Lec7	Multi-mass systems. Constraints, degrees of freedom. The use of second Newton's laws in multi-mass constrained material systems. The principle of the center of mass motion and the principle of momentum in multi-mass systems.	2
Lec8	Total angular momentum and angular momentum principle in the multi-mass systems. Introduction to the dynamics of a rigid body. The equation of the dynamics of a rigid body rotation. Using the principle of angular momentum and the equation of rotational dynamics in determining the frequency of free vibration of complex systems. Equivalent mass and stiffness.	2
Lec9	Determination of the dynamic response in a rotating motion. The method of reduction of inertial forces. Angular momentum in the plane motion of a rigid body and dynamics of plane motion. The kinetic energy of rigid body in a general motion. The König's theorem.	2
Lec10	Forces in plane motion of a rigid body and in the relative motion and in the rotation about a fixed point.	2
		Total hours: 20
Form of classes – Classes		Number of hours
Cl1	Practical problems of kinematics of particle, rotational motion and plane motion of rigid body.	2
Cl2	Practical problems of kinematics of relative motion of particle. Solving examples of tasks of Kinematics of rigid body rotation about a fixed point.	2
Cl3	Solving examples of tasks with dynamic free mass particle using The Newton's second law (rectilinear and curvilinear motion)	2
Cl4	The Newton's second law (applicable in the dynamics of the constrained massl particle).	2
Cl5	Examples of tasks from free vibrations of simple mechanical systems with one degree of freedom (determination of free vibration frequencies and the motion equations) Examples of tasks from forced vibration of simple mechanical systems with one degree of freedom.	2
Cl6	Examples of the tasks of the dynamics of particle (momentum principle, the principle of conservation of energy)	2
Cl7	Examples of the tasks of the dynamics and rotational motion of the rigid body using momentum principle, angular momentum principle and mass center movement rule.	2
Cl8	Dynamic force responses in the supports of rotated body.	2
Cl9	Equations of motion for rigid body in plane movement. The kinetic energy of a rigid body in a general motion. The König's theorem. Determination of the differential equations of motion of the dynamical conservative systems based on the energy conservation law.	2
Cl10	Test	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. calculation exercises
N3. tutorials
N4. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02,PEK_W03	test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01 -PEK_K03	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. B. Gabryszewska, A. Pszonka: „Mechanika”, cz. II „Kinematyka i dynamika”, PWr, 1998 2. J. Zawadzki, W. Siuta: „Mechanika ogólna”, PWN, Warszawa 1971 3. J. Misiak : „Mechanika ogólna. Dynamika”. Tom II,WNT, Warszawa 1993

SECONDARY LITERATURE

1. J. Giergiel : „Mechanika ogólna”, WNT, Warszawa 1980 2. B. Skalmierski: „Mechanika” PWN, Warszawa19773. J. Leyko : „Mechanika ogólna”, WNT, Warszawa 19804. M. Klasztorny: „Mechanika” DolnośląskieWyd. Edukacyjne, Wrocław 2000

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechanics II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W07	C1	Lec1-Lec10	N1, N3, N4
PEK_U01, PEK_U02, PEK_U03	K1MBM_U05, K1MBM_U08	C2	Cl1-Cl9	N2, N3,N4
PEK_K01, PEK_K02, PEK_K03	K1MBM_K01, K1MBM_K03, K1MBM_K04	C3	Cl1-Cl9	N2,N3,N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy konstrukcji maszyn I**
Name in English: **Fundamentals of Machine Design I**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032022**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10	20	
Number of hours of total student workload (CNPS)	90		60	60	
Form of crediting	Examination		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	3		2	2	
including number of ECTS points for practical (P) classes			2	2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.8		1.4	1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge: 1 It has a basic understanding of the types of engineering materials, their structure, properties and properties, processing, applications and selection rules. 2 It has a basic knowledge of mechanics, strength of materials and manufacturing techniques. 3 He has knowledge of the methods of mapping geometric formations on the plane and the principles of saving design of machine elements and the performance of their schemes.
2. Skills: 1 Able to read and interpret drawings and diagrams used in the technical ability to perform the technical documentation. 2 It has self-learning ability, and is able to retrieve information from various sources, to make their interpretation, and to draw conclusions and formulate and justify opinions. 3 It can be used in the process of constructing knowledge gained on subjects: Metallurgy, Mechanics, Strength of materials, Engineering Graphics.
3. Competencies: 1 He can think and act in an entrepreneurial manner. 2. Is aware of the seriousness and impact of activities in mechanical engineering, and understands the need for professional activities (both individually and collectively).

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge about the process of design and engineering.
C2. Gaining knowledge of the construction, operation and use of the major machine components (connections) and the rules for their selection and construction.
C3. Gain practical skills to make a simple construction task through a typical solution to the problem, the content of which is to construct a simple device with screw drive (for example, a screw press, bearing puller, scissor lift, car jack, etc.) while using the knowledge of the connections, used in mechanical engineering (screw, bolt, dowel, keyways, spline, serrated, snap-fitting, welded and spring).

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - He has knowledge in the design, principles of design, design features, and knows the algorithm design and construction.
PEK_W02 - It has a basic knowledge of connections in the construction of machines, their use and design calculations.
PEK_W03 - He has knowledge of the factors affecting the fatigue strength of machine elements and how they are taken into account in the design calculations.

II. Relating to skills:
PEK_U01 - Able to independently formulate and solve simple technical tasks.
PEK_U02 - He can choose and calculate the basic connection used in mechanical engineering.
PEK_U03 - He can choose the optimal (in light of the criteria used) machine parts and know their limitations.

III. Relating to social competences:
PEK_K01 - Can search information and carry out their critical analysis.
PEK_K02 - Able to work independently and in a team.
PEK_K03 - Objectively evaluate the task, conceptual design, and they can justify the chosen solution and the method of its implementation.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Syllabus and requirements. Defined notions of technical product and design. Design features, principles of design. Rationale for the existence of a product. Design and construction - differences. Description of the process of design.	2
Lec2	Stress, fatigue, fatigue strength and method of its determination. Smith's and Haighe's graphes.	2
Lec3	Factors affecting the reduction of fatigue. Method of accounting them in the calculation. β - fatigue stress concentration factor.	2
Lec4	Allowable stress k - means for their appointment. Factor of safety and actual safety factor.Joints in mechanical engineering, classification and characteristics	2
Lec5	Bolted connections, thread specifications. Determination of the forces and moments on the thread. The minimum height of the nut in the screw.	2

Lec6	Efficiency and self-locking of a power screw. The notion of preload. Method for the calculation of bolted connections with preload. Calculations of thread forms.	2
Lec7	Shaft-hub connections: keys, splines, serrated joints. Dowel connections. Main features and calculation rules.	2
Lec8	Welded and pin connections. Specifications, principles of design and calculations.	2
Lec9	Pressed connections. Analytical bases of geometry selection, elements fit.	2
Lec10	Steel elastic connectors. Fundamentals of strength calculations of selected types of springs. Forming of cylindrical coil springs.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Introduction. Health and Safety Training. Determination of static stiffness, energy dissipated and acquired in elastic-damping elements.	2
Lab2	Determination of the frictional characteristics of the cross slide bearing.	2
Lab3	Determination of the resistance to motion of tapered roller bearings.	2
Lab4	Theoretical and practical identification of resonance in the shaft of a machine with not balanced mass.	2
Lab5	Research of the pressed connections.	2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1	Preparation of design specifications for the designed device.	2
Proj2	Possible solutions of the problem, a draft drawing (without details) of one selected solution (acceptance criteria included).	4
Proj3	Calculations and analysis of designed elements (power screw, bearings, bolts, etc..).	7
Proj4	Performance of assembly drawing designed device and working drawings of elements selected by lecturer.	7
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. calculation exercises
N3. tutorials
N4. laboratory experiment
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	exam, quiz
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01 - PEK_K03	Quizzes, oral response, the report of the laboratory
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01 - PEK_K03	defense of project, quizzes, evaluation of computational design review, review of project preparation
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Podstawy konstrukcji maszyn; Praca zbiorowa pod red. Z. Osińskiego. Warszawa, PWN 1999. 2. Dietrych J. i inni; Podstawy konstrukcji maszyn. Tom I i II. Warszawa, WNT. 3. Beitz G.; Nauka konstruowania . Warszawa, WNT 1984. 4. Ćwiczenia z podstaw konstrukcji maszyn. Poradnik. Praca zbiorowa pod red. Z. Lawrowskiego, skrypt PWr., Wrocław , 1982. 5. Roloff / Matek, Maschinenelemente - Normung, Berechnung, Gestaltung, Wiesbaden, Vieweg 1994.

SECONDARY LITERATURE

1. A. Dziama; Metodyka konstruowania maszyn, PWN, Warszawa, 1985. 2. Dietrych M. i inni; Podstawy konstrukcji maszyn. Tom I i II. Warszawa, WNT.1966. 3 .Skarbiński M., Skarbiński J.; Technologiczność konstrukcji maszyn. Warszawa, WNT 1982. 4. Niemann G., Winter H.; Maschinenelemente. Band II. Berlin, Springer-Verlag 1985. 5. Niezgodzinski M., Niezgodziński T.; Wzory, wykresy i tablice wytrzymałościowe Warszawa, PWN 2000.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Machine Design I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02	K1MBM_W18	C2	Lec1 - Lec10	N1-N5
PEK_W03	K1MBM_W18	C2, C3	Lec3	N1, N2, N3, N5
PEK_U01 - PEK_U03	K1MBM_U14, K1MBM_U18, K1MBM_U21	C1-C3	Proj1-Proj4, Lab1 - Lab5	N2-N5
PEK_K01 - PEK_K03	K1MBM_K10	C3	Lab1 - Lab5	N2-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy organizacji produkcji**
Name in English: **Basis of Production Organization**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032035**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Examination				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2

Lec2		2
Lec3		2
Lec4		2
Lec5		4
Lec6		4
Lec7		2
Lec8		2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Rogowski Andrzej „Podstawy organizacji i zarządzania produkcją w przedsiębiorstwie” Wydawnictwo: CeDeWu 2010
Karpiński Tadeusz „Inżynieria produkcji” Wydawnictwa Naukowo-Techniczne, Warszawa 2004

SECONDARY LITERATURE

Durlik I. „Inżynieria zarządzania” cz. I i II, Agencja Wydawnicza Placet, Warszawa 1998
Chlebus E.: „Techniki komputerowe CAx w inżynierii produkcji”, WNT Warszawa, 2000
Knosala R. „Komputerowo zintegrowane zarządzanie” WNT, Warszawa 1999

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Basis of Production Organization
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W24	C1	Lec1, Lec2	N1
PEK_W02	K1MBM_W24	C2	Lec3, Lec4, Lec5	N1
PEK_W03	K1MBM_W24	C3	Lec6, Lec7, Lec8	N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Maszyny technologiczne CNC i roboty**
Name in English: **Technological CNC machines and robots**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032036**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10	10	
Number of hours of total student workload (CNPS)	60		30	30	
Form of crediting	Crediting with grade		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	2		1	1	
including number of ECTS points for practical (P) classes			1	1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge about design & manufacturing process, structure and operation of machine components and assemblies, as well as principles of their selection and designing.
2. Well-grounded knowledge about basic manufacturing techniques and role of technological machines.
3. Ability to design a manufacturing process in the field of chipless forming and machining.

SUBJECT OBJECTIVES

C1. Getting acquainted with engineering of basic CNC manufacturing machines and robots, in particular with their control, drive and measurement systems.
C2. Getting acquainted with programming principles of CNC machines according to ISO standard and with principles of building and implementing driver software, as well as with methods supporting a programmer's work.
C3. Getting acquainted with principles and possibilities of using automated single- and multimachine systems for executing specific machining tasks.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knowledge of engineering and operation principles of modern CNC manufacturing machines, in particular principles of their operation control.

PEK_W02 - Knowledge of selection principles of CNC manufacturing machines intended for specific machining tasks.

PEK_W03 - Knowledge of programming principles of CNC machines.

II. Relating to skills:

PEK_U01 - Ability to evaluate CNC manufacturing machines with respect to their suitability for specific machining tasks.

PEK_U02 - Ability to elaborate a program structure for basic CNC machines, as well as to use standard subprograms and cycles.

PEK_U03 - Ability to select and preset machining parameters, select tools and verify correctness of the developed programs.

III. Relating to social competences:

PEK_K01 - Ability to search-out and use professional literature recommended for the course and to gain knowledge independently.

PEK_K02 - Ability to make use of modern IT tools.

PEK_K03 - Understanding of the necessity of systematic and individual work on mastering the course content.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	General characteristics of manufacturing machines and their classification. Geometrical, kinematic and dynamic structures of the machines. Technical and operational parameters. Basic requirements.	2
Lec2	Parts, mechanisms and components of CNC manufacturing machines: bodies, spindle and guiding assemblies, tooling and workpiece systems. Main drive and feeding systems of modern manufacturing machines. Measurement, diagnostics and supervision systems.	2
Lec3	Basics of automatic control of manufacturing machines. Classification of control systems (NC, CNC, DNC, AC and PLC systems).	2
Lec4	Introduction to programming numerically controlled machines – geometrical basics of CNC control, coordinate systems, driver structure, interpolation. Ways of computer-aided programming – machining simulators.	2
Lec5	Review of groups of CNC machines: lathes, milling machines, grinding machines (technical & usable features and purpose of the machines).	2
Lec6	Review of groups of CNC machines: machining centres, autonomous machining stations (technical & usable features and purpose of the machines). Structure and purpose of coordinate measuring machines.	2
Lec7	CNC machines for electrochemical and laser machining (technical & usable features and purpose of the machines).	2
Lec8	Multimachine, robotized manufacturing systems, production centres and lines (organizational structures and application fields). Computer-integrated manufacturing systems (CIM).	2

Lec9	Machines and devices for additive manufacturing and reverse engineering techniques – exemplary applications. Trends in development of CNC manufacturing machines (machines for HSC and HPC machining, hexapods, intelligent and hybrid machine tools).	2
Lec10	Credit colloquium.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	The use of robots in sheet and spot welding processes.	2
Lab2	Control of machines in sheet metal forming processes.	2
Lab3	The use of Coordinate Measuring Machine (CMM).	2
Lab4	Automation of technological processes using PLC controllers (FESTO system).	2
Lab5	Machines to implement additive technology (Rapid Prototyping). Laboratory crediting.	2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1	Selection of a machine tool, preparation of a workpiece, selection of tools and machining parameters.	2
Proj2	Determination of characteristic points of a contour and location of a workpiece in the machine-tool workspace. Linear and circular interpolation.	2
Proj3	Elaboration of a driver software to control the manufacturing process on a CNC machine – establishing corrective functions; programming movements with correction of tool dimensions. Subprograms technique, incremental programming, programming movements in a loop.	2
Proj4	Elaboration of a driver software to control the manufacturing process on a CNC machine – use of machining cycles at programming. Completion of the project and its verification.	2
Proj5	Summary of the work – presentation of the project and its assessment.	2
		Total hours: 10

TEACHING TOOLS USED

N1. Traditional lecture with use of transparencies and slides
N2. Own work – preparation for crediting the lecture
N3. Own work – preparation for projekt class, laboratory
N4. Presentation of the project
N5. Consultancies

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	Credit colloquium
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	Assessment of the project preparation
F2	PEK_U01 - PEK_U03	Defence of the project
P = 0.5(F1+F2)		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Honczarenko J.: Flexible automation of manufacture. Machine tools and machining systems. WNT Warsaw, 2000 (in Polish).
Kosmol J.: Automation of machine tools and machining. WNT Warsaw, 2000 (in Polish).
Honczarenko J.: Numerically controlled machine tools. WNT Warsaw, 2009 (in Polish).
Programming of CNC machine tools. Editorial Office REA. Warsaw, 1999 (in Polish).
Nikiel G.: Programming of CNC machine tools on the example of control system Sinumerik 810D/840D. ATH Bielsko-Biała, 2004 (available in internet) (in Polish).
Habrat W.: Operation and programming of CNC machine tools. Operator's handbook. KaBe, Krosno, 2007 (in Polish).
Kosmol J., Słupik H.: Programming of numerically controlled machine tools. Silesian University of Technology, Gliwice, 2001 (in Polish).

SECONDARY LITERATURE

Engineer's handbook. Machining. Vol. 1, 2, 3. WNT Warsaw, 1992 – 1994 (in Polish).
Instruction manual of Sinumerik control system programming (available in internet) (in Polish).
Dudik K., Górski E.: Lathe operator's handbook. WNT Warsaw, 2000 (in Polish).
Dudik K., Górski E.: Milling machine operator's handbook. WNT Warsaw, 2003 (in Polish).
Catalogues of tools used at CNC machine tools (in Polish).

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technological CNC machines and robots
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W03	K1MBM_W35	C1 - C3	Wy1 - Wy9	N1, N3
PEK_U01 - PEK_U03	K1MBM_U17	C1 - C3	Pr1 - Pr4; Lab1 - Lab5	N2, N4
PEK_K01 - PEK_K03	K1MBM_K04	C1 - C3	Pr1 - Pr4; Lab1 - Lab5	N2- N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy eksploatacji i remontów maszyn**
Name in English: **Fundamentals of machine exploitation and repair**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032037**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge of chemistry, physics, engineering drawing, material science and machine component construction; knows the principles of matching typical machine components; understands the necessity of lubrication and wear preventing measures in machine operation; knows the basic technological processes for typical machine parts; understands the necessity of protecting the natural resources and reducing the amount of wastes; is aware of the consequences of polluting the environment with production wastes.
2. The student has knowledge concerning the hazards arising from industrial activity and machine operation; knows the international conventions and the Polish laws applying to environmental protection, and the environmental aspects of constructing, using and upgrading machines; is aware of the importance of and understands the nontechnical aspects and consequences of engineer and production manager activity, including its impact on the environment, and the consequent responsibility for the decisions made.

SUBJECT OBJECTIVES

C1. The student is to acquire basic knowledge about machine operation processes; to understand the systemic approach to operation and to the description and assessment of the operation process; to learn to describe the technical condition and reliability of an object.
C2. The student is to learn models of the reliability of simple repairable and unrepairable objects and of the reliability of complex objects.
C3. The student is to acquire skills of planning stocks of spare parts and consumable materials; to learn the principles of implementing repair management, the methods of regenerating worn out machine parts, modernizing machines, waste acquisition and recycling; to learn the principles of preventing and diagnosing in the operation of machines and the environmental principles of their operation.
C4. The student is to learn how to process rating indices and operational test simulation results; to acquire basic knowledge relating to diagnosing and assessing the condition of machines through the measurement and analysis of such machine operating parameters as energy consumption, machine component heating, vibration and noise levels and machine unit positioning accuracy; to learn to determine the technical condition of a machine, the degree of its wear and the range of repairs.
C5. The student is to acquire the skill of selecting a machine repair system and organizing repairs.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - The student understands the systemic approach to the operation process, knows how to describe this process and the technical condition of an object and knows the principles of assessing its reliability.
PEK_W02 - The student has knowledge relating to the assessment of the technical condition of an object, the cost-effectiveness of a machine repair, the way of preparing and carrying out the repair; understands the impact of the machine and the processes being conducted on the human being and the environment; knows the principles of eco-friendly machine operation.
PEK_W03 - The student knows the methods of assessing machine condition; can assess the need for, viability and range of a machine repair.

II. Relating to skills:
PEK_U01 - The student can assess the condition of simple and complex technical objects and their reliability.
PEK_U02 - The student can assess the need for a repair and its essential extent, select a method of regenerating parts, manage the stock of consumable materials and spare parts.
PEK_U03 - The student can minimize the adverse effects of a machine and the process being run on the personnel and the environment.

III. Relating to social competences:
PEK_K01 - The student knows how to search for information on machine repairs and to critically evaluate this information.
PEK_K02 - The student can objectively evaluate diagnostic parameters and collaborate in a team to select the optimum method of bringing a machine back to its original operating condition.
PEK_K03 - The student can objectively evaluate arguments, substantiate her/his ideas, using machine operation knowledge.

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1	Basic machine operation terms. The praxeological and systemic approach to operation.	2
Lec2	The description and assessment of the operation process.	2
Lec3	The description of the technical condition of an object.	2
Lec4	The notion of reliability. The reliability of simple repairable and unrepairable objects.	2
Lec5	The reliability of complex objects.	2
Lec6	The planning of spare parts and consumable materials inventories. The technically justified methods of regenerating machine parts.	2
Lec7	Repair management, repair systems, machine modernization.	2
Lec8	Prevention and diagnostics in machine use. Waste acquisition, recycling and neutralization.	2
Lec9	Environmental aspects of constructing, operating and repairing machines.	2
Lec10	The rational lubrication of machines, lubrication techniques, minimal lubrication. The treatment and neutralization of lubricants, cooling agents and technological fluids.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	The basic operational states of a technical object, operating process rating indices. The analysis of the condition of a technical object (a car, an engineering machine) on the basis of its fuel and energy consumption.	2
Lab2	The study of the influence of selected operating parameters of a machine on its energy consumption, the assessment of machine condition.	2
Lab3	The analysis of the repairability of a selected technical object. The determination of repair time and weak links.	2
Lab4	The assessment of the energy consumption, clearance, preload and condition of machine spindle bearings.	2
Lab5	The vibroacoustic diagnosis of the technical condition of machine assemblies.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. laboratory experiment
N4. tutorials
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 ÷ PEK_W03	written examination
P = ocena z egzaminu		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U02 ÷ PEK_U03, PEK_K01 ÷ PEK_K03	short tests
F2	PEK_U02 ÷ PEK_U03, PEK_K01 ÷ PEK_K03	reports from laboratory classes
P = średnia ze wszystkich ocen		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Konspekty przekazane przez prowadzącego,
2. Ziemba S: Problemy rozwoju nauki o eksploatacji maszyn i urządzeń technicznych, PWN W-wa 1983,
3. Olearczyk E: Zarys teorii użytkowania urządzeń technicznych, WNT W-wa,
4. Gołąbek A: Elementy teorii eksploatacji - skrypt PWr,
5. Podniało A: Paliwa, oleje i smary w ekologicznej eksploatacji, WNT W-wa 202

SECONDARY LITERATURE

Miesięcznik: Inżynieria i Utrzymanie Ruchu Zakładów Przemysłowych

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of machine exploitation and repair
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W25, K1MBM_W26	C1, C2	Lec1-Lec5	1, 2, 4, 5
PEK_W02	K1MBM_W05, K1MBM_W11, K1MBM_W22	C3	Lec6-Lec10	1, 2, 4, 5
PEK_W03	K1MBM_W15, K1MBM_W26, K1MBM_W27	C4, C5	Lec1-Lec10	1, 2, 3, 4, 5

PEK_U01, PEK_K01	K1MBM_K02, K1MBM_K05, K1MBM_K11, K1MBM_U12	C2, C4, C5	La1-La5	2, 3, 4
PEK_U02, PEK_K01-PEK_K03	K1MBM_K05, K1MBM_K10, K1MBM_U12, K1MBM_U32	C3, C4, C5	La1-La5	2, 3, 4, 5
PEK_U03	K1MBM_U26	C1, C3	La1-La5	2, 3, 4, 5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK KURSÓW HUMANISTYCZNYCH**
Name in English: **Block of humanistic courses**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032041**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	2.5				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1		20
		Total hours: 20

TEACHING TOOLS USED

N1.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	wg kart opracowanych przez SNH	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of humanistic courses
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W29, K1MBM_W30	wg kart opracowanych przez SNH		wg kart opracowanych przez SNH

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Grafika inżynierska - geometria wykreślna**
Name in English: **Engineering graphics - descriptive geometry**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032042**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10	20			
Number of hours of total student workload (CNPS)	60	60			
Form of crediting	Crediting with grade	Crediting with grade			
Group of courses					
Number of ECTS points	2	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	0.6	1.4			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge of the fundamental theorems of Euclidean geometry
2. Student has ability to use of the drawing utensils
3. Student has ability to draw basic geometric structures, such as division of a line's segment into n equal parts, plotting a regular hexagon

SUBJECT OBJECTIVES

C1. Knowledge of the theoretical and practical basis of the Monge descriptive projection method of the geometric structures on the drawing's plane, as the basis for design recording (technical drawing)
C2. Acquiring the ability to solve tasks requiring the use of a projection by Monge, including measuring tasks (descriptive determining of the distances, angles, actual size).

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has ordered knowledge of the geometric structures mapping onto drawing's plane using Monge method and has elementary knowledge in the field of axonometry.

PEK_W02 - Student can indicate an appropriate algorithm of the mapping for solution of the position and the relationship between of the geometric structures in the space.

PEK_W03 - Student has mastered the basics of geometric structures restitution based on the Monge's projections.

II. Relating to skills:

PEK_U01 - Student can practically apply the principles of the Monge projection method to map the elements and geometric structures (including solids) on the drawing plane.

PEK_U02 - Student can set the actual sizes characterized the measuring tasks of the descriptive geometry.

PEK_U03 - Student is able to interpret the drawing, made by the method of Monge, showing the position of the geometric structure in the space.

III. Relating to social competences:

PEK_K01 - Student is able to work independently and solve problems involving Monge projection method.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic definitions and principles of the parallel, rectangular projection by Monge, the mapping of basic geometric elements (point, line, plane).	2
Lec2	The edges and breakdown points. Transformation of the position (rotation, revolved section) and the reference system. Solids - definitions.	2
Lec3	Cross body (with projecting plane) as the set of the common points of the solid and cutting plane, breakdown points of the solid by a straight line, cutting of the solid by set of the cutting planes.	2
Lec4	The penetration of the solids - transmission lines definition, the use of auxiliary cutting planes and reference system transformation.Projections in the three orthogonal planes.	2
Lec5	Completing the missing solid projection- use of the axonometric projection.Final test (1 hr.).	2
		Total hours: 10
Form of classes – Classes		Number of hours
Cl1	Information on the drawing utensils and principles of the geometric structures drawing. Projection of a point and a straight line, the mapping of a plane using her traces; identification of the basic elements localization in the space using two orthogonal projection planes.	2
Cl2	Belonging of the basic geometric elements, completion of the missing projection. Edge as a common element of two planes.	2
Cl3	Breakdown point as a common point of a line and plane. The edge between flat figures. Identification and construction of parallel and perpendicular relationship of basic geometric elements. Identification of the relationship of parallelism and squareness of basic geometric elements.	2

Cl4	Rotation and revolved section of basic geometric elements (line's segment, plane rotation) - used in measuring tasks (determination of the real size of a line's segment,an angle of a plane figure).	2
Cl5	Reference system transformation application in measuring tasks and localization identification. The mapping of elementary solids in the Monge projection, the points and straight lines belonging to the solid walls identification.	2
Cl6	Determination of the cross sections of polyhedra and solids of revolution cutted by projection planes. Cutting a solid with assembly of the cutting planes.	2
Cl7	Determination of the transmission line of polyhedra. Solids of revolution transmission line determination.	2
Cl8	Mapping the solid on three orthogonal projection planes. Modifying the solid by projecting plane against one of a projection plane.	2
Cl9	Mapping the solid with axonometric projection. Determination of the missing projection of the solid modified by cutting planes. Relationsip between Monge projections and axonometric view.	2
Cl10	Final test	2
		Total hours: 20

TEACHING TOOLS USED

N1. problem lecture
N2. problem exercises
N3. self study - preparation for project class
N4. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03	Final test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement

F1	PEK_U01, PEK_U02, PEK_U03	Final test, good rating is needed (min. 3.0)
F2	PEK_K01	evaluation of n (sheets) projects preparation, n = min. 3 - max. 6, good rating of each project is needed, F2 = (P1 + ... Pn) / n
P = F1*3/4+F2*1/4		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Lewandowski Z., Geometria wykreślna, PWN, Warszawa 1980 (i późniejsze wydania),[2] Otto F., Otto E., Podręcznik geometrii wykreślnej, PWN, Warszawa 1998,[3] Zbiór zadań z geometrii wykreślnej, red. Nowakowski T., Oficyna Wyd. Politechniki Wrocławskiej, Wrocław 2001,[4] Bieliński A., Geometria wykreślna, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005

SECONDARY LITERATURE

[1] Szerszeń S., Nauka o rzutach, PWN, Warszawa 1974 (i późniejsze wydania),[2] Przewłocki S., Geometria wykreślna w budownictwie, Wyd. Arkady, Warszawa 1997,[3] Bogaczyk T., Romaszkiewicz-Białas T., 13 wykładów z geometrii wykreślnej, Oficyna Wyd. Politechniki Wrocławskiej, Wrocław 1997,[4] Błach A., Geometria. Przegląd wybranych zagadnień dla uczniów i studentów. Arkady, Warszawa 1998.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Engineering graphics - descriptive geometry
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W14	C1	Lec1-Lec5	N1, N4
PEK_U01, PEK_U02, PEK_U03	K1MBM_U14	C2	Cl1-Cl9	N2, N3, N4
PEK_K01	K1MBM_K05	C1, C2	Cl1-Cl9	N2-N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologia materiałów inżynierskich**
Name in English: **Engineering Materials Technology**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032043**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge concerning physics and mathematics. Ability to use basic measuring equipment like slide caliper.
2. Ability to analyze information included in laboratory instructions
3. Ability to work in a team

SUBJECT OBJECTIVES

C1. Familiarization with metallurgical processes of ore conversion, production of steel and non-ferrous metals.
C2. Familiarization with basic methods of testing of mechanical properties of steel and non-ferrous metals and principles of forming of items with use of powder metallurgy.
C3. Obtaining and reinforcement of social competences connected with a teamwork with a goal to solve problems effectively.
C4. Familiarization with knowledge about basic mechanical properties of engineer materials like tensile strength, compressive strength, impact strength, hardness by participation in testing of given materials.
C5. Familiarization with methods of conducting of non-destructive testing like visual inspection, dye-penetrant examination, magnetic particle testing, radiographic and ultra-sonic testing by participation in testing given parts.
C6. Familiarization with technological tests and forming of items with use of powder metallurgy by participation in an experiment.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - As a result of conducted lecture the student should be able to define the basic physical properties of engineering materials, to quote and to describe the ways of processing of ores the metals, to characterize the metallurgical processes of receiving the metals and the alloys of metals.
PEK_W02 - As a result of conducted laboratory the student should be able to define the mechanical properties of metals and the alloys, to describe the method of tests destructive and non-destructive, to characterize the method of carrying out the technological tests.
PEK_W03 - As a result of conducted classes the student should be able to distinguish basic engineering materials, to characterize their physical and mechanical properties, to identify method investigations of properties of engineering materials.

II. Relating to skills:
PEK_U01 - As a result of the lecture the student should be able to analyze processes metallurgical obtaining metal, compare the properties of engineering materials
PEK_U02 - As a result of laboratory classes student should be able to carry out in a limited range the basic test of tensile strength, compressive strength, impact tests, hardness tests and technological tests
PEK_U03 - As a result of the course the student should be able to obtain information from the literature, have the ability to self-learning, carry out measurements, determine the value and to evaluate certainty basic mechanical properties.

III. Relating to social competences:
PEK_K01 - Demonstrates skills needed in teamwork on improving methods of choice of a strategy to optimally solve problems assigned group.
PEK_K02 - Is able objectively evaluate the arguments rationally explain and justify his own point of view using the knowledge of the basics of engineering materials.
PEK_K03 - Respects the customs and rules of the academic community.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organization of groups. General information about properties of engineer materials. Refractory materials and fuels in pyrometallurgy.	2

Lec2	Metallurgy of iron. Ore treatment, blast furnace process, production of steel.	2
Lec3	Metallurgy of copper. Ore treatment, pyrometallurgical and hydrometallurgical processes of production of copper and its alloys	2
Lec4	Metallurgy of zinc. Ore treatment, pyrometallurgical and hydrometallurgical processes of production of zinc and its alloys. Metallurgy of aluminum. Treatment of ores, production of aluminum oxide and refining of aluminum.	2
Lec5	Production of high melting metals with use of powder metallurgy and methods of production of parts with use of metallic powders.	2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1	Organization of groups, safety. Tensile test of metals	2
Lab2	General information about metals and alloys. Technological tests	2
Lab3	Compression test and impact test	2
Lab4	Hardness measurement	2
Lab5	Non-destructive testing	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. laboratory experiment
N4. report preparation
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	final test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement

F1	PEK_U01-PEK_U03, PEK_K01-PEK_K03	oral answers, short tests
P = średnia z F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Z. Mirski. Technology and engineering materials testing, laboratory. Wrocław University of Technology Publishing House, 2010.
2. Krynicki L., L. Sozański. Technology of metals. Publisher University of Technology, 1994.

SECONDARY LITERATURE

Supplementary materials for exercises No. 1-5. W10 library (building B4, III floor)

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Engineering Materials Technology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W03	K1MBM_W10	C1, C2	Le1 - Le5	N1, N5
PEK_W02, PEK_W03	K1MBM_W10	C4, C5, C6	Le1 - Le5	N1, N5
PEK_U01, PEK_U03	K1MBM_U20	C4, C5, C6	Lab1 - Lab5	N2, N3, N4
PEK_U02, PEK_U03	K1MBM_U20	C4, C5, C6	Lab1 - Lab5	N2, N3, N4
PEK_K01, PEK_K03	K1MBM_K04	C3	Lab1 - Lab5	N2, N3, N4
PEK_K02, PEK_K03	K1MBM_K04	C3	Lab1 - Lab5	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Grafika inżynierska - zapis konstrukcji**
Name in English: **Engineering Graphics**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032045**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			20	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses				X	
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		2
Proj9		2
Proj10		2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for project class
N3.
N4.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	
P = F1=FW		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U03	
F2	PEK_U01-PEK_U03	
F3	PEK_U01, PEK_U02, PEK_K01	
P = 0,2*FW+0.2*F1+0.2*F2+0.4*F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Dobrzański T., Rysunek techniczny maszynowy. WNT, Warszawa 2010.
2. Rydzanicz I., Zapis konstrukcji. Podstawy. Oficyna Wyd. PWr, Wrocław 2000.
3.Materials (abstracts) for the lectures on the website

SECONDARY LITERATURE

1. Suseł M., Makowski K.. Grafika inżynierska z zastosowaniem programu AutoCAD, Oficyna WydawniczaPWr, 2005
2. Kasprzycki A., Sochacki W. Wybrane zagadnienia projektowania i eksploatacji maszyn i urządzeń.[Dokument elektroniczny], s. 7-47
3. Strony internetowe do nauki programu AutoCAD np http://www.cad.pl/kursy/

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Engineering Graphics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W14	C1, C2	Lec1-Lec5	N1
PEK_W02	K1MBM_W14	C1	Lec1-Lec5	N1, N3
PEK_W03	K1MBM_W14	C1, C3	Lec1-Lec5, Proj1-Proj4	N1, N2, N3
PEK_U01	K1MBM_U14	C2, C3	Proj1-Proj9	N2, N3, N4
PEK_U02	K1MBM_U14	C2	Proj1-Proj4, Proj8-Proj9	N2, N3, N4
PEK_U03	K1MBM_U14	C3	Proj5-Proj9	N4

PEK_K01	K1MBM_K09	C3	Proj1-Proj5	N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Statystyka inżynierska**
Name in English: **Statistics for Engineers**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032046**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			10	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge of mathematics confirmed positive marks on the upper secondary school leaving certificate

SUBJECT OBJECTIVES

C1. Gaining basic knowledge of probability and mathematical statistics takes into account the aspects of application and the acquisition of skills exploration figures in the field of construction and operation of equipment, organization and management, as well as optimize the design, technology and systems.
C2. Acquiring skills development (reduction) of data using statistical software (STATISTICA, MatLab, Gretl, R) and the possibility of a spreadsheet (Excel).
C3. The acquisition and consolidation of social skills including emotional intelligence involving the ability to work in a group of students with a view to effectively solve problems with regard to accountability, integrity and fairness in the proceedings.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - knows the basic descriptive statistics pertaining to the results of measurements in engineering and knows the principle of grouping data and compilation of the distribution

PEK_W02 - knows the basic theoretical distributions of discrete and continuous features and has a basic knowledge of the principles of estimating confidence intervals for the average value and the dispersion characteristics

PEK_W03 - has knowledge of the methods for parametric and non-parametric statistical hypotheses about the average value, the equality of the two values of the average of the value of homogeneity of variance and multiple variance

II. Relating to skills:

PEK_U01 - able to perform data reduction for a suitable choice of the statistics that describe the average value, the dispersion and the shape of the distribution as well as how the raw data to create a frequency distribution, and illustrate a set of data using a histogram, the empirical distribution function and graph frameset

PEK_U02 - able to fit the empirical data and theoretical distribution on the basis of estimated quantile values for selected probabilities, and estimate the probability for selected quantiles and can correctly choose the type of statistical test and perform testing hypotheses about the average and distribution of features

PEK_U03 - can analyze dependencies in a multi-dimensional characteristics of categorical data table and can perform regression analysis and correlation of two and more variables, estimate the parameters characterizing the strength and shape of the relationship

III. Relating to social competences:

PEK_K01 - acquisition and consolidation of competence to understand the need for self-study, including the ability to improve attention and focus on what's important and to develop the ability to independently apply their knowledge and skills and to find the information and its critical analysis

PEK_K02 - team cooperation on improving methods for the selection of a strategy to optimally assigned to group problem solving

PEK_K03 - compliance with customs and rules in academia and independent and creative thinking

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Statistical methods of data analysis - the essence of statistical modeling. The descriptive analysis of the data: the forms of representation of statistical data, measures of association, variability, asymmetry and concentration. Development and presentation of statistical data. Grouping data - ranks simple and distribution. Histogram and empirical cumulative distribution.	2
Lec2	Random variables and their distributions. Numerical characteristics of the distribution. Selected discrete and continuous distributions. Elements of the theory of estimation - point estimate. Interval estimation of the mean value and variance. The confidence intervals. Parametric statistical hypotheses. Testing hypotheses about the average value, the equality of the two average values. Testing hypotheses about the rate structure and the structure of the equality of two ratios. Testing hypotheses about the variance and equality of two variances.	2
Lec3	Nonparametric hypothesis testing. Conformance Test chi-square, Kolmogorov-Smirnov test. Test of independence Pearson chi-square. Based measures based on chi-square. The odds ratio. Nonparametric tests: test Wald-Wolfowitz runs test, Wilcoxon rank-Mann-Whitney test.	2

Lec4	Correlation and regression analysis. The method of least squares. Pearson correlation coefficients and Spearman. Linear regression function. Multivariate regression analysis and correlation. The estimation of linear multiple regression function. The significance test for multiple regression coefficients. Estimation of the multiple correlation coefficient. The coefficient of determination.	2
Lec5	Univariate analysis of variance and post-hoc test: Tukey, Duncan and least significant difference. Kruskal-Wallis test and post-hoc test of Dunn. Methods of analysis of the dynamics of the phenomena - time series. Time series smoothing methods. Analysis of periodic fluctuations. Presentation of selected computer programs supporting statistical analysis STATISTICA, R, Gretl.	2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1	Organizational matters. Introduction to using a spreadsheet. Math and statistics Excel. Generate a vector of continuous variables with normal distribution. Descriptive statistics - calculating measures of location, variability, asymmetry and concentration. Construction series distribution. A graphical representation of the data set - the histogram and the empirical distribution function and the graph ramkowy.	2
Proj2	Basic distributions encountered in mathematical statistics: a normal distribution, Student, chi-square, F Snedecor. Probability density function and cumulative distribution. Point and interval estimation of the expected value, the rate structure (fraction), variance and standard deviation.	2
Proj3	Testing of statistical hypotheses. Parametric tests of significance for the expected value and the variance of the general population. The test for two variances for two medium and two indicators of the structure. Student's test for paired test, homogeneity of variance Bartlett's many, many medium homogeneity test (ANOVA).	2
Proj4	Non-parametric tests of significance - compatibility test Pearson's chi-square test, Kolmogorov sensor compatibility,. Chi-square test of independence - kontyngencyjne boards. Mann-Whitney test. Median test and Wilcoxon signed-ranks test. Rank sum test Kruskal-Wallis test to assess the relationship between the two zmiennymiDwuwymiarowa regression analysis and correlation. A scatterplot. Strength of the association correlation - correlation coefficient estimation, test of significance for the correlation coefficient, parameter estimation of linear regression function, a test of significance for the regression coefficient (slope of the regression line), the confidence interval for the regression coefficient.	2
Proj5	Multivariate analysis of correlation and regression. Estimation of the multiple regression function. The significance test for multiple regression coefficients. Estimation of the coefficient of determination and multiple correlation. Curvilinear regression. Logistic regression. Maximum likelihood estimation. Interpretation of the results of logistic regression.	2
		Total hours: 10

TEACHING TOOLS USED

N1. informative lecture
N2. self study - preparation for project class
N3. calculation exercises
N4. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01,PEK_K01	small exam, evaluation of computing project
F2	PEK_U02,PEK_K02	small exam, evaluation of computing project
F3	PEK_U03,PEK_K03	small exam, evaluation of computational design, defense project
P = (F1+F2+F3)/3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Bobrowski D: Probability in technical applications. Warsaw 1986, WNT [2] R. Smith: Statistics for physicists. Warsaw 2002, PWN [3] Ostasiewicz W. (ed.): Statistical methods for data analysis. Wroclaw 1999, Publisher of Economics in Wroclaw [4] Zeliaś A., Pawelek, B., S. Wanat: Statistical Methods. The tasks and tests. Warsaw 2002, PWE

SECONDARY LITERATURE

[1] I. Bak, Markowicz I., Mojsiewicz M., K. Wawrzyniak: Statistics in tasks. Part I and II. Warsaw 2001. Publisher of Science and Technology [2] Cieciura M., Zacharski J.: Probabilistic methods in practical terms. Warsaw 2007, VIZJA PRESS & IT Sp. z oo [3] Dobosz M.: The computer-assisted statistical analysis of test results. Warsaw 2001, Academic Publishing House EXIT. [4] Frątczak E. Gach-Ciepiela Laws, Babiker H. event history analysis. Elements of the theory, some examples of applications. 2005 Warsaw School of Economics in Warsaw. [5] Puppet L: Fundamentals of engineering studies. Warsaw 2002, PWN. [6] Maliński M.: Computer-assisted mathematical statistics. Gliwice 2000, Silesian University of Technology Press

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Statistics for Engineers
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W01	C1, C2	Lec1, Lec2, Lec3,	N1, N2, N3
PEK_W02	K1MBM_W01	C1, C2	Lec1, Lec3, Lec4,	N1, N2, N3
PEK_W03	K1MBM_W01	C1, C2, C3	Lec1, Lec4, Lec5,	N1, N2, N3, N4
PEK_U01	K1MBM_U04	C1, C2	Pr1, Pr2	N1, N2, N3
PEK_U02	K1MBM_U04	C1, C2	Pr2, Pr3, Pr4	N1, N2, N3
PEK_U03	K1MBM_U01, K1MBM_U05	C1, C2	Pr4, Pr5	N2, N3, N4
PEK_K01	K1MBM_K05	C3	Pr5	N4
PEK_K02	K1MBM_K04	C3	Pr1, Pr5	N4
PEK_K03	K1MBM_K05	C3	Pr1, Pr5	N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Termodynamika techniczna**
Name in English: **Technical thermodynamics**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032047**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. knowledge of matter cover according to the physics education program in the range of Physics module
2. Ability of individual performance of laboratory experiments, enhanced by elementary manual dexterity
3. Awareness of the team working necessity and ability of its execution

SUBJECT OBJECTIVES

C1. Understanding of gas processes and possibility of its usage in technique basing onthe laws of thermodynamic
C2. Knowledge and understanding of the engines air standard cycles and ability to evaluate its efficiency
C3. Familiarisation with the practical realisation of air standard cycle for combustions engines and piston compressors

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Names and describes the laws of thermodynamics and thermodynamic processes
PEK_W02 - Characterises and explains air standard cycles and is able to evaluate its efficiency
PEK_W03 - Names and describes the procedures of the air standard cycles realization in combustion engines and piston compressors

II. Relating to skills:

PEK_U01 - Is able to calculate the level of imperfection of the adiabatic, isothermal process as an example of polytropic process
PEK_U02 - Calculates values of specific heat for gasses and volumetric efficiency of a piston compressor
PEK_U03 - Calculates and verifies coefficient of heat transfer through a plat plate as well as conductive coefficient for forced and natural convection

III. Relating to social competences:

PEK_K01 - Understand the necessity and is aware of possibilities of continuous education, particularly increasing their knowledge of technical thermodynamics (studies II and III degree),
PEK_K02 - Is aware of the importance, responsibility and the effects of engineer work from Mechanical Engineering faculty in terms of responsibility for the environment, resulting from the proper use of the knowledge of technical thermodynamics
PEK_K03 - Recognizes the need to improve professional skills, personal and social

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic definitions: mass, the amount of pressure, temperature, volume	2
Lec2	I Law of Thermodynamics - work, heat, internal energy, power, thermodynamic system open – closed, enthalpy, volume and technical work	2
Lec3	Thermodynamic processes calculation of heat and work variations.	2
Lec4	Cycles, entropy, the efficiency of cycles	2
Lec5	Carnot Cycle, Second Law of Thermodynamics, reversible processes, irreversible entropy relationship of the Second Law of Thermodynamic	2
Lec6	The flow of gas through the nozzles, the energy balance for open movable systems, dynamic stream performance	2
Lec7	Basic air standard cycles for engine, efficiencies and comparison. Combustion, the calorific value of the fuel, combustion control charts	2
Lec8	Piston and rotodynamic; energy balance, an indicator diagram and operation of the compressor	2
Lec9	Basic laws of heat transfer by convection, radiation and conduction	2
Lec10	Compressible fluid flow. Diaphragm, convective heat exchangers	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Practical realization of adiabatic process	2
Lab2	Examination of the adiabatic flow through a Bendemann nozzle	2

Lab3	Determination of volumetric efficiency of a piston compressor	2
Lab4	The study of isothermal process	2
Lab5	Examination of the process of heat transfer through a flat barrier with: a) the occurrence of convection and radiation, b) applying a debilitating radiation screen	2
		Total hours: 10

TEACHING TOOLS USED

N1. multimedia presentation
N2. laboratory experiment
N3. self study - preparation for laboratory class
N4. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 PEK_W02 PEK_W03	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 PEK_U02 PEK_U03,PEK_K01 -PEK_K03	quiz, a report from the laboratory
F2	PEK_U01 PEK_U02 PEK_U03,	quiz, a report from the laboratory
F3	PEK_U01 PEK_U02 PEK_U03	quiz, a report from the laboratory
F4	PEK_U01 PEK_U02 PEK_U03	quiz, a report from the laboratory
P = (F1+F2+F3+F4)/4		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technical thermodynamics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W06	C1	Lec1 Lec2 Lec3	N1.
PEK_W02	K1MBM_W06	C2	Lec4 Lec5 Lec6	N1.
PEK_W03	K1MBM_W06	C3	Lec7 Lec8 Lec9 Lec10	N1.
PEK_U01	K1MBM_U10	C1	La1 La4	N2. N3. N4.
PEK_U02	K1MBM_U10	C2	La2 La3	N2. N3. N4.
PEK_U03	K1MBM_U10	C3	La5 La6	N2. N3. N4.
PEK_K01	K1MBM_K01	C1 C2 C3	La6	N1. N2.
PEK_K02	K1MBM_K02	C1 C2 C3	La6	N2. N3.
PEK_K03	K1MBM_K06	C1 C2 C3	La6	N3. N4.

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Materiałoznawstwo I**
Name in English: **Materials Science I**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032048**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Examination		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	2.4		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic of physic at the high school level
2. Basic of chemistry at the high school level

SUBJECT OBJECTIVES

C1. Knowledge of interaction between structure, manufacturing and properties the basic groups of engineering materials
C2. Knowledge of basic rules of selection materials applied for constructional elements in machines building
C3. Knowledge of basic crystallography and cristalline structures properties
C4. Knowledge of structures and properties of iron-cementite system alloys
C5. Knowledge basic properties of unalloyed steels

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Know basic types and properties of materials
PEK_W02 - Know influence of basic manufacturing technoilogies on the basic materials properties
PEK_W03 - Know basic types and properties of iron alloys structures

II. Relating to skills:

PEK_U01 - Able to assess the type of materials applied for engineering design
PEK_U02 - Can determine the structures of materials applied for engineering design
PEK_U03 - Can determine the basic properties of materials applied for engineering design

III. Relating to social competences:

PEK_K01 - Information retrieval and their critical analyse
PEK_K02 - Observance of custom and rules binding at academic environment

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Classification of engineering materials. Dependences between manufacturing process, structure and materials properties. Rules for materials selection at machines construction.	2
Lec2	Polymer, compositeand ceramic materials - classification, structures and properties	2
Lec3	Elements of crystallography. Build of real crystals. Defects of crystalline structures	2
Lec4	Equilibrium and equilibrium criteria. Internal energy. Entropy. Free energy.	2
Lec5	Phase transformations. Crystallisation. Allotropic and magnetic transformations.	2
Lec6	Alloys. Structure and types of alloys. Intermetallic phases.	2
Lec7	Characteristic of phases presented in alloys of metals	2
Lec8	Binary phase diagrams. Phase rule.	2
Lec9	Analyse of basic types of phase equilibrium diagrams.	2
Lec10	Iron-cementite equilibrium diagram. Diagram analysis.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Introduction.The aim and methods of materials investigation. Construction and operation of metallographic microscope. Macroscopic investigation of materials and investigation of technological defects.	2
Lab2	Binary equilibrium diagram analysis	2
Lab3	Microstructural investigation of mono- and multiphase alloys at etched and non-etched state.	2
Lab4	Diagram and microstructures of iron-cementite diagram analysis	2
Lab5	Summation and laboratory practice credit	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - self studies and preparation for examination
N3. self study - preparation for laboratory class
N4. laboratory experiment
N5. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03,	Oral-written exam
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01 - PEK_K02	Introduction test, oral answers, report
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
1. M.F.Ashby, D.R. Jones - Engineerig Materials

SECONDARY LITERATURE
M. F. Ashby- Materials Selection in Mechanical Design

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Materials Science I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W02	K1MBM_W10, K1MBM_W11	C1 - C3	Lec 1 - Lec 7	N1 - N3
PEK_W03	K1MBM_W10, K1MBM_W11	C4 - C5	Lec 8 - Lec 10	N1 - N3
PEK_U01 - PEK_U03	K1MBM_U01, K1MBM_U02, K1MBM_U06	C1 - C2	Lab 1 - Lab 5	N3 - N5
PEK_K01 - PEK_K02	K1MBM_K09	C1 - C5	Lab 1 - Lab 5	N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Ergonomia i BHP**
Name in English: **Ergonomics and safety**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032049**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. has basic knowledge from range of characteristic and properties of hazardous physical agents (electric energy, mechanical vibrations, lighting, electromagnetic field, dusts), chemical and biological agents.
2. has systematical knowledge from range of mathematics, physics, chemistry and informatics.

SUBJECT OBJECTIVES

C1. Acquirement of basic knowledge from areas of labor law, as well as work accidents and occupational diseases
C2. Acquirement of basic knowledge from areas of ergonomics and labor biomechanics
C3. Acquirement of basic knowledge from analysis and protection before dangerous, harmful and strenuous factors in work environment

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - It knows basic regulations and standards of work safety

PEK_W02 - It has basic knowledge from ergonomics area and it is conscious for capability of its practical application in designing and manufacturing of products

PEK_W03 - It knows basic threats at work stands and methods of protection before them.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Labor protection, work safety regulations and principles	2
Lec2	Accidents at work and occupational diseases, estimate of professional risk on work positions	2
Lec3	Ergonomics as interdisciplinary science	2
Lec4	Labor biomechanics - science about threats for employee health discovering, being result of executable work	2
Lec5	Dangerous and harmful agents in work environment	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

N2. problem discussion

N3. tutorials

N4. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

CIOP - Science about work - safety, sanitation, ergonomics, CIOP, Warsaw 2000 , B. Rączkowski - Industrial Safety in practice - BHP, ODDK, Gdansk 2012

SECONDARY LITERATURE

D. Idczak - Ergonomics as forming of work conditions, L. Skuza - Accidents at work from A to Z

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Ergonomics and safety
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W27	C1	Lec1, Lec2	1,2,3,4
PEK_W02	K1MBM_W30	C2	Lec3	1,2,3,4
PEK_W03	K1MBM_W26	C3	Lec4, Lec5	1,2,3,4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Materiałoznawstwo II**
Name in English: **Materials Science II**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032050**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	120		60		
Form of crediting	Examination		Crediting with grade		
Group of courses					
Number of ECTS points	4		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.8		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Positive credit of Materials Science I lecture course
2. Positive credit of Materials Science I laboratory practice

SUBJECT OBJECTIVES

C1. Knowledge of division rules, classification and notatation for non-alloyed steels, alloyed steels , casts and their application
C2. Knowledge of heat treatment and termo-chemical teratment basement and their influence on steel properties
C3. Knowledge of types and non-iron metals properties

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Know the rules of division, classification and notatation for non-alloyed steels, alloyed steels, casts and their application

PEK_W02 - Know the basement of termo and termo-chemical treatments and their influence on steel properties

PEK_W03 - Know the types and properties of non-iron metal alloys

II. Relating to skills:

PEK_U01 - Be able to divide, classification and notation of non-alloyed steels, alloyed steels, casts and their application

PEK_U02 - Be able to determine the types of heat and termo-chemical treatment application and theit influence on steel properties

PEK_U03 - Be able to determine the types and properties of non-iron metal alloys

III. Relating to social competences:

PEK_K01 - Information retrieval and their critical analyse

PEK_K02 - Observance of custom and rules binding at academic environment

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Grey cast irons. Graphitisation. Modification of cast irons.	2
Lec2	Types of graphite and cast irons metall matrix.Classification and rules of cast irons notation.	2
Lec3	Phase transformation in steels during heating and cooling processes	2
Lec4	TTT diagrams. Hardenability. Supersaturation and ageing processes.	2
Lec5	Surface heat treatment of steel: surface hardening, carburization, nitruration.	2
Lec6	Influence of alloyed elements on phase transformations in steels.	2
Lec7	General classification and rules of non-alloyed and alloyed steels notation	2
Lec8	Alloed structural steels. Weldability	2
Lec9	Alloyed tool stels and steels with special properties: corrosion, creep and heat resistant steels.	2
Lec10	Copper, aluminium and light elements alloys	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Microstructures of steels, cast steels and cast irons based on Fe-Fe3C binary diagram	2
Lab2	Influence of heat treatment on microstructure and properties of steels	2
Lab3	Microstructures and properties of tool steels and steels with special properties.	2
Lab4	Microstructures and properties of aluminium and copper alloys.	2
Lab5	Summation, supplement and credit of laboratory practice.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - self studies and preparation for examination
N3. self study - preparation for laboratory class
N4. laboratory experiment
N5. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03,	Oral-written exam
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01-PEK_K02	Introduction test, oral answers, report
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
1. M.F.Ashby, D.R. Jones - Engineerig Materials

SECONDARY LITERATURE
M. F. Ashby- Materials Selection in Mechanical Design, vol 1 and 2

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Materials Science II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W02	K1MBM_W12	C1, C2	Lec 1 - Lec 7	N1 - N3
PEK_W03	K1MBM_W12	C3	Lec 8 - Lec 10	N1 - N3
PEK_U01-PEK_U03	K1MBM_U16	C1 -C3	Lab 1 - Lab 3	N3 - N5
PEK_K01-PEK_K02	K1MBM_K09	C1 - C3	Lab 1 - Lab 5	N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Wytrzymałość materiałów I**
Name in English: **STRENGTH OF MATERIALS I**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032051**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20	20			
Number of hours of total student workload (CNPS)	120	60			
Form of crediting	Examination	Crediting with grade			
Group of courses					
Number of ECTS points	4	2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes	1.8	1.4			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of statics and fundamentals of mechanics – forces, reactions, constraints, Newton's laws. More specifically the familiarity with the following concepts is required: moment of a force at a point, balance/reduction of an arbitrary spatial force system, definitions of internal forces in a member, vector algebra and mass geometry. The ability to calculate the following quantities: internal force in a member, moment of static and moment of inertia of composite figures and simple solids, the parallel and rotary transformation of the coordinate system.

SUBJECT OBJECTIVES

C1. Technical problem solving based on mechanics.
C2. Performing strength analyses of machine components.
C3. Teamwork and following academic principles.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Student knows: foundations of tensor analysis and its applications in the solid mechanics,
PEK_W02 - limitations of solutions of geometrically linear structures, when to superimpose displacements, what is the stability of the compressed member and what load leads to its loss,
PEK_W03 - the most useful failure criteria hypotheses and their applications,

II. Relating to skills:
PEK_U01 - Student has practical skills in: performing the parallel and rotational transformation as well as calculating the eigenvalues of the stress, strain or moment of inertia tensors,
PEK_U02 - calculating of the stress and displacement in a member with a compact or a thin-walled cross-section loaded with tension–compression, torsion, shear or bending force as well as stress in welded, riveted, bolted joints.
PEK_U03 - designing a member resistant to buckling in the elastic and elastic-plastic regions.

III. Relating to social competences:
PEK_K01 - Social competencies: independent research and critical evaluation of the found sources,
PEK_K02 - objective evaluation of arguments, rational explanation and justification of the student's viewpoint using knowledge of the strength of materials,
PEK_K03 - conforming to the academic principles.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Basic notions. Experimental foundations of the discipline. Strength design of straight members in tension and compression.	2
Lec2	Stress theory.	2
Lec3	Theory of strain. Engineering measurements of strain. Physical relationships between stress and strain.	2
Lec4	Torsion of circular shafts. Torsion of members of arbitrary cross-section. Thin-walled members.	2
Lec5	Shearing of joints. Symmetric bending of straight members. Internal forces and stresses.	2
Lec6	Displacements in beams. Deflection line of a beam.	2
Lec7	General case of bending. Unsymmetrical bending. Buckling of members.	2
Lec8	Stress concentration. Permissible stress. Factor of safety. Strain energy, spherical and deviatoric parts of tensor, shear energy.	2
Lec9	Failure criteria and combined modes of loading.	2
Lec10	Energy methods for determining displacements in statically determinate and indeterminate member systems.	2
		Total hours: 20
Form of classes – Classes		Number of hours
Cl1	Strength design of straight members in tension and compression. Effect of temperature.	2

Cl2	Statically indeterminate cases in stretching/compressing.	2
Cl3	Płaski stan naprężenia. Koło Mohra.	2
Cl4	Shafts in torsion – strength and stiffness.	2
Cl5	Unsymmetrical bending.	2
Cl6	Displacements in beams. Deflection line of a beam.	2
Cl7	Buckling of compressed members.	2
Cl8	Applications of failure criteria hypotheses.	2
Cl9	Castigliano and Menabre-Castigliano theorem.	2
Cl10	Written test.	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. calculation exercises
N3. homework
N4. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 do PEK_W03	
F2	PEK_W01 do PEK_W03	Written and oral exam
P = 0.25 F1 + 0.75 F2		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 do PEK_U03, PEK_K01 do PEK_K03	Oral examination, written test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] J. Misiak: Mechanika techniczna. Statyka i wytrzymałość materiałów, t1. WNT, 1996.
[2] R. Żuchowski: Wytrzymałość materiałów. Oficyna Wydawnicza P.Wr., 1996.
[3] Z. Dyląg, A. Jakubowicz, Z. Orłoś: Wytrzymałość materiałów. WNT, 1997.
[4] Z. Brzoska: Wytrzymałość materiałów. PWN, 1979.
[5] M.E. Niezgodziński, T. Niezgodziński: Wytrzymałość materiałów. PWN, 1981.
[6] R. Kurowski, Z. Parszewski: Zbiór zadań z wytrzymałości materiałów. PWN, 1966.
[7] T. Rajfert, Rżysko J.: Zbiór zadań ze statyki i wytrzymałości materiałów. PWN, 1976.

SECONDARY LITERATURE

[1] S.P. Timoshenko: Historia wytrzymałości materiałów. Arkady, 1966.
[2] S. Katarzyński, S. Kocańda, M. Zakrzewski: Badania własności mechanicznych metali. WNT, 1967.
[3] J. Walczak: Wytrzymałość materiałów oraz podstawy teorii sprężystości i plastyczności, PWN, 1973.
[4] E. Rusiński: Mikrokomputerowa analiza ram i nadwozi pojazdów i maszyn roboczych. W K Ł, 1990.
[5] W. Śródka: Trzy lekcje metody elementów skończonych. Oficyna Wydawnicza P.Wr., 2004.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
STRENGTH OF MATERIALS I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 do PEK_W03	K1MBM_W09	C1	Lec1-10	N1, N4
PEK_U01 do PEK_U03	K1MBM_U19	C2	Cl1-10	N2, N3
PEK_K01 do PEK_K03	K1MBM_K01, K1MBM_K03	C3	Cl1-10	N1 do N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Maszynoznawstwo**
Name in English: **Machines science**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032052**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10				10
Number of hours of total student workload (CNPS)	60				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses					
Number of ECTS points	2				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		10
		Total hours: 10
Form of classes – Seminar		Number of hours
Sem1		10
		Total hours: 10

TEACHING TOOLS USED
N1. traditional lecture with the use of transparencies and slides N2. self study - self studies and preparation for examination N3. multimedia presentation N4. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U02	
F2	PEK_U01	
P = F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Machines science
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W02	K1MBM_W17, K1MBM_W18	C1		N1,N2
PEK_U01-PEK_U2	K1MBM_U01, K1MBM_U07	C2,C3		N3,N4
PEK_K01-PEK_K02	K1MBM_K02, K1MBM_K07	C4		N1,N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Teoria mechanizmów i manipulatorów**
Name in English: **Theory of Mechanisms and Manipulators**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032053**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20			20	
Number of hours of total student workload (CNPS)	90			90	
Form of crediting	Examination			Crediting with grade	
Group of courses					
Number of ECTS points	3			3	
including number of ECTS points for practical (P) classes				3	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			2.1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematical analysis, matrix algebra
2. Knowledge of fundamental laws in statics, kinematics and dynamics
3. Skill in fuction analysis, derivatives, basic matrix and vector operations

SUBJECT OBJECTIVES

C1. Acquire knowledge in topology, kinematics and dynamics of mechanisms and manipulators
C2. Acquire and understanding of basic mechanisms and manipulators
C3. Getting skills in determining kinematic and dynamic parameters

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Understands theoretical fundamentals of mechanism and robot topology
PEK_W02 - Has the knowledge of kinematic and dynamic analysis methods
PEK_W03 - Is able to commentate results of analysis, evaluate their correctness

II. Relating to skills:

PEK_U01 - Is able to evaluate topological carrectness of kinematic systems (redundant costraints)
PEK_U02 - Is able to determine kinematic and dynamic properties
PEK_U03 - Is able to create models of simple planar mechanisms and manipulators

III. Relating to social competences:

PEK_K01 - Has a conviction of responsibility for the work done

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Topology of mechanisms, movable properties	2
Lec2	Kinematics of mechanisms	2
Lec3	Kinematics of mechanisms, cont.	2
Lec4	Planetary gear trains	2
Lec5	Manipulators' properties. Planar serial and parallel systems	2
Lec6	Matrix description of spatial systems	2
Lec7	Kinetostatic analysis	3
Lec8	Friction in joints, efficiency	2
Lec9	Dynamic motion analysis, motion fluctuation	3
		Total hours: 20
Form of classes – Project		Number of hours
Proj1	Introduction to modelling mechanisms in SAM (Simulation and Analysis of Mechanisms) – presentation of examples	2
Proj2	Mechanisms' topology: rules of drawing digrams, topology analysis - joint classification, mobility (test, project)	2
Proj3	Rules of creating models in SAM system, creating simple models, model motion simulation, presentation of analysis results	2
Proj4	Kinematic analysis - velocity and acceleration determination - vector methods (test, project)	2
Proj5	Kinematic analysis - velocity and acceleration determination using SAM (project)	2
Proj6	Planar manipulators - matrix notation of kinematics (project)	2
Proj7	Modelling manipulators using SAM: forward and inverse tasks (project)	2
Proj8	Anaysis of planetary transmissions, angular velocity ratio determination (test, project)	2

Proj9	Modelling of planetary transmissions and gear linkage mechanisms using SAM (project)	2
Proj10	Joint force and external equilibrium determination (test, project)	2
		Total hours: 20

TEACHING TOOLS USED

N1. problem lecture
N2. self study - preparation for project class
N3. individual project
N4. tutorials
N5. preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	written examination
P = Ocena z egzaminu		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03	project defence
F2	PEK_U01, PEK_U02, PEK_U03, PEK_K01	test
P = średnia wszystkich ocen		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Gronowicz A.: Fundamentals of kinematic systems analysis (in Polish). Oficyna Wydawnicza PWr., Wrocław 2003; Morecki A., Knapczyk J., Kędzior K.: Theory of mechanisms and manipulators (in Polish). WNT 2002; Miller S.: Theory of machines and mechanisms. Analysis of mechanical systems (in Polish). Oficyna Wydawnicza PWr. Wrocław 1996; Gronowicz A. i inni: Theory of machines and mechanisms. Set of analysis and synthesis problems (in Polish). Oficyna Wydawnicza PWr. Wrocław 2002

SECONDARY LITERATURE

Olędzki A.: Fundamentals of machines and mechanisms theory (in Polish). WNT 1987; Morecki A., Oderfeld J.: Theory of machines and mechanisms (in Polish). PWN 1987; Waldron K., Kinzel G.: Kinematics, Dynamics and Design of Machinery. John Wiley &Sons, Inc. 1999

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Theory of Mechanisms and Manipulators
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W17	C1, C2, C3	Lec1-Lec9	N1 - N5
PEK_U01, PEK_U02, PEK_U03	K1MBM_U11	C1, C2, C3	Proj1-Proj10	N2, N3, N4
PEK_K01	K1MBM_K04	C3	Proj1-Proj10	N3

SUBJECT SUPERVISOR

Prof. dr hab. inż. Antoni Gronowicz tel.: 71 320-27-10 email: antoni.gronowicz@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Metrologia wielkości geometrycznych**
Name in English: **Metrology of geometrical quantites**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032054**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		20		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has a basic knowledge of mathematics and physics at secondary school level
2. Student has the ability to read drawings and diagrams contained in the technical documentation.
3. Student has basic knowledge in the design of machine elements. It has a basic knowledge of manufacturing techniques of machine parts.

SUBJECT OBJECTIVES

C1. Acquisition of knowledge about quantities and units of measurement associated with the geometry of the product description.
C2. Acquisition of knowledge about the types and characteristics of equipment for the measurement of geometrical quantities.
C3. Learning how to use the equipment for measurement of geometrical quantities.
C4. Gaining skills in the selection of test equipment, analyze test results, evaluation of measurement errors and the expression of measurement uncertainty.
C5. Wyszukiwanie istotnych informacji oraz ich krytyczna analiza.
C6. The acquisition and consolidation of social skills including emotional intelligence, involving the cooperation among students with a view to effective problem solving. Responsibility, honesty and fairness in the academic society life.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - It can identify the quantity associated with of the geometrical description of the product, can name units of measure used to describe them, know diferences between universal and dedicated equipment for the measurement of geometrical quantities, know how to describe its metrological characteristics. He knows and is able to explain the terms used in metrology of geometrical quantities.
PEK_W02 - Able to define the elements of the measurement process and their impact on the result of the measurement.
PEK_W03 - Knows the specific, standardized quantities are subject of measurements of a different typical machine manufacturing techniques.

II. Relating to skills:
PEK_U01 - Understands the dimensional requirements imposed to products included in the technical documentation. Can use standards for tolerances and fits linear and geometric tolerances. It can calculate the value of measurement errors, estimated measurement uncertainty for the different measurements.
PEK_U02 - He can make the selection of appropriate test equipment and set it up depending on the task measuring. Can use measuring equipment used in engineering to measure the geometrical quantities.
PEK_U03 - Able to solve the basic problems of the practical use of the tools and of measuring. Able to recognize sources of error, their values, and estimate the uncertainty of measurement.

III. Relating to social competences:
PEK_K01 - Search for information and its critical analysis
PEK_K02 - Team collaboration on improving the method of selection of strategies aimed at optimal solution entrusted of problems to a group.
PEK_K03 - Objective evaluation of arguments, the rational explanation of his own point of view using the knowledge of metrology.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. Basic concepts of metrology. Quantities and units of measurement. Integrated measurement units. SI units, measurement standards, a hierarchical system of measurement standards.	1

Lec2	Measurement, measurement types, method and measurement principle.	1
Lec3	Errors and their sources. The types of errors. Distributions of errors variability. Methods of estimation and expression of uncertainty in measurement.	2
Lec4	Dimensions, tolerance of linear dimensions nad fits.	2
Lec5	GPS - geometrical tolerance according to ISO 1101. Geometrical deviations mesurements.	2
Lec6	Description of geometric structure of surfaces - roughness and waviness, and their measurement.	2
Lec7	Tolerance and machine parts measurement.	2
Lec8	Tolerating and measurements of machines parts manufactured in the process of: casting, plastic forming, welding, plastics processing.	2
Lec9	Classification of the measuring equipment, the metrological characteristics and methods of assessment.	2
Lec10	hods and means of mechanization and automation of measurements.	2
Lec11	Analysis of dimension. Fundamentals of statistical control of dimensions.	1
Lec12	Fundamentals of coordinate measurement techniques.	1
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Organizational matters. General principles for the use of measuring equipment.	2
Lab2	Measurements of linear dimensions.	2
Lab3	Measurements of angular dimensions.	2
Lab4	Direct and indirect measurements of cones.	2
Lab5	Identification and measurement of threads.	2
Lab6	Assessment of the geometrical structure of the surface.	2
Lab7	Identification and measurement of cylindrical gears.	2
Lab8	Measurements of selected shape deviations.	2
Lab9	Measurements of selected displacement.	2
Lab10	Measurements of machine parts with pneumatic measurement equipment.	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. laboratory experiment
N3. report preparation
N4. self study - preparation for laboratory class
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01; PEK_W02; PEK_W03	test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01; PEK_U02; PEK_U03; PEK_K01; PEK_K02; PEK_K03;	report on laboratory exercises, test, oral answer
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Jakubiec W., Malinowski J.: "Metrologia wielkości geometrycznych". WNT, Warszawa 2007.[2] Instrukcje do ćwiczeń laboratoryjnych.

SECONDARY LITERATURE

[1] Adamczak S., Makieła W.: " Metrologia w budowie maszyn. Zadania z rozwiązaniami. Wydanie II, zmienione". WNT, Warszawa 2007.[2] Adamczak S., Makieła W.: "Pomiary geometryczne powierzchni". WNT, Warszawa 2009.[3] Humenny Z. i inni: " Specyfikacje geometrii wyrobów (GPS)". WNT, Warszawa 2004[4] Jakubiec W., Malinowski J., Płowucha W.: "Pomiary gwintów w budowie maszyn". WNT, Warszawa 2008.[5] Jezierski J., Kowalik H., Siemiątkowski Z., Warowny R.:" Analiza tolerancji w konstrukcji i technologii maszyn". WNT, Warszawa 2009.[6] Ochęduszko K., "Koła zębate. Tom 3. Sprawdzanie". WNT Warszawa 2007 (dodruk 2012)[7] Ratajczyk E.: "Współrzędnościowa technika pomiarowa". Oficyna Wydawnicza PW, Warszawa 2005

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Metrology of geometrical quantites
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number

PEK_W01; PEK_W02; PEK_W03;	K1MBM_W15	C1; C2; C3; C4; C5; C6	Wy1 - Wy12	N1; N5
PEK_U01; PEK_U02; PEK_U03;	K1MBM_U12, K1MBM_U40	C1; C2; C3; C4; C5; C6	Wy1 - Wy12	N2; N3; N4; N5
PEK_K01; PEK_K02; PEK_K03;	K1MBM_K04, K1MBM_K05, K1MBM_K06	C1; C2; C3; C4; C5; C6	La1 - La10	N2; N3; N4; N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy automatyki**
Name in English: **Fundamentals of Automatic Control**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032055**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		20		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Examination		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of the complex functions and differential equations.

SUBJECT OBJECTIVES

C1. Getting knowledge about the basic description methods of automatic systems.
C2. Getting knowledge about the basic analysis methods of automatic systems.
C3. Getting knowledge about the basic synthesis methods of automatic systems.
C4. Learning to design control systems.
C5. The practical skills to build and run basic automation systems.
C6. Skills to evaluate the performance of control systems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knowledge of basic methods for describing automation systems.
PEK_W02 - Knowledge of basic methods to analyze automation systems.
PEK_W03 - Knowledge of methods to synthesize automation systems.

II. Relating to skills:

PEK_U01 - Can define the mathematical description of the automation system.
PEK_U02 - Able to analyze the function of the automation system.
PEK_U03 - Can design automation system.

III. Relating to social competences:

PEK_K01 - Can broaden their knowledge by using additional aids.
PEK_K02 - Can think and act in a creative way.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, basic terms, the structure of control systems and their classification.	2
Lec2	Description of linear automation systems: differential equations, transfer function, time characteristics.	2
Lec3	Description of linear automation systems: the frequency response, the frequency characteristics.	2
Lec4	Dynamic objects: proportional, inertial, differential.	2
Lec5	Dynamic objects: Integral, oscillating, delay.	2
Lec6	Automatic control. Requirements. Static control. astatic control.	2
Lec7	Controllers: PI, PD, PID	2
Lec8	Nonlinear systems. Methods of description and analysis. Discrete automatic control.	2
Lec9	Boolean algebra, combinational systems.	2
Lec10	Logic sequential systems. Credit.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Static and dynamic characteristics of automatic objects.	2
Lab2	Frequency characteristics of automatic objects.	2
Lab3	Simulation tests of automatic objects in Matlab-Simulink system.	2
Lab4	On-off control.	2
Lab5	Programming languages of PLC controllers.	2
Lab6	Mathematical fundamentals of digital automation systems.	2
Lab7	Elements and contactor-relay systems.	2
Lab8	Logic combinational systems.	2

Lab9	Modeling and programming of sequential processes.	2
Lab10	Modeling and programming of complex processes. Credit.	2
		Total hours: 20

TEACHING TOOLS USED

N1. self study - self studies and preparation for examination
N2. self study - preparation for laboratory class

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03	Exam
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03, PEK_K01-PEK_K02	Average grade
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Greblicki W., Podstawy automatyki. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2006.
Praca zbiorowa, tytuł: Laboratorium podstaw automatyki i automatyzacji,wydawnictwo: Oficyna Wydawnicza Politechniki Wrocławskiej, rok: 2005

SECONDARY LITERATURE

Kaczorek T., Dzieliński A., Dąbrowski W., Łopatka R., Podstawy teorii sterowania., WNT Warszawa 2009.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Automatic Control
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W03	K1MBM_W01, K1MBM_W16	C1-C3	Lec1-Lec15	N1
PEK_U01 - PEK_U03 PEK_K01 - PEK_K02	K1MBM_K05, K1MBM_U05	C4-C6	Lab1-Lab15	N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Techniki wytwarzania-odlewnictwo**
Name in English: **Manufactures techniques - casting**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032056**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	90		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has a basic knowledge about the metallurgical process of metal ores and receiving ferrous alloys and non-ferrous metals; Has a basic knowledge about the types of engineering materials - their properties, applications and principles of their selection; Has a basic knowledge about the structure of metals and alloys as well as the principles of their classification and labeling;
2. Can determine the characteristics of the materials microstructure, identify occurring in material phases; Also is able to differentiate: the microstructure of ferrous alloys (in terms of carbon content), non-ferrous alloys and the effect of the heat treatment;
3. Can read and interpret the figures and diagrams used in the technical documentation;

SUBJECT OBJECTIVES

C1. The acquisition of general knowledge about the basic techniques of foundry manufacturing methods;
C2. Acquiring the selection skills and a critical analysis of chosen casting technology and basic parameters of that process;
C3. Acquisition and consolidation of social skills like the ability of working in a group to solve the problems effectively; The acquisition of sense of responsibility and respect for traditions existing in academia and society;

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Has a basic knowledge of the manual and machine manufacturing technologies of foundry molds and cores

PEK_W02 - Has a knowledge of the basic methods of melting and treatment of metallurgical alloys.

PEK_W03 - Has a basic knowledge about designing the casting products and the processes for their production with principles of technology of their selection dependent on the type of casting and the type of alloy.

II. Relating to skills:

PEK_U01 - Can analyze and design the process of production casting equipment to a simple product.

PEK_U02 - Can choose the right technology for casting and define the basic parameters of that process.

PEK_U03 - Can choose the right method of treatment of the casting alloy and define its basic parameters.

III. Relating to social competences:

PEK_K01 - Can search for information and critically analyze them, rationally explain them and justify the own point of view using the knowledge of foundry branch.

PEK_K02 - Recognizes the importance of team cooperation on ways to choose a strategy to optimally solve assigned to a group problems.

PEK_K03 - Understands the need to respect the traditions and rules in academia and society.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational issues. Discussion about the specific shape of the statethe from liquid metal, fundamental concepts and algorithms for casting production.	1
Lec2	Principles for design and construction of casting equipment.	2
Lec3	Materials and equipment used for the preparation of the molding and core sands and the methods of their manufacturing and testing their properties.	3
Lec4	Methods for manual and automatic manufacturing of foundry molds and cores.	3
Lec5	Production of molds and cores from self-and thermosetting molding sands.	2
Lec6	Manufacturing the castings using a precise technique of lost models.	1
Lec7	Knocking out and the cleaning of castings.	2
Lec8	Manufacturing the castings in metal molds.	3
Lec9	Melting casting alloys. Metallurgical and thermal treatment of cast alloys and castings. Test of the knowledge.	3
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Research the materials and molding sands. Construction of casting models and core boxes.	2
Lab2	Manual production of foundry molds and cores.	2
Lab3	Automatic production of foundry molds and cores.	2
Lab4	Production of molds and cores from self-and thermosetting molding sands.	2

Lab5	Manufacturing the castings in metal molds.	2
		Total hours: 10

TEACHING TOOLS USED
N1. traditional lecture with the use of transparencies and slides N2. self study - self studies and preparation for examination N3. self study - preparation for laboratory class N4. report preparation N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	colloquium
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03	short exam
F2	PEK_K01 - PEK_K03	report
P = średnia z wszystkich ocen		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Perzyk M. i inni; Odlewnictwo WNT Warszawa 2000;
2. Tabor A. Odlewnictwo wyd. „Akapit" Kraków 1996;
3. Murza-Mucha P., Techniki wytwarzania – Odlewnictwo. PWN, Warszawa 1978;
4. Granat K. Laboratorium z odlewnictwa, skrypt PWr, Wrocław 2007;
5. Perzyk M. i inni: Materiały do projektowania procesów odlewniczych, skr. P.Warsz. Warszawa 1981;

SECONDARY LITERATURE

1. Lewandowski J. L.; Tworzywa na formy odlewnicze, wyd.: „Akapit" Kraków 1997;
2. Błaszkowski K. Technologia formy i rdzenia, Warszawa 1990;
3. Poradnik inżyniera – Odlewnictwo WNT Warszawa 1986;

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Manufactures techniques - casting
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02	K1MBM_W21	C1, C2	lec1, lec3-9	N1-N5
PEK_W03	K1MBM_W21	C2	lec2	N1- N3, N5
PEK_U01	K1MBM_U27	C2	la1	N2-N3, N5
PEK_U02, U03	K1MBM_U27	C1, C2	La1-La5	N2-N5
PEK_K01	K1MBM_K01	C3	La1-La5	N2-N5
PEK_K02, PEK_K03	K1MBM_K04, K1MBM_K06	C3	La1-La5	N2-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Wytrzymałość materiałów II**

Name in English: **STRENGTH OF MATERIALS II**

Main field of study (if applicable): **Mechanical Engineering and Machine Building**

Level and form of studies: **I level, part-time**

Kind of subject: **obligatory**

Subject code: **MMM032057**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2.
N3. laboratory experiment
N4. report preparation
N5. self study - preparation for laboratory class

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 do PEK_W03,	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 do PEK_U03, PEK_K01 do PEK_K03.	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
STRENGTH OF MATERIALS II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 do PEK_W03	K1MBM_W09	C1, C2		N1, N2
PEK_U01 do PEK_U03. PEK_K01 do PEK_K03	K1MBM_K01, K1MBM_K03, K1MBM_U20	C1, C2		N3 do N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Metoda elementów skończonych**
Name in English: **Finite Element Method**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032058**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			20	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of strength materials. Analysis of beam, plate and shell structures. Fundamentals of engineering materials.
2. Matrix algebra
3. Skills in basic CAD tolls. Skills for solving basic engineering elements with use of classical elastic theory.

SUBJECT OBJECTIVES

C1. Learn the basics of the finite element method theory
C2. Learn how to prepare proper model for FEM calculations
C3. Learn to model and perform simulations of the effort of the load carrying structures with use of numerical methods

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Have knowledge in the fundamentals of finite element method
PEK_W02 - Have the knowledge to prepare proper geometrical and discrete model to solve FEM task.
PEK_W03 - Is able to use FEM in practical application of calculation of engineering structures. Can formulate and solve problems of the

ultimate strength of load carrying structures.

II. Relating to skills:
PEK_U01 - Skills in software for the FEA
PEK_U02 - Have the knowledge to prepare proper geometrical and discrete model to solve the task in the range of elastic deformation.
PEK_U03 - Is able to perform FEA in the field of liner and nonlinear statics, dynamics, vibrations and linear buckling.

III. Relating to social competences:
PEK_K01 - Learn the responsibility for his work.
PEK_K02 - Creative thinking and acting
PEK_K03 - Learn team work due to the necessity of information flow during project realisation

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Development of the numerical methods in the theory of constitutive equations.	1
Lec2	Introduction and basic assumptions of FEM	1
Lec3	Approximation functions, classifications of finite elements, convergence conditions	2
Lec4	Construction of stiffness matrix of the fundamental finite elements (plate, shield, beam, solid)	1
Lec5	Characteristics of the fundamental finite elements 1D, 2D, 3D and presentation of the basic relations	2
Lec6	Definition of the material model used in simulations of static, dynamic problems with use of FEM.	1
Lec7	Mehtodics of discrete model creation	1
Lec8	Numerical simulations with use of FEM in statics, dynamics and thermal problems	1
		Total hours: 10
Form of classes – Project		Number of hours
Proj1	Introduction. Presentation of the software	1
Proj2	Discrete model creation principles. Assumptions and simplifications of the model	2
Proj3	Solid models discretization. Analysis of the parameters (type of the element, mesh density) and its influence on the results.	2

Proj4	Designing and modeling of the thin walled beam and shell structures	3
Proj5	Boundary conditions: DOF and load applicaiton	2
Proj6	Principles of the creation of the complex models of load carrying structures.	2
Proj7	Principles of design and modeling of structural nodes and the load transfer	2
Proj8	Results analysis. Effort criterion.	2
Proj9	Modal analysis, buckling and thermal load	2
Proj10	Individual modeling of selected structural node	2
		Total hours: 20

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. problem exercises
N3. project presentation
N4. individual work and preparation to the exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	exam
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01-PEK_K03	mark on the basis of the simulation project part
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Rusiński E., Metoda elementów skończonych. System COSMOS/M, WKiŁ Warszawa 1994
Rusinski E., Czmochowski J., Smolnicki T.: Zaawansowana metoda elementów skończonych w konstrukcjach nośnych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2000
Zienkiewicz O.C.: Metoda elementów skończonych, Arkady 1972

SECONDARY LITERATURE

Rusiński E.: Zasady projektowania konstrukcji nośnych pojazdów samochodowych. Oficyna Wyd. PWr Wrocław 2002
Rakowski G., Kacprzyk Z.: Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005
Szmelter J., Dacko M., Dobrociński S., Wieczorek M.: Metoda elementów skończonych w statyce konstrukcji, Arkady 1979
Gawroński W., Kruszewski J., Ostachowicz W., Tarnowski K., Wittbrodt E.: Metoda elementów skończonych w dynamice konstrukcji, Arkady, Warszawa 1984
Waszczyszyn Z., Cichoń Cz., Radwańska M.: Metoda elementów skończonych w stateczności konstrukcji, Arkady, Warszawa 1990
Kleiber M.: Wprowadzenie do metody elementów skończonych, PWN, Warszawa-Poznań 1989

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Finite Element Method
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W18, K1MBM_W19	C1		N4
PEK_W02	K1MBM_W19	C2		N2, N4
PEK_W03	K1MBM_W18	C3		N4
PEK_U01, PEK_K01	K1MBM_K02, K1MBM_U22	C1		N2
PEK_U02, PEK_K02	K1MBM_K02, K1MBM_U22	C2		N1, N2
PEK_U03, PEK_K03	K1MBM_K02, K1MBM_U18, K1MBM_U19, K1MBM_U22	C3		N1, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Układy napędowe pojazdów**
Name in English: **Driving Systems of Vehicles**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032059**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	90		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses	X				
Number of ECTS points	3		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. positive marks of mechanics, mathematical analysis and construction of foundations.
2. basic knowledge of working various systems or machines devices.
3. Basic ability to work in groups.

SUBJECT OBJECTIVES

C1. The aim of the course is to broaden the knowledge of the construction vehicle propulsion systems and their components. The student gets acquainted with the methods of developing and preparing the characteristics of individual components of propulsion systems, traction characteristics and primary energy sources.
C2. The aim of the course is to acquire practical knowledge of the methods of calculation and selection of individual drive components and determine how to prevent undesirable phenomena such as the circulating power, etc. He knows the need for further professional development.
C3. The aim of the course is the acquisition of practical skills experiment planning, conducting it and interpreting the results. The student is aware of the impact of selected environmental solutions and is able to use the correct terminology. Student is responsible for own work and group work.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - primary energy sources can be selected and the characteristics are known; can and described the power flow through the various elements of the powertrain, hydrostatic, hydrodynamic and mechanical, powertrain components are selected on the basis of calculations and characteristics.

PEK_W02 - can point out the use of power systems and improve them to suit your needs based on the development of technology;

PEK_W03 - is able to describe and explain the principles of operation of the various components of propulsion systems, indicate the potential for adverse effects and identify methods for their elimination.

II. Relating to skills:

PEK_U01 - can also using foreign literature to interpret the results obtained in the laboratory experiments and the use of catalogs;

PEK_U02 - is able to analyze and develop the results in order to obtain the characteristics or parameters measured in the propulsion system of vehicles and machinery at different settings of the control system;

PEK_U03 - is able to offer own ideas and own propulsion control systems performing similar functions.

III. Relating to social competences:

PEK_K01 - is capable and understands the need for continuous updating of skills and acquire new kwowledge;

PEK_K02 - is responsible for the decisions both in terms of environmental and mechanical engineering activities;

PEK_K03 - is able to work in a team and solve the tasks assigned to the various positions and is responsible for the group to achieve its intended purpose.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Systematic drive systems (systems single source, multi-source, serial, parallel, hybrid) - application examples. The basic functions performed by the powertrain (transmission, transformation, distribution, accumulation and energy recuperation) - Case studies.	2
Lec2	The characteristics of conventional primary and secondary energy sources - rules of control. Strenuous-intensity characteristics of power consumers - examples of typical load in the form of linear, area, cycle, spectrum charges etc.	2
Lec3	Propulsion systems of the "rigid" and "flexible" kinematic coupling. The issue of non-compliance kinematic and power circulating in the propulsion system - basic physical, technical effects, methods of elimination-examples.	2
Lec4	Basic structure of the propulsion system selection and selection problem of primary energy sources: a) typical mechanical drive system b) typical drive system converter c) typical hydrostatic system. Drive systems with stepper motors and servo-electric principle	2
Lec5	Issues of transients in the propulsion system under the elastic ties, starting characteristics of conventional and programmable - minimizing the negative effects of dynamic.	2
		Total hours: 10
Form of classes – Laboratory		Number of hours

Lab1	Experimental studies hydrostatic drive earth working vehicle.	2
Lab2	Experimental studies on hybrid caterpillar driving system.	2
Lab3	Experimental determination of the characteristics of the selected receiver of energy and the choice of the optimum driveline capstans.	2
Lab4	Comparison of the boot process of asynchronous motor in the driving system	2
Lab5	Study of the effect of elastic stiffness in a driving system on its dynamic toughness.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. laboratory experiment
N3. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 PEK_W02 PEK_W03	written-oral exam
P = egzamin pisemno ustny		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 PEK_U02 PEK_U03 PEK_K01-PEK_K03	short test, laboratory report, oral answer
P = pozytywne oceny z wszystkich ćwiczeń laboratoryjnych		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Szumanowski A. , tytuł: Układy napędowe z akumulacja energii, PWN, rok: 1990Pieczonka K. , tytuł: Maszyny urabiające, Politechnika Wrocławska, rok: 1988Szydelski Z. , tytuł: Napęd i sterowanie hydrauliczne, WKŁ, rok: 1999Kaczmarek T., tytuł: Napęd elektryczny robotów, Wydawnictwo Politechniki Poznańskiej, rok: 1996Wróbel T. , tytuł: Silniki krokowe, Wydawnictwo Naukowo-Techniczne, rok: 1993Kosmol J., tytuł: Serwonapędy obrabiarek sterowanych numerycznie, Wydawnictwo Naukowo-Techniczne, rok: 1998

SECONDARY LITERATURE

Dębicki M., tytuł: Teoria samochodu, WNT , rok: 1969Szumanowski A. , tytuł: Czas energii, WKiŁ, rok: 1988Mitschke M. , tytuł: Dynamika samochodu. Napęd i hamowanie., WKiŁ, rok: 1987Michałowski K. Ocioszyński J., tytuł: Pojazdy samochodowe o napędzieelektrycznym i hybrydowym, WKiŁ, rok: 1989

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Driving Systems of Vehicles
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W20	C1, C2, C3	Lec1-Lec5	N1, N3
PEK_W02	K1MBM_W25	C1, C2, C3	Lec2-Lec5	N1, N3
PEK_W03	K1MBM_W17	C1, C2, C3	Lec1-Lec5	N1, N3
PEK_U01	K1MBM_U01	C3	Lab1-Lab5	N2
PEK_U02	K1MBM_U24	C3	Lab1-Lab5	N2
PEK_U03	K1MBM_U25	C3	Lab1-Lab5	N2
PEK_K01	K1MBM_K07	C1, C2	Lab1-Lab5	N3
PEK_K02	K1MBM_K02	C1, C2	Lab1-Lab5	N3
PEK_K03	K1MBM_K04	C3	Lab1-Lab5	N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Techniki wytwarzania-przeróbka plastyczna**
Name in English: **Manufacturing techniques-plastic working.**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032060**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	90		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has knowledge of basic mechanical properties of engineering materials.
2. Have a basic knowledge of physics and mathematics.
3. Have skills in measurement methods, techniques for measuring and evaluating the results of the measurement.

SUBJECT OBJECTIVES

C1. Understanding the different manufacturing technologies by processing plastic products. Method used to investigate the effect of shaping the properties of the manufactured products.
C2. Understanding the phenomena limiting plastic forming processes.
C3. Knowledge of modern technologies for shaping plastic.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knows the basic technologies and material plastic forming process parameters.
PEK_W02 - Able to properly define the problem in the field of plastic forming and properly be characterized.
PEK_W03 - Can choose the right technology plastic forming and defining the basic parameters of the process.

II. Relating to skills:

PEK_U01 - Can search for information on plastic forming and execute their critical analysis.
PEK_U02 - Can use the theoretical knowledge gained in forming the lecture and apply it in practice.
PEK_U03 - Able to perform selected laboratory tests and correct to assess their performance.

III. Relating to social competences:

PEK_K01 - Can think and act in a creative way.
PEK_K02 - Acquires the ability to work as a team.
PEK_K03 - Understands the impact of engineering.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	History of plastic processing.	1
Lec2	Effect of plastic forming process on the properties of the product.	2
Lec3	Sheet metal forming processes. Analysis of cutting and bending processes.	2
Lec4	Course of process of formation of articles about non - the developable surface.	2
Lec5	Processes of forming lumps. Analysis of the process of rolling plates and profiles.	2
Lec6	The conduct and analysis of the extrusion process.	2
Lec7	The course and forging process analysis.	2
Lec8	Manufacture of metal in the drawing process.	2
Lec9	Metal Forming Tools.	2
Lec10	Overview of modern technologies for shaping plastic.	2
Lec11	Final test.	1
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Deforming on hold and annealing metals.	2
Lab2	Rolled metal sheets and profiles.	2
Lab3	Squeezing metallurgical and machine parts.	2
Lab4	Manufacture of metal in the drawing process.	2
Lab5	Expression - cut, bending and pressing.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. report preparation
N4. laboratory experiment

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01÷ PEK_W03	Colloquium.
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U03 PEK_K01÷PEK_K03	quizzes, laboratory report, participate in discussions problem
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

The Gronostajski J., Plastic processing of metals, Wrocław 1974Morawiecki M., Sadok L., Wosiek the E., Theoretical bases of technological processes of plastic alteration, Wyd. Silesia, Katowice 1981
http://www.metalplast.pwr.wroc.pl/instrukcje.html

SECONDARY LITERATURE

The Romanowski the P., Guide of plastic processing on hold, the Publishing house Scientifically - Technical, Warsaw 1976. the Erbel the S., Kuczyński the K., Marciniak the Z., Plastic Processing of, PWN, Warsaw 1981.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Manufacturing techniques-plastic working.
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01÷ PEK_W03	K1MBM_W21	C1÷ C3	Lec1÷ Lec10	N1
PEK_U01÷PEK_U03	K1MBM_U29	C1÷ C3	Lab1÷ Lab5	N2, N3, N4
PEK_K02÷ PEK_K03	K1MBM_K04	C1÷ C3	Lab1÷ Lab5	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Techniki wytwarzania-obróbka ubytkowa**
Name in English: **Production Technics - Machining**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032062**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		20		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Examination		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		2
Lec14		2
Lec15		2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
Lab6		2
Lab7		2
Lab8		2
Lab9		2
Lab10		2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. laboratory experiment

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03	
P = P		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U03; PEK_K01-PEK_K03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Production Technics - Machining
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03;	K1MBM_W22	C1-C3		N1
PEK_U01-PEK_U03; PEK_K01-PEK_K03	K1MBM_K04, K1MBM_K07, K1MBM_U26, K1MBM_U31	C1-C3		N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Techniki wytwarzania-spawalnictwo**
Name in English: **Manufacturing techniques - welding**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032062**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	90		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. 1.Has a basic knowledge concerning metallurgical processes of treatment of ores, production of steel and non-ferrous metals, has a basic knowledge about mechanical properties of engineer materials, organized knowledge about types of metallic engineer materials, its composition, properties, applications and rules of right choice.
2. 2.Has a detailed knowledge about structures of steel and cast iron, rules of its classification and description, has a basic knowledge about thermal and thermo-mechanical treatment, knowledge about alloyed steels and non-ferrous metals and alloys, has the theoretical knowledge about electric circuits.
3. 3.Can analyze macrostructures of materials, technological imperfections, can estimate features of microstructure of metals, can identify phases using the balance curves, can distinguish microstructures according to amount of carbon in steel, influence of thermal treatment, can analyze electric circuits, understands technical drawings, can prepare technical documentation

SUBJECT OBJECTIVES

C1. Getting of basic knowledge about joining of metals with use of welding methods.
C2. Getting of skills of the right choice of joining and basic parameters of the process.
C3. Obtaining and keeping of social competences concerning ability to cooperate in the student's group with a goal to solve problems effective way. Responsible, honest and serious approach to new duties, respecting customs of academic society

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knows types of joints, welding positions, description of joints, reasons of cracking of joints
PEK_W02 - Knows basic methods of welding and parameters of the process
PEK_W03 - Has the knowledge concerning metallurgy of welding processes, brazing/soldering, resistance welding and thermal cutting

II. Relating to skills:
PEK_U01 - Can define basic parameters of welding, describe basic properties of welding equipment and make a right choice of consumables
PEK_U02 - Can define basic parameters of brazing/soldering and resistance welding, describe basic properties of welding equipment and make a right choice of consumables
PEK_U03 - Can define basic parameters of thermal cutting, analyze influence of cutting on properties of the cutting surface and precision of following of the shape

III. Relating to social competences:
PEK_K01 - Shows ability necessary to cooperate in a team with a goal to improve methods of right strategy of optimal solving of problems
PEK_K02 - Is able to assess properly ratios, explain and justify his own point of view with use of a knowledge concerning basic matters of material science.
PEK_K03 - Respects customs and rules of academic society

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organization of the lecture, Safety in welding, Types of welds and joints, welding positions	2
Lec2	Basics of metallurgy of welding processes. Fuel gas welding of steel, cast iron and non-ferrous metals	2
Lec3	Basic information about arc welding. Shielded manual metal arc welding	2
Lec4	Gas shielded tungsten arc welding GTAW. Gas shielded metal arc welding GMAW.	2
Lec5	Submerged arc welding and electroslag welding. Welding with use of concentrated energy sources	2
Lec6	Brazing and soldering. Braze welding	2
Lec7	Resistance pressure joining, Friction welding	2

Lec8	Thermal oxygen, plasma and laser cutting. Water cutting. Hardfacing and thermal spraying	2
Lec9	Stresses and deformations in welding. Thermal treatment of welded joints	2
Lec10	Acceptance tests of welded structure. Quality systems in welding	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Organization of the lab. Safety in welding. Fuel gas welding of steel. Stresses and deformations in welding.	2
Lab2	Brazing and soldering of steel, copper and aluminum. Thermal oxygen and plasma cutting	2
Lab3	Shielded manual metal arc welding. Submerged arc welding	2
Lab4	Gas shielded tungsten and metal arc welding. Robotic welding	2
Lab5	Resistance pressure joining. Friction welding	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. laboratory experiment
N4. report preparation
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	final test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	verbal answers, short tests

P = średnia z F1

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Ambroziak, A. (ed.). Manufacturing techniques. Welding. Laboratory. Wrocław University of Technology, 2011, http://Www.Dbc.Wroc.Pl/

SECONDARY LITERATURE

1 Pilarczyk, J. (eds.): Advisory Engineer. Welding. Vol I and II, WNT Warszawa, 2003, 2005
2 Klimpel A: Welding, Resistance Welding and Cutting Metals., WNT, Warsaw, 1999

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Manufacturing techniques - welding
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W03	K1MBM_W21	C1, C3	Le1 - Le10	N1, N5
PEK_U01 - PEK_U03	K1MBM_U28	C1, C2, C3	Lab1 - Lab5	N2, N3, N4
PEK_K01 - PEK_K03	K1MBM_K04	C3	Lab1 - Lab5	N2 - N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Hydrostatyczne układy napędowe**
Name in English: **Hydrostatic drive systems**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032063**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student possess basic knowledge of fluid mechanics.
2. Student can solve diferential equations of mathematical models of hydraulis components and systems.
3. Student possess basic knowledge of classic mechanics.

SUBJECT OBJECTIVES

C1. Students acquaintance withbasic lows of hydrostatic drive systems.
C2. Students acquaintance with hydraulic components and their working principle.
C3. Students acquaintance with configuration of simple hydrostatic drive systems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - In the result of lesson student should be able to define requirements for hydraulic fluids of hydrostatic drive systems.

PEK_W02 - In the result of lesson student should be able to describe working pinciple of basic components of hydrostatic system.

PEK_W03 - In the result of lesson student should be able to characterize of working of basic hydrostatic drive systems.

II. Relating to skills:

PEK_U01 - In the result of lesson student should be able to analyse operation of hydrostatic components and systems.

PEK_U02 - In the result of lesson student should be able to calculate basics parameters of hydrostatic drive system.

PEK_U03 - In the result of lesson student should be able to interpret basic characteristic of hydrostatic components and systems.

III. Relating to social competences:

PEK_K01 - In the result of lesson student should possess ability of information analysis with diferent complex level.

PEK_K02 - In the result of lesson student should possess ability of objective argument evaluate, efficient explanation and justification own opinion with help of knowledge of hydrostatic drive systems.

PEK_K03 - In the result of lesson student should possess ability of follow the rules valid in academic environment.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, lecture range presentation, check form, requirements.	1
Lec2	Basic symbols of hydraulic and pneumatics components.	1
Lec3	Hydraulic fluids - their properties.	2
Lec4	Positive displacement pumps - systematics, characteristics, efficiencies.	2
Lec5	Valves - systematics, types, functions.	2
Lec6	Hydraulic and volumetrics losses in displacement machines and in the system.	2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1	Experimental determination properties of working fluid - bulk modulus.	1
Lab2	Experimental determination resistance character in hydraulic pipes - linear resistance.	2
Lab3	Local resistences in hydraulic systems. Orifice as a local resistance - cavitation effect.	2
Lab4	Experimental determination pump characteristic.	2
Lab5	Static characteritics of conventional directional control valve.	2
Lab6	Check.	1
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. multimedia presentation
N3. laboratory experiment
N4. report preparation
N5. self study - preparation for laboratory class

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03	colloquium
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U03, PEK_K01 -PEK_K03	test, report, oral response
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Kollek W.: Basics of design of hydraulic drives and control (in polish). Oficyna Wydaw. Polit. Wrocławskiej, 2004 .
Kollek W.: Gear pumps (in polish). Zakład Narodowy im. Ossolińskich, Wrocław 1996.
Stryczek S.: Hydrostatic drive (in polish). WNT, 1992.
Osiecki A.: Machines hydrostatic drive (in polish). WNT, Warszawa 1996.
Lambeck R.: Hydraulic pumps and motors. Marcel Dekker INC. New York 1983.
Pippenger J.: Hydraulic valves and control. Marcel Dekker INC. New York 1984.

SECONDARY LITERATURE

Szydelski Z.: Hydraulic drive and control in vehicles and heavy duty machines. WNT 1980.
Kollek W.: Basics of hydraulic drive theory. NOT, Wrocław 1978.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Hydrostatic drive systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W08	C1	Lec1,Lec2,Lec3	N1,N2
PEK_W02	K1MBM_W08	C2	Lec3, Lec4	N1,N2
PEK_W03	K1MBM_W08, K1MBM_W20	C3	Lec4,Lec5	N1,N2
PEK_U01	K1MBM_U09	C1,C2	Lab1,Lab2,Lab4	N3,N4,N5
PEK_U02	K1MBM_U09, K1MBM_U24	C3	Lab3,Lab4,Lab5	N3,N4,N5
PEK_U03	K1MBM_U24, K1MBM_U25	C1,C3	Lab2,Lab5	N3,N4,N5
PEK_K01-PEK_K03	K1MBM_K09	C1-C3	Lab1-Lab5	N1-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy konstrukcji maszyn II**
Name in English: **Fundamentals of Machine Design II**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032064**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20			20	
Number of hours of total student workload (CNPS)	90			60	
Form of crediting	Examination			Crediting with grade	
Group of courses					
Number of ECTS points	3			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge: 1 It has a basic knowledge of metallurgy, construction materials, mechanics, strength of materials and manufacturing techniques, engineering graphics. 2 It has a basic knowledge of Fundamentals od Machine Design I (process design and engineering, connections used in mechanical engineering) and perform the technical documentation using AutoCAD.
2. Skills: 1 It has self-learning ability, and is able to retrieve information from various sources, to make their interpretation, and to draw conclusions and formulate and justify opinions. 2 It can be used in the process of constructing knowledge gained on subjects: metallurgy, mechanics, strength of materials, Engineering Graphics, Fundamentals of Machine Design I.
3. Competencies: 1 He can think and act in an entrepreneurial manner. 2 Is aware of the seriousness and impact of activities in mechanical engineering, and understands the need for professional activities (both individually and collectively).

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge about the design of machine shafts (structural calculations, the selection of geometric features, resonance, mounting elements on the shaft) and the holder shafts - bearings (bearings characteristics, selection criteria, rules for bearing and fit).
C2. Gaining knowledge of the construction, operation, selection, design calculations and operation of the couplings and conveyor units and changing the rotation (mechanical transmission belts, chains and gears).
C3. Gain practical skills to make a simple construction task through a typical solution to the problem, the content of which is the optimal design of the drive unit driven machine (eg conveyor, ball mill, crusher, rotary kiln, etc.) The process of constructing a computer-aided both in the selection of design features (using the computer programs for the calculation of constructed elements) as well as at the stage of their graphical application (AutoCAD).

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - He knows the algorithm design calculations machine shafts and shafts supporting elements.
PEK_W02 - It has an extended knowledge in the construction of clutches, their applications and the selection and calculation.
PEK_W03 - It has a basic knowledge of construction, operation, principles of selection and design calculations of the conveyor units and changing the rotation (mechanical gears: belt, chain and gear).

II. Relating to skills:
PEK_U01 - Able to independently formulate and solve simple technical tasks.
PEK_U02 - He can choose and calculate the shafts, bearings, couplings, mechanical.
PEK_U03 - It can construct an optimal (in light of the criteria used) drive any machine work.

III. Relating to social competences:
PEK_K01 - Can search information and carry out their critical analysis.
PEK_K02 - Able to work independently and in a team.
PEK_K03 - Objectively evaluate the task, conceptual design, and they can justify the chosen solution and the method of its implementation.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Syllabus and requirements. Shafts and axes – characteristics. Theoretical bases selection of constructional features of shafts. Fundamentals of shafts and axes forming. Methods for the axial location of machine elements on a shaft. Design calculations of the shafts (preliminary, checkout). The phenomenon of resonance. Calculations of shafting for resonance in bending mode.	2
Lec2	Main features of rolling and sliding friction. Classification of bearings, main features of rolling contact and sliding bearings. Procedure and criteria for the selection of roller contact bearings. Bearing arrangement. Fits, lubrication and sealing in application for roller bearings.	2

Lec3	Classification of coupling and clutches. Main features of couplings. Selection and calculation rules. Main features of clutches. Engagement process, Work and friction losses, heat balance, service life. Equivalent friction radius.	2
Lec4	Belt transmissions, classification, general characteristic and selection criteria. Friction coupling of the belt with the wheel. Elastic slip, actual transmission ratio, load transfer coefficient. Force distribution, tensioning devices in belt. Required tension force and ways of regulation.	2
Lec5	Efficiency of belt transmission and belt durability. Characteristics material for belts. The design of pulleys (material, main dimensions). Design calculations of V-belt transmissions. Przekładnie cięgnowe cd. Przekładnie łańcuchowe, ich charakterystyka i sposób obliczania.	2
Lec6	Gear transmissions. Classification and main features. Fundamental rule of engagement. Cycloid and involute profiles.	2
Lec7	Basic rack tooth profile. Standardization of involute wheels. Basic notions. Geometry of spur gears. Generation methods.	2
Lec8	Boundary tooth number, mesh correction, addendum modification.	2
Lec9	Tooth loading model for bending and contact pressure. Service factor. Distribution of forces in spur and helical gearing.	2
Lec10	ISO recommended methods for the calculation of gear transmission, a summary.	2
		Total hours: 20
Form of classes – Project		Number of hours
Proj1	Preparation of design specifications for the designed drive system (operation principles, location data, quantitative data, operation conditions).	2
Proj2	Possible solutions of the problem, a draft drawing (without details) of one selected solution (acceptance criteria included).	2
Proj3	Assumption of acceptance criteria for each of the sub-assemblies of the unit. Selection of the best solution using a dedicated software.	10
Proj4	Implementation stage of the design process: assembly and selected working drawings. Drafting technique - CAD.	6
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. calculation exercises
N3. tutorials
N4. self study - preparation for project class
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	exam, quiz
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01 - PEK_K03	defense of project, quizzes, evaluation of computational design review, review of project preparation
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1.Podstawy konstrukcji maszyn. Praca zbiorowa pod red. Z. Osińskiego. Warszawa, PWN 1999.2.Dietrych J. i inni; Podstawy konstrukcji maszyn. Tom II i III, Warszawa, WNT.3.Dziama A. i inni; Przekładnie zębate. Warszawa, PWN 1995.4.Dietrych M. i inni; Podstawy konstrukcji maszyn. Tom III i IV. W-a, WNT 1996.5.Ćwiczenia z podstaw konstrukcji maszyn. Poradnik. Praca zbiorowa pod red. Z. Lawrowskiego, skrypt PWr., Wrocław , 1982.6.Beitz G.; Nauka konstruowania. Warszawa, WNT 1984.7.Krawiec S.; Obliczenia konstrukcyjne przekładni pasowych i zębatych wspomaga-ne mikrokoputerem, skrypt PWr.,Wrocław, 1992.8.Capanidis D, Krawiec S. Wieleba W.; Materiały pomocnicze do ćwiczeń projektowych z PKM wspomaganych komputerowo, IKEM PWr., 1993.

SECONDARY LITERATURE

1.Jaśkiewicz Z., Wąsiewski A.; Przekładnie walcowe. Warszawa, WKŁ 1992.2.Niemann G., Winter H.; Maschinenelemente. Band II. Berlin, Springer- Verlag 1985.3.Niemann G., Winter H.; Maschinenelemente. Band III. Berlin, Springer- Verlag 1983.4.Skarbiński M., Skarbiński J.; Technologiczność konstrukcji maszyn. Warszawa, WNT 1982.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Machine Design II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number

PEK_W01	K1MBM_W18	C1	Lec1, Lec2	N1, N3, N5
PEK_W02	K1MBM_W18, K1MBM_W25	C2	Lec3	N1, N3, N5
PEK_W03	K1MBM_W18, K1MBM_W19, K1MBM_W25	C2	Lec4-Lec10	N1, N3, N5
PEK_U01 - PEK_U03	K1MBM_U02, K1MBM_U07, K1MBM_U21, K1MBM_U34	C3	Proj1-Proj4	N2-N5
PEK_K01 - PEK_K03	K1MBM_K02, K1MBM_K03, K1MBM_K05, K1MBM_K11	C1-C3	Proj1-Proj4	N2-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Tworzywa sztuczne**
Name in English: **Polymers**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032065**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge in the field of materials science and chemistry.

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge of construction, preparation, modification and properties of polymeric materials
C2. Acquisition of basic knowledge about the technology used for processing plastics
C3. Learning how the selection of polymeric materials in certain applications.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - He knows the basic groups of polymers, their structure, properties,
PEK_W02 - He knows the technology used for the processing of polymeric materials,
PEK_W03 - He knows the basic applications of polymeric materials.

II. Relating to skills:
PEK_U01 - Able to identify polymeric materials
PEK_U02 - Can indicate the processing technology for producing a selected product from the plastic material,
PEK_U03 - Place the selected polymeric materials for specific applications.

III. Relating to social competences:
PEK_K01 - Searches of information and its critical analysis,
PEK_K02 - Team cooperation on improving methods for the selection of a strategy to optimally solve problems assigned to the group,
PEK_K03 - Compliance with the customs and rules of the academic community.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basics, nomenclature. Classification and distribution of plastics	2
Lec2	Construction and preparation of polymers and plastics. Polymerization processes and the production of plastic plastics.	2
Lec3	Construction of the polymers and the resulting properties.	2
Lec4	Models mechanical behavior of polymers. Rheology and behavior of the plastic during processing	2
Lec5	Transformation of plastics, the impact of environmental conditions on the behavior of materials polymer.	2
Lec6	Methods for modification of polymeric materials and their impact on the property. Preparation of polymer composites.	2
Lec7	Overview of polymeric construction materials - Properties and application of thermoplastic materials.	2
Lec8	Primary processing technologies plastics - injection molding	2
Lec9	Manufacturing technologies of polymeric materials - extrusion and thermoforming	2
Lec10	Joining and processing technologies niche plastics	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Polymeric materials and methods for their identification	2
Lab2	Technologies of plastics joining	2
Lab3	Primary processing technology - injection molding	2
Lab4	Secondary processing technologies - Vacuum thermoforming and blow molding	2

Lab5	Tools for processing plastics	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. laboratory experiment
N4. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01	quiz
F2	PEK_U02	test, oral answer
F3	PEK_U03	quiz, oral answer
F4	PEK_K01, PEK_K02, PEK_K03	oral answer, report
P = (F1+F2+F3+F4)/4		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Robert Sikora, Przetwórstwo tworzyw wielkocząsteczkowych, Warszawa : "Żak", 1993;Wojciech Kucharczyk, Wojciech Żurowski, Przetwórstwo tworzyw sztucznych dla mechaników, Radom : Politechnika Radomska. Wydawnictwo, cop. 2005; Izabella Hyla, Tworzywa sztuczne : własności, przetwórstwo, zastosowanie, Gliwice : Wydawnictwo Politechniki Śląskiej, 2000.

SECONDARY LITERATURE

Piotr Jasiulek, Łączenie tworzyw sztucznych metodami spawania zgrzewania, klejenia i laminowania, Krosno, Wydaw. i Handel Książkami "KaBe", 2004;

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Polymers
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W03	K1MBM_W13	C1	Lec1-Lec10	N1
PEK_U01-PEK_U03, PEK_K01, PEK_K02, PEK_K03	K1MBM_K09, K1MBM_U29	C2, C3	Lab1-Lab5	N2-N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie w produkcji**
Name in English: **Management in production**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032066**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knows and understands the nature of the management process and the basic functions of management.
2. Understands the basic concepts and basic economic rights and economic phenomena and their effects.
3. Posesses a basic knowledge of manufacturing processes.

SUBJECT OBJECTIVES

C1. Knowing the specifics of management of the production and manufacturing processes
C2. Knowledge of methods and techniques for managing different types of manufacturing processes
C3. The acquisition of skills in planning, organizing and controlling of production processes

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Distinguishes and characterizes by different types of production systems.
PEK_W02 - Can define the concepts of production and technological processes.
PEK_W03 - Has knowledge of the methods and techniques of production systems management.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Characteristics of manufacturing organizations	1
Lec2	Characteristics of production systems	2
Lec3	Manufacturing system, its organization and components	2
Lec4	Classification of production processes	1
Lec5	Types and forms of production	2
Lec6	Methods of manufacturing control systems (pull, push and squeez)	2
Lec7	Methods of organization of production systems	4
Lec8	Features of bottlenecks in manufacturing processes	1
Lec9	Methods of manufacturing inventory management	3
Lec10	Principles of planning and scheduling	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W1, PEK_W2, PEK_W3,	Test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Chlebus E.: "Techniki komputerowe CAx w inżynierii produkcji", Wydawnictwa Naukowo-Techniczne, Warszawa 2000,
2. Durlik I.: "nżynieria zarządzania : Cz. 1 i Cz.2", Wydawnictwo Placet, Warszawa 2007,
3. Liwowski B.: "Podstawowe zagadnienia zarządzania produkcją", Oficyna Ekonomiczna, Kraków 2006

SECONDARY LITERATURE

1. Rogowski A..: "Podstawy organizacji i zarządzania produkcją w przedsiębiorstwie", Wydawnictwa Fachowe CeDeWu, Warszawa 2010,
2. Burchart-Korol D.: "Zarządzanie produkcją i usługami", Wydawnictwo Politechniki Śląskiej, Gliwice 2007

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Management in production
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W1, PEK_W2, PEK_W3	K1MBM_W24	C1, C2	Lect1 - Lect10	N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Budowa pojazdów samochodowych**
Name in English: **Construction of vehicles**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032101**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	120				
Form of crediting	Examination				
Group of courses					
Number of ECTS points	4				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	2.4				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of machine design
2. The ability to associate and use knowledge

SUBJECT OBJECTIVES

C1. Knowing the main units and systems of motor vehicles
C2. Understanding the basic principles of the selection of types of teams and systems in motor vehicle
C3. Knowledge and understanding of the workings of teams and systems in motor vehicle

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - It has a basic knowledge of the construction and operation of major components or motor vehicle
PEK_W02 - It has a basic knowledge of the names of the various components and systems of a motor vehicle.
PEK_W03 - Versed in the current state and the latest trends in design and development of vehicles

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic information about the ingredients of the road transport system	1
Lec2	Classification of vehicles. Approval. The elements of identification	2
Lec3	Fundamentals of traffic engineering. resistance to motion	1
Lec4	The choice of power source. Power on wheels and engine characteristics	1
Lec5	Construction of automotive powertrain vehicles	2
Lec6	Construction of car chassis. Bearing and suspension system	2
Lec7	Wheels and tires	1
Lec8	The construction of the steering	2
Lec9	Construction of the brake system	2
Lec10	Automation systems of your vehicle	1
Lec11	The criteria for assessing the safety car	1
Lec12	Compatible vehicles	1
Lec13	Outdoor Lighting Vehicle	1
Lec14	CAN / BUS	1
Lec15	Features built-ins of vehicles with special	1
		Total hours: 20

TEACHING TOOLS USED

N1. multimedia presentation
N2. case study
N3. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01	exam
F2	PEL_W02	exam
F3	PEL_W03	exam
P = F1+F2+F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Reimpell J., Betzler J.: Chassis cars. Basic construction. Optics Warsaw 2001
PAWrzecioniarz, W.Ambroszko, A.Górniak - Energy Efficient Design of powetrain and body, Wrocław University of Technology, 2011

SECONDARY LITERATURE

L. Prochowski: Mechanical Movement. Publisher of Science and Technology, Warsaw, 2005.
M. Zając: Transmission systems for trucks and buses. WKiŁ Warsaw 2003

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Construction of vehicles
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_KM_W04, K1MBM_W18	C1-C3	WY1-WY15	N1- N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Inżynieria pojazdów przemysłowych**
Name in English: **Off-Road Vehicles Engineering**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032103**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		20	10	
Number of hours of total student workload (CNPS)	60		60	30	
Form of crediting	Examination		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	2		2	1	
including number of ECTS points for practical (P) classes			2	1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4	0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge in the field of construction vehicle drive systems
2. Can work with a group and individually solve complex tasks
3. Advance knowledge in mechanics, mathematical analysis and basics of machine design vehicle drive systems

SUBJECT OBJECTIVES

C1. The aim of the course is to extend knowledge of the structure and working methods of engineering vehicles, in detail: wheeled and tracked. The range also includes the calculation of the force resistance while moving, turning with comparison of different chassis systems
C2. The aim of the course is to gain practical knowledge on the calculation of supporting elements typical wheeled and tracked chassis . Classes also expand knowledge in the use of various vehicle chassis systems;
The aim of the course is to gain knowledge in the field of cooperation tool with the soil to determine the suitability of tools for various works .
C3. The aim of the course is to gain ability of working in the group, analyzing the results .

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student can calculate the various components of suspension systems both wheeled and tracked vehicles.

PEK_W02 - Student is able to identify the right tool for the task to be performed.

PEK_W03 - Student knows the basis for cooperation tool with the ground and is familiar with the methods , allowing to obtain a full load.

II. Relating to skills:

PEK_U01 - Student can use also foreign literature, and base on experiance analyzes and interprets the results.

PEK_U02 - Student is able to analyze and compile the results in order to obtain characteristics or measured performance drive systems for vehicles and machines with different settings of the control system.

PEK_U03 - Student can propose their own ideas for chassis systems.

III. Relating to social competences:

PEK_K01 - able to and understands the need for continuous retraining and acquiring new information.

PEK_K02 - It is responsible for the decisions made both in terms of environmental protection.
as well as mechanical engineering activities

PEK_K03 - able to work in a group and solve the tasks assigned to the various positions and is responsible for the Group to achieve the intended purpose.

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1	Means of transport in nature. Overview of methods of moving animals and vehicles with examples. The theory of rubber wheel movement on different surfaces. Characteristics and examples of calculations resistance movement. Selected examples of industrial vehicles (articulated in the mines aggregates , chassis propelled telescopic cranes, jib chassis container cars , forklifts). Typical suspension systems of wheeled vehicles , construction examples and calculations of selected support elements. Engineering mechanisms of selected industrial vehicle (chassis steering system mechanisms wheeled vehicles with one and several torsion axles). The theory of tracked vehicle. Steering resistance, driving, pulling power, determination unit pressure and determining the pulling forces. Mechanisms track tensioning systems - examples of calculations. Suspension systems of tracked vehicles. Examples of solutions and calculations of selected components. Steel, elastomer and other tracks . Construction, suspension of road wheels and / or body operating advantages and disadvantages. The basic theory of walking vehicles. Examples of their use. The construction principle and examples of solutions and calculations hovercraft. Comparison of different methods of transport : wheeled vehicles, tracked, walking, hovercraft and screw vehicles. Sensors and transducers used in working machines. The problems associated with their use, reliability and buildings not influencing the kinematics of rigging, steering mechanisms etc. Automation of working machines. Methods of mining land in order to achieve a high degree of filling tools, path following mechanisms tools to increase the efficiency of the drive system. Overview of operating systems and hardware used in wheeled loaders. Determining path and movement of the tool. Determination of kinematic motion. Calculate the power requirements of a typical boom. Selection of the powertrain. Overview of operating systems and hardware used excavators. Calculate the power requirements of a typical boom. Selection of the powertrain. Examples of machinery and handling equipment - cranes, cranes with their construction and examples of design solutions.	20
		Total hours: 20
Form of classes – Laboratory		Number of hours

Lab1	Working tool and overturning stability normative standard testing of industrial vehicle. Overhead crane lifting system dynamic impact forces examining. Rock excavating process examining by different shape tools. Experimental determination of tractive forces generated by tracked undercarriage on different grounds 1/2. Experimental determination of tractive forces generated by tracked undercarriage on different grounds 2/2. Examining of friction coefficient between elastomeric truck and steel rope. Traction parameters estimation of vehicle moving on steel rope. Truck vehicle moving resistance force estimation. Wheeled vehicle moving resistance force estimation. Analysis load the track elastomeric teeth working with contoured feedback. Cornering resistant forces experimental examination of truck vehicle. Cornering resistant forces experimental examination of wheeled vehicle. Moving parameters examining of vehicle equipped with multidirectional wheels type: Mecanum. Traction parameters estimation of: vehicle using magnetic adhesion, screw drive vehicle and hoovercraft. Examination of gravel loading process with a bucket loader.	20
		Total hours: 20
Form of classes – Project		Number of hours
Proj1	The aim of the project is to develop a drive system for a wheeled or tracked vehicle. The project includes calculating the pulling forces, driving torque resistance movement and preparation of drawings selected component. The project may also involve the selection of the geometry of the boom in order to maintain straight path movement of the tool and powertrain classic or hybrid. In this case, the determined resistance to motion during scooping muck and selects individual components .	10
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. laboratory experiment
N3. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 PEK_W02 PEK_W03	written exam
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01-PEK_K03	Positive marks from raports and tests
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 PEK_U02	Project positive mark
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Inżynieria maszyn roboczych, K. Pieczonka, OW PWr, 2007
2. Theory of ground vehicles; J. Y. Wong, John Wiley & Sons, New York
3. Tyre and Vehicle Dynamics, H. B. Pacejka, Delft University of Technology
4. Vehicle Dynamisc, Theory and Applicaton, R. N. Jazar, Springer, 2008
5. Automotive Engineering Powertrain, Chassis System and Vehicle Body, A. Crolla, Elsevier, 2009
6. Fundamentals of Vehicle Dynamisc, T. D. Gillespie, Society of Automotive Engeeners,
7. Ciągniki, H. Dajniak, Wydawnictwa Komunikacji i Łączności, 2008
8. Kierowalność i stateczność samochodu, A. Litwinow, WKŁ, 1975
9. Teoria ruchu pojazdu gąsienicowego, Z. Burdziński, WKŁ, 1972

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Off-Road Vehicles Engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W01, K1MBM_W20, K1MBM_W34			
PEK_U01-PEK_U03	K1MBM_KM_U01, K1MBM_KM_U02, K1MBM_KM_U03, K1MBM_KM_U06			
PEK_K01-PEK_K02	K1MBM_K01, K1MBM_K04, K1MBM_K10			

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Projektowanie elementów z tworzyw sztucznych**
Name in English: **Design of plastic elements**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032106**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1		2
Lec2		2
Lec3		4
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. problem discussion

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Design of plastic elements
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W11	C1		N1
PEK_W02	K1MBM_W13, K1MBM_W18	C2		N1
PEK_W03	K1MBM_W13	C3		N1,N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Proseminarium dyplomowe**
Name in English: **Thesis proseminar**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032108**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					10
Number of hours of total student workload (CNPS)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1		1
Sem2		2
Sem3		4
Sem4		3
		Total hours: 10

TEACHING TOOLS USED

N1. problem discussion
N2. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Thesis proseminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number

PEK_U01-PEK_U03	K1MBM_U01, K1MBM_U02, K1MBM_U18, K1MBM_U41, K1MBM_U43, K1MBM_U46	C1, C2		N1, N2
PEK_K01-PEK_K03	K1MBM_K03, K1MBM_K04, K1MBM_K05	C3		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**
Name in English: **Thesis seminar**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032110**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					10
Number of hours of total student workload (CNPS)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1		1
Sem2		9
		Total hours: 10

TEACHING TOOLS USED

N1. problem discussion
N2. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01-PEK_K03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Thesis seminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01, PEK_U02, PEK_U03	K1MBM_U33	C1, C2		N1, N2

PEK_K01-PEK_K03	K1MBM_K01, K1MBM_K02, K1MBM_K05	C3		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technika w medycynie**
Name in English: **Technique in Medicine**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032121**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
		Total hours: 20

TEACHING TOOLS USED

N1. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technique in Medicine
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W11, K1MBM_W17, K1MBM_W25, K1MBM_W30	C1,C3		N1
PEK_W02	K1MBM_W25	C2		N1
PEK_K01	K1MBM_K01, K1MBM_K02, K1MBM_K06, K1MBM_K08	C1, C2, C3		N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Silniki spalinowe**
Name in English: **Combustion engines**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032124**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
		Total hours: 10

TEACHING TOOLS USED

N1. multimedia presentation
N2. laboratory experiment
N3. self study - preparation for laboratory class
N4. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01	
F2	PEK_W02	
F3	PEK_W03	
P = F1+F2+F3		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_K01	
F2	PEK_U02, PEK_K02	
F3	PEK_U03, PEK_K03	
P = F1+F2+F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Combustion engines
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_KM_W04, K1MBM_W06	C1		N1.
PEK_W02	K1MBM_KM_W04	C2 C3		N1.
PEK_W03	K1MBM_KM_W04	C3		N1.
PEK_U01	K1MBM_KM_U03, K1MBM_KM_U05, K1MBM_KM_U06	C1 C2		N2. N3. N4.
PEK_U02	K1MBM_KM_U03, K1MBM_KM_U05	C2 C3		N2. N3. N4.
PEK_U03	K1MBM_KM_U03, K1MBM_KM_U05	C2 C3		N2. N3. N4.
PEK_K01 - PEK_K03	K1MBM_K01, K1MBM_K02, K1MBM_K07	C1		N1. N3.

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy tribologii**
Name in English: **Fundamentals of Tribology**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032125**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge: 1 He has ordered knowledge about the types of engineering materials - metal, ceramic, polymer and composite materials.2. It has a basic knowledge of the construction, operation and use of the main components and machine assemblies.3. It has a basic knowledge of physics, chemistry, statistics.
2. Skills: 1. It can analyze the macroscopic fractures, microstructure of materials, technological drawbacks of origin, is able to determine the characteristics of the microstructure of metallic materials.2. He can choose the material on a given machine element and can explore its basic properties.
3. Competencies: 1 Is aware of the importance and understanding of non-technical aspects and impacts of mechanical engineer.2. Is aware of the importance of behavior in a professional manner and have a sense of responsibility for their own work.

SUBJECT OBJECTIVES

C1. Familiar with the processes of friction, wear and lubrication of moving nodes and methods for machine control these processes in terms of minimizing their effects (special attention will be paid to the construction and technological methods of increasing the reliability and durability of sliding pairs, as well as the problem of lubrication and lubricant selection as an effective prevention of friction and wear).
C2. Understanding the impact of selected parameters of friction vector, ie, pressure, velocity slip material cooperating associations and grease on the tribological characteristics of sliding pairs. Get to know the influence of the structure of the material to abrasion and impact bushing stiffness for load distribution in the bearing friction.
C3. Show students that they can effectively counteract the negative effects of friction in the moving solid contact with real objects illustrate some of the issues discussed theoretically in the lecture.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Has knowledge of the processes of friction, wear and lubrication of moving nodes machine.
PEK_W02 - Know the basic types of lubricants and their applications.
PEK_W03 - He knows the design and technological methods of increasing the reliability and durability of sliding pairs.

II. Relating to skills:
PEK_U01 - It can choose materials for sliding nodes and understand relationships and dependencies between the material used and its durability.
PEK_U02 - It can perform basic tests of materials used in the nodes of friction, interpret them and implement in the final node machines.
PEK_U03 - He can use the theoretical knowledge acquired friction and lubrication of the lecture and apply it in practice.

III. Relating to social competences:
PEK_K01 - It can search for information and critically analyze them.
PEK_K02 - Properly define and resolve dilemmas, adheres to the principle of professional ethics.
PEK_K03 - Able to work independently and as a team, and properly assess their own tasks and priorities of the group.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Program and requirements. Brief history of tribology. Elastic contact of smooth bodies. The real contact of solids. The problem of the surface layer.	2
Lec2	Friction and wear processes, their distribution and characteristics. Sliding and rolling friction. Theories of friction. Effect of pressure and sliding velocity on the friction and wear.	2
Lec3	Characteristics of materials (metal and others) on the sliding nodes and the rules for their selection. Simple and reversed pair of friction. Susceptibility, stiffness and configuration elements as factors that increase the wear resistance.	2

Lec4	Grease as a construction material. Objectives lubrication. The way of obtaining o fluid friction. Distribution of lubricants. Lubricating oils and their properties. Greases, their distribution and characteristics.	2
Lec5	Final test.	2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1	1.Determining of properties of slide bearing materials.	2
Lab2	2.Determining of coefficient of static friction.	2
Lab3	3 Research of lubricity of greases using a four ball tester.	2
Lab4	4. Determination of the behavior of friction materials for brakes and clutches.	2
Lab5	5. Study materials for the seizure.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - self studies and preparation for examination
N3. laboratory experiment
N4. self study - preparation for laboratory class
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	test, quiz
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	quiz - entrance ticket, the report of the laboratory exercises, oral answer
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1.Lawrowski Z.; Tribologia, Tarcie, zużywanie i smarowanie. W-a, PWN, 1993.2.Garkunov D. N.; Trybotechnika. Moskva, Mašinostroenie, 1999.3.Czarny R.; Smary plastyczne. Warszawa, WNT, 2004.4.Ćwiczenia laboratoryjne z podstaw konstrukcji maszyn. Praca zbiorowa pod red. F. Szymankiewicza, skrypt PWr., Wrocław , 1990.5.Embedded detailed instructions posted on the website: www.ikem.pwr.wroc.pl/pkmit

SECONDARY LITERATURE

1.Bartz W.; Schmierfette, Zusammensetzung, Eingeschaften, Prüfung und Anwen-dung. Renningen, Export Verlag, 2000.2.Lawrowski Z.; Technika smarowania. W-a, PWN, 1987.3.Płaza S.; Fizykochemia procesów tribologicznych, Łódź, Wyd. Uniwersytetu Łódzkiego, 1997.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Tribology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W11, K1MBM_W18, K1MBM_W26	C1	Lec1, Lec2	N1, N2, N5
PEK_W02	K1MBM_W18, K1MBM_W25	C1	Lec4	N1, N2, N5
PEK_W03	K1MBM_W21, K1MBM_W22, K1MBM_W26	C1	Lec3	N1, N2, N5
PEK_U01 - PEK_U03	K1MBM_U01, K1MBM_U04, K1MBM_U06, K1MBM_U15, K1MBM_U20	C2, C3	Lab1 - Lab5	N3, N4, N5
PEK_K01 - PEK_K03	K1MBM_K02, K1MBM_K03, K1MBM_K04	C3	Lab1 - Lab5	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Napęd hydrauliczny**
Name in English: **Hydraulic drive**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032126**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		20	10	
Number of hours of total student workload (CNPS)	90		60	60	
Form of crediting	Examination		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	3		2	2	
including number of ECTS points for practical (P) classes			2	2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4	0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student possess basic knowledge of fluid mechanics.
2. Student can solve diferential equations of mathematical models of hydraulis components and systems.
3. Student possess basic knowledge of hydrostatic drive systems.

SUBJECT OBJECTIVES

C1. Students acquaintance with simple and advanced hydraulic components.
C2. Students acquaintance with hydraulic drive systems.
C3. Students acquaintance with control and regulation methods selected parameters of hydraulic drive systems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - In the result of lesson student has knowledge for description of basic hydraulic systems in vehicles and heavy duty machines.

PEK_W02 - In the result of lesson student has knowledge for design of hydraulic drive systems.

PEK_W03 - In the result of lesson student has knowledge for description hydraulic components for control or regulation selected parameters.

II. Relating to skills:

PEK_U01 - In the result of lesson student is able to design hydraulic system with control system - make suitable calculations and on their basis student is able to select suitable hydraulic components with proper dimensions and properties.

PEK_U02 - In the result of lesson student is able to make measurements of hydraulic components and systems and describe results and formulate proper conclusions.

PEK_U03 - In the result of lesson student is able to build and start and analyse working hydraulic and electrohydraulic drive system.

III. Relating to social competences:

PEK_K01 - Student can cooperate in group during hydraulic and electrohydraulic system building and report preparation.

PEK_K02 - Student can plan measurements and project preparation.

PEK_K03 - Student correctly identyfi and solve problems with hydraulic and electrohydraulic system during its building. Student formulate appropriate conclusions.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, lecture range presentation, check form, requirements, list of references.	1
Lec2	Hydraulic systems properties.	1
Lec3	Speed regulation of hydraulic motor during fast and working movement.	2
Lec4	Hybrid hydraulic systems.	1
Lec5	Cavitation effect, calculaction of sucking line of hydraulic pump.	1
Lec6	Hydraulic brake systems.	1
Lec7	Hydraulic ABS systems.	2
Lec8	Hydraulic systems of travel mechanism.	1
Lec9	Steering servomechanisms.	1
Lec10	Multipumps systems.	1
Lec11	Synchronisation of hydraulic actuators movement.	2
Lec12	Hydropneumatic suspension, vibration dampers.	1
Lec13	Load-sensing hydraulic systems.	2
Lec14	Thermal balance of hydraulic systems.	1
Lec15	Design of hydraulic drive.	2
		Total hours: 20

Form of classes – Laboratory		Number of hours
Lab1	Introduction - laboratory topics presentation, check form, requirements. Laboratory regulations and industry safety.	1
Lab2	Sequence control of hydraulic motors.	2
Lab3	Serial and papralel connection of hydraulic actuators.	2
Lab4	Control of hydraulic system with proportional reliefe valve.	1
Lab5	Hydraulic systems with check valves and flow regulator.	2
Lab6	Methods of safety increasing in hydraulic systems - controlled check valve.	1
Lab7	Functions of hydraulic accumulator.	2
Lab8	Functions and applications of relief valve with unloading.	1
Lab9	Load-sensing system tests.	1
Lab10	Regulation with constant power in hydraulic system.	1
Lab11	Volumetric control.	1
Lab12	Comparison tests of speed control and regulation systems for hydraulic actuator.	2
Lab13	Methods of power losses reduction in hydraulic systems.	1
Lab14	Tests of dynamics processes in hydraulic systems.	1
Lab15	Check.	1
		Total hours: 20
Form of classes – Project		Number of hours
Proj1	Introduction to project.	1
Proj2	Generating of system structure.	1
Proj3	Preparation of basic calculations.	2
Proj4	Selection of typical components.	2
Proj5	Preparation of static characteristic of the system.	2
Proj6	Description of system operation and selected components specification.	1
Proj7	Project presentation and check.	1
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. laboratory experiment
N3. self study - preparation for project class
N4. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 PEK_W02 PEK_W03	colloquium
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U02 PEK_U03	oral response for practical veryfication of design and buliding of systems.
F2	PEK_U02	report
F3	PEK_U03	student's activity note
P = (2F1+F2+F3)/4		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_K01-PEK_K03	Project check
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Kollek W.: Basics of design of hydraulic drives and control (in polish). Oficyna Wydaw. Polit. Wrocławskiej, 2004 .
Kollek W.: Gear pumps (in polish). Zakład Narodowy im. Ossolińskich, Wrocław 1996.
Stryczek S.: Hydrostatic drive (in polish). WNT, 1992.
Osiecki A.: Hydrostatic drive of machines (in polish). WNT, Warszawa 1996.
Garbacik A., Szewczyk K.: Hydraulic drive and control. Basics of systems designing (in polish). Skrypt Politechniki Krakowskiej, Kraków 1998.
Lambeck R.: Hydraulic pumps and motors. Marcel Dekker INC. New York 1983.
Pippenger J.: Hydraulic valves and control. Marcel Dekker INC. New York 1984.

SECONDARY LITERATURE

Jędrzykiewicz Z.: Design of hydrostatic systems. Basics (in polish). Skrypt 1313. AGH Kraków 1992.
Pizoń A.: Hydraulic and electrohydraulic control and regulation system (in polish). WNT, 1987.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Hydraulic drive
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_KM_W03, K1MBM_W14, K1MBM_W20	C2 C3	Lec1 Lec4 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13	N1
PEK_W02	K1MBM_KM_W03, K1MBM_W08, K1MBM_W14, K1MBM_W20	C1 C2	Lec1 Lec2 Lec5 Lec14 Lec15	N1 N3
PEK_W03	K1MBM_W16, K1MBM_W20	C1 C2 C3	Lec1 Lec3 Lec6 Lec7 Lec9 Lec11 Lec13	N1
PEK_U01	K1MBM_KM_U03, K1MBM_U23, K1MBM_U25	C1 C2 C3	Proj1 Proj2 Proj3 Proj4 Pojr5 Proj6 Proj7 Lab13	N1 N3
PEK_U02	K1MBM_U12, K1MBM_U24	C1 C2 C3	Lab4 Lab9 Lab10 Lab11 Lab12 Lab14	N2 N4
PEK_U03	K1MBM_U09, K1MBM_U23, K1MBM_U24	C1 C2 C3	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab12 Lab13	N2 N4
PEK_K01	K1MBM_K04, K1MBM_K09	C1 C2 C3	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14	N2 N4
PEK_K02	K1MBM_K04, K1MBM_K09	C1 C2 C3	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14 Proj1 Proj2 Proj3 Proj4 Proj5 Proj6 Proj7	N2 N3 N4
PEK_K03	K1MBM_K09	C1 C2 C3	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11 Lab12 Lab13 Lab14 Proj1 Proj2 Proj3 Proj4 Proj5 Proj6 Proj7	N2 N3 N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Ustroje nośne**

Name in English: **The load-carrying structures**

Main field of study (if applicable): **Mechanical Engineering and Machine Building**

Level and form of studies: **I level, part-time**

Kind of subject: **optional**

Subject code: **MMM032127**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			20	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		2
Proj9		2
Proj10		2
		Total hours: 20

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. problem exercises
N3. multimedia presentation
N4. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01-PEK_K03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
The load-carrying structures
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_KM_W01, K1MBM_KM_W02, K1MBM_W19	C1, C2, C3		N3
PEK_W02	K1MBM_KM_W02	C1, C2		N3
PEK_W03	K1MBM_W09	C3		N3
PEK_U01	K1MBM_KM_U01, K1MBM_KM_U02, K1MBM_U19, K1MBM_U22	C1, C3		N1, N2, N4
PEK_U02	K1MBM_KM_U01, K1MBM_KM_U02, K1MBM_U19, K1MBM_U22	C2, C3		N1, N2, N4
PEK_U03	K1MBM_KM_U01, K1MBM_KM_U02, K1MBM_U19, K1MBM_U22	C3		N1, N2, N4
PEK_K01-PEK_K03	K1MBM_K04, K1MBM_K05	C1-C3		N1, N2, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Modelowanie obciążeń pojazdów samochodowych**
Name in English: **Numerical Simulations of Vehicle Construction Loads**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032128**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			20	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			2.1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1		2
Proj2		4
Proj3		4
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		2
		Total hours: 20

TEACHING TOOLS USED

N1. multimedia presentation
N2.
N3. self study - preparation for project class
N4. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_03 PEK_K01, PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Numerical Simulations of Vehicle Construction Loads
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_KM_W01, K1MBM_W01	C1		N1
PEK_W02	K1MBM_KM_W01	C2		N1
PEK_U01	K1MBM_U09, K1MBM_U10	C1		N2, N3, N4
PEK_U02	K1MBM_U09, K1MBM_U10	C1, C2		N2, N3, N4
PEK_K01	K1MBM_K09	C2		N1, N4
PEK_K02	K1MBM_K01, K1MBM_K05	C2		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biomechanika inżynierska**
Name in English: **Biomedical Engineering**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032129**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture	Number of hours

Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
		Total hours: 20

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biomedical Engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02	K1MBM_W11, K1MBM_W30	C1, C2		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA**
Name in English: **Diploma Thesis**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMM032150**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				2	
Number of hours of total student workload (CNPS)				450	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				15	
including number of ECTS points for practical (P) classes				15	
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

TEACHING TOOLS USED

N1.
N2. problem discussion

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_K01	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Diploma Thesis
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01, PEK_U02	K1MBM_U41, K1MBM_U42, K1MBM_U45	C1-C3		N1
PEK_K01	K1MBM_K01, K1MBM_K02, K1MBM_K03, K1MBM_K04, K1MBM_K05, K1MBM_K06, K1MBM_K08, K1MBM_K09, K1MBM_K10	C1-C3		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologie spajania**
Name in English: **Joining technology**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032202**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. - The student knows the types of welds, welding positions, joints marking, causes of welded joints cracking
- The student knows the basic welding methods and parameters of the welding processes
- The student has knowledge of the fundamentals and applications of soldering, brazing, resistance welding and thermal cutting
2. - The student is able to select the right technology (method) of joining (bonding) and define basic parameters of the process;
- The student is able to select the right technology (method) of thermal cutting and define basic parameters of the process;
- The student is able to design a simple bonding process of the product

SUBJECT OBJECTIVES

C1. Acquisition of knowledge about the different types of welded structures
C2. Acquiring the ability to develop bonding technology
C3. Searching for information and its critical analysis

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Has knowledge of the performance of various welded structures
PEK_W02 - Knows welding, resistance welding, soldering, brazing and adhesive bonding technologies of different metals and alloys
PEK_W03 - Has knowledge of use of welding, resistance welding, soldering, brazing and adhesive bonding

II. Relating to skills:
PEK_U01 - Is able to select the right bonding technology
PEK_U02 - Is able to select the appropriate parameters of welding, soldering, brazing, resistance welding and adhesive bonding
PEK_U03 - Is able to design bonding process of different types of structures

III. Relating to social competences:
PEK_K01 - searching for information and its critical analysis
PEK_K02 - team cooperation on improving methods for the selection of a strategy to optimally solve assigned problems
PEK_K03 - objective evaluation of arguments, rational explanations and justifications of own point of view, using knowledge of welding technology

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to economics of welding processes	2
Lec2	Technological parameters of manual metal arc welding	2
Lec3	Technological parameters of TIG welding	2
Lec4	Technological parameters of submerged arc welding	2
Lec5	Technological parameters MAG/MIG welding	2
Lec6	Advanced soldering and brazing technologies	2
Lec7	Selected aspects of resistance welding	2
Lec8	Adhesive technology of engineering materials	2
Lec9	Laser welding	2
Lec10	Welding of pressure vessels	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Selection of MMA welding parameters	2
Lab2	Selection of MIG, MAG, TIG welding parameters	2
Lab3	Selection of filler materials for welding high-alloy steels	2
Lab4	Influence of welding parameters on the process of resistance weld forming. Evaluation of resistance welded joints.	2
Lab5	Adhesive bonding of basic engineering materials	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. report preparation
N4. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03; PEK_K03	Final test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01- PEK_U03 PEK_K01 - PEK_K03	short test
P = Średnia z F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Klimpel A.: Spawanie, Zgrzewanie i Ciecie Metali., WNT, Warszawa, 1999
2. Tasak E.: Spawalność stali,Fotobit, Kraków,2002
3. Pilarczyk J., Pilarczyk J. : Spawanie i napawanie elektryczne metali, Wyd. Śląsk, Katowice 1996
4. Ferenc K.,Ferenc J.: Konstrukcje spawane. Projektowanie połączeń, WNT, Warszawa 2000

SECONDARY LITERATURE

Pilarczyk J. (red.): Poradnik Inżyniera. Spawalnictwo. T. I i II, WNT Warszawa, 2003, 2005
Normatywy spawalnicze
Normy

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Joining technology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W21	C1-C3	lec 1-10 lab 1-5	1-5
PEK_U01_PEK_U03	K1MBM_U28	C1-C3	lab 1-5	1-5
PEK_K01-PEK_K03	K1MBM_K02	C1-C3	lec 1-10 lab 1-5	1-5
PEK_W01-PEK_W03	K1MBM_TSW_W03	C1-C3	lek 1-10	1-5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Planowanie wytwarzania CAD/CAM**
Name in English: **Technology planning CAD/CAM**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032205**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		20		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of geometric modeling and CAD systems.
2. Fundamentals of technology planning.
3. Basic knowledge about numerically controlled machine tools.

SUBJECT OBJECTIVES

C1. Gaining knowledge in the field of technology design for CNC machine tools using CAD/CAM systems.
C2. Presentation of modern tools supporting manufacturing.
C3. Discussion of issues of selection, implementation and integration of CAD/CAM systems.
C4. Discussion of issues related to project management in the field of structural design and technology.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knowledge about existing solutions supporting structural design and technology.
PEK_W02 - Ordered knowledge of technological design in CAM systems.
PEK_W03 - Knowledge regarding the selection, integration and implementation of CAD/CAM systems in enterprises.

II. Relating to skills:
PEK_U01 - Student should be able to analyze parts taking into account that will be manufactured on CNC machine tools. Analysis of the structure manufacturability.
PEK_U02 - Student should be able to prepare geometric data necessary to carry out project work.
PEK_U03 - Student should be able to prepare a technological process for CNC machine tools using selected CAD/CAM systems.

III. Relating to social competences:
PEK_K01 - Ability to work in a design team.
PEK_K02 - Ability to critically evaluate the results and their impact on the functioning of the company.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to CAD/CAM. A review of available solutions.	2
Lec2	Project management in an environment of CAD/CAM system. Relationship between documents. Generating the documentation.	2
Lec3	Technological design in CAM systems. The steps and tasks performed.	2
Lec4	Processes verification through computer simulation.	2
Lec5	Final test.	2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1	Presentation of the selected environment of CAD/CAM system.	2
Lab2	Solid modeling in a CAD system.	2
Lab3	Surface modeling in a CAD system.	2
Lab4	Preparation of geometric models for processing by milling.	2
Lab5	Technological design in the CAM system - milling module. 2.5D machining.	2
Lab6	Project management. Processes verification through computer simulation. NC code generation.	2
Lab7	Generating tool paths for 3D models where 3 axes control is required.	2
Lab8	Technological design in the CAM system - turning module.	2
Lab9	Use of the FBM method in the design of technology for machined parts.	2
Lab10	Laboratory crediting.	2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. problem discussion
N3. problem exercises
N4. self study - preparation for laboratory class
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03,	final test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03, PEK_K01	task at the last meeting
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technology planning CAD/CAM
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_W23	C1, C3, C4	Lec1, Lec2, Lec3, Lec4, Lec5	N1, N5
PEK_U01, PEK_U02, PEK_U03, PEK_K01	K1MBM_U17	C2, C4	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8, Lab9, Lab10	N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Projektowanie procesów technologicznych**
Name in English: **Technological designe processes**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032206**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			20	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		1
Lec6		1
		Total hours: 10

Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		2
Proj9		2
Proj10		2
		Total hours: 20

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - self studies and preparation for examination
N3. tutorials
N4. self study - preparation for project class
N5. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03, PEK_K01, PEK_K02, PEK_K03	
P = ocena z kolokwium		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_K01, PEK_K02, PEK_K03, PEK_U01, PEK_U02, PEK_U03	
F2	PEK_K01, PEK_K02, PEK_K03, PEK_U01, PEK_U02, PEK_U03	
P = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technological designe processes
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_W14, K1MBM_W21, K1MBM_W22, K1MBM_W24	C1-C3		N1, N2, N3, N4
PEK_U01-PEK_U03	K1MBM_TSW_U01, K1MBM_TSW_U02, K1MBM_U02, K1MBM_U14, K1MBM_U26, K1MBM_U31	C3		N1-N5
PEK_K01-PEK_K03	K1MBM_K01	C1-C3		N1-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologia i materiały stosowane w wytwarzaniu konstrukcji lekkich**
Name in English: **New technologies materials in manufacturing light constructions**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032207**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10	10	
Number of hours of total student workload (CNPS)	30		30	30	
Form of crediting	Crediting with grade		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	1		1	1	
including number of ECTS points for practical (P) classes			1	1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7	0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for project class
N3. self study - preparation for laboratory class
N4. self study - self studies and preparation for examination
N5. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01,PEK_W02,PEK_W02	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01,PEK_W02,PEK_W02 PEK_U01, PEK_U01, PEK_U01	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
New technologies materials in manufacturing light constructions
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01,PEK_W02,PEK_W03	K1MBM_TSW_W02, K1MBM_TSW_W05	C1, C2, C3		N1
PEK_U01, PEK_U03, PEK_U03	K1MBM_TSW_U02, K1MBM_U14	C1, C2, C3		N1, N2, N3
PEK_K01	K1MBM_K02	C1, C2, C3		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**
Name in English:
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032210**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					10
Number of hours of total student workload (CNPS)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1		2
Sem2		8
		Total hours: 10

TEACHING TOOLS USED

N1. problem discussion
N2. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01,PEK_K02,PEK_K03	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01-PEK_U03	K1MBM_U33	C1		N1, N2
PEK_K01-PEK_K03	K1MBM_K01, K1MBM_K02, K1MBM_K05	C2,C3		N1, N2

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologie wytwarzania wyrobów z tworzyw sztucznych**
Name in English: **Technologies of plastics parts manufacturing**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032211**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		1
Lec6		1
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
		Total hours: 10

TEACHING TOOLS USED

N1. problem lecture
N2. multimedia presentation
N3. laboratory experiment
N4. self study - preparation for laboratory class
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U1, PEK, U_2, PEK_K01, PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technologies of plastics parts manufacturing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W13	C1,C2		N1,N2
PEK_W02,PEK_W03	K1MBM_W26	C1,C2		N, N2, N3
PEK_U01,PEK_U02,PEK_U03	K1MBM_U30	C1,C2		N3
PEK_K01,PEK_K02	K1MBM_K05, K1MBM_K07	C1,C2		N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Metrologia w procesach wytwarzania**
Name in English: **Metrology in manufacturing techniques**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032220**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Examination		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has a basic knowledge of mathematics and physics.
2. Student has the ability to read drawings and diagrams contained in the technical documentation.
3. Student has basic knowledge in the design of machine elements. It has a basic knowledge of manufacturing techniques of machine parts.

SUBJECT OBJECTIVES

C1. Acquisition of knowledge about the types and characteristics of equipment for the measurement of geometrical quantities.
C2. Gaining the ability to analyze the results of measurements, measurement errors and expressing measurement uncertainty in dependence of production lot scale.
C3. Wyszukiwanie istotnych informacji oraz ich krytyczna analiza.
C4. The acquisition and consolidation of social skills including emotional intelligence, involving the cooperation among students with a view to effective problem solving. Responsibility, honesty and fairness in the academic society life.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Able to identify and define the quantity of the measuring machine parts. He knows and is able to determine the arrangements for ensuring the measurement integrity.

PEK_W02 - Can name the elements of the measurement system and define its functional characteristics. He knows the characteristic values measured in different types of machines.

PEK_W03 - He knows the principles governing the creation of tools, components and measuring systems in dependence of production lot scale.

II. Relating to skills:

PEK_U01 - Understands the dimensional requirements imposed to products included in the technical documentation. Can use literature related to the assessment of the geometry of the product. Can calculate the value of measurement errors, estimated measurement uncertainty for the different measurements.

PEK_U02 - He can make the selection of appropriate test equipment and set it up depending on the task measuring. Can create documents for the implementation of the measurements on the test bench.

PEK_U03 - Can use industrial measuring equipment management systems.

III. Relating to social competences:

PEK_K01 - Search for information and its critical analysis

PEK_K02 - Team collaboration on improving the method of selection of strategies aimed at optimal solution entrusted of problems to a group.

PEK_K03 - Objective evaluation of arguments, the rational explanation of his own point of view using the knowledge of metrology.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. Basic concepts of metrology. Quantities and units of measurement. Integrated measurement units. SI units, measurement standards, measurement itegrity.	1
Lec2	Elements of measurenment systems and their properties.	1
Lec3	The method of determining the measurement uncertainty.	2
Lec4	Distribution of the variability of dimensions for typical processes.	2
Lec5	Toleration of machines in various technological processes.	2
Lec6	Designing of measuring devices's heads .	1
Lec7	Design and control tests for checking the geometry of the product.	1
Lec8	Integration of measuring stands.	1
Lec9	Mechanization and automation of measurement processes.	1
Lec10	Methods of measurement systems analysis.	2
Lec11	Methods and tools for monitoring measurement equipment.	1
Lec12	Elements of statistical control of manufacturing processes.	1
Lec13	Organization and documentation of the process control of machines.	2
Lec14	Analysis of tolerance and interchangeability of parts.	2
		Total hours: 20

Form of classes – Laboratory		Number of hours
Lab1	Organizational matters. General principles for the use of measuring equipment.	1
Lab2	Checking selected metrological characteristics of measuring instruments.	2
Lab3	Selection of equipment for specific measurement tasks.	2
Lab4	Analysis of the measurement system.	2
Lab5	Measurement in the integrated measurement environment.	2
Lab6	Analysis and implementation of the CMM measurement tasks.	1
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. report preparation
N3. self study - preparation for laboratory class
N4. tutorials
N5. self study - self studies and preparation for examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01; PEK_W02; PEK_W03; PEK_K01; PEK_K02; PEK_K03;	test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01; PEK_U02; PEK_U03; PEK_K01; PEK_K02; PEK_K03;	report on laboratory exercises, test, oral answer
P = średnia wszystkich ocen		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1]Jakubiec W., Malinowski J.: "Metrologia wielkości geometrycznych". WNT, Warszawa 2007.

SECONDARY LITERATURE

[1] Jakubiec W., Malinowski J., Płowucha W.: "Pomiary gwintów w budowie maszyn". WNT, Warszawa 2008.
[2] Ochęduszko K., "Koła zębate. Tom 3. Sprawdzanie". WNT Warszawa 2007 (dodruk 2012)
[3] Humienny Z. i inni: " Specyfikacje geometrii wyrobów (GPS)". WNT, Warszawa 2004
[4] Adamczak S., Makieła W.: " Metrologia w budowie maszyn. Zadania z rozwiązaniami. Wydanie II, zmienione". WNT, Warszawa 2007.
[5] Jezierski J., Kowalik H., Siemiątkowski Z., Warowny R.:" Analiza tolerancji w konstrukcji i technologii maszyn". WNT, Warszawa 2009.
[6] Adamczak S., Makieła W.: "Pomiary geometryczne powierzchni". WNT, Warszawa 2009.
[7] Zelczak A.:" Pneumatyczne pomiary długości". WKŁ, Warszawa 2006.
[8] Ratajczyk E.: "Współrzędnościowa technika pomiarowa". Oficyna Wydawnicza PW, Warszawa 2005

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Metrology in manufacturing techniques
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01; PEK_W02; PEK_W03;	K1MBM_W15	C1; C2; C3; C4	Wy1 - Wy14	N1; N5
PEK_U01; PEK_U02; PEK_U03;	K1MBM_TSW_U01, K1MBM_U01, K1MBM_U12	C1; C2; C3; C4	La1 - La6	N2; N3; N4; N5
PEK_K01; PEK_K02; PEK_K03;	K1MBM_K04, K1MBM_K05	C1; C2; C3; C4	Wy1 - Wy14, La1 - La6	N1; N2; N3; N4; N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Badanie jakości wyrobów**
Name in English: **Research of qualities of products**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032221**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Examination		Crediting with grade		
Group of courses					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student should has a basic knowledge about the basic mechanical properties of engineering materials; has ordered knowledge about the types of metallic engineering materials - their structure, properties, applications and principles of selection; has detailed knowledge about the structures of steel and cast iron, the principles of classification and labeling; has a basic knowledge about heat and thermo-chemical treatment, has a knowledge about alloy steels and non-ferrous metals and alloys.Has a theoretical knowledge about circuitry.
2. Can analyze the macroscopic fractures, microstructure of materials, technological defects; is able to determine the characteristics of the microstructure of metallic materials; is able to identify the phases on the basis of equilibrium diagrams; can distinguish between the microstructure in terms of carbon content in steel, the influence of heat treatment; can analyze circuits, can read and interpret the drawings and diagrams used in technical documentation
3. Has a basic knowledge of the manufacturing processes of products from the liquid metal, the plastic molding, welding and machining techniques.
Has a basic knowledge of metrology of geometrical quantities.

SUBJECT OBJECTIVES

C1. To familiarize students with methods of product quality assesment manufactured from the liquid metal, through the plastic molding, welding techniques and machining.
C2. Acquisition of knowledge about the basic methods of quality assesment of castings, forgings, stampings, rolled products, drawn, welded products, welded and brazed, glued, screwed, sintered products form metal powders, products manufactured by machining, heat-treated products and products made of plastics.
C3. The acquisition and consolidation of social skills including emotional intelligence involving the ability to work in a group of students with a view to effective problem solving. Responsibility, honesty and fairness in the acting; observance of customs in academia environment and society.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knows the basic methods of quality assessment of castings and products made by methods of plastic working.
PEK_W02 - Knows the basic quality assessment methods of products made by prosesses like welding, glueing, screwing and sintered products from metal powders.
PEK_W03 - Knows the basic quality assessments methods of products manufactured by machining, heat treatement and plastic products.

II. Relating to skills:
PEK_U01 - Can choose the appropriate method for the quality assessment of products manufactured by castings and by methods of
plasting working and specify a quality class of product .
PEK_U02 - Can choose the appropriate method for the quality assessment of products produced in the process of welding and specify a quality class of product .
PEK_U03 - Can choose the appropriate method for the quality assessment of products manufactured by machining and plastic products and specify a quality class of product .

III. Relating to social competences:
PEK_K01 - Searching for the information and critical analysis,
PEK_K02 - Objective evaluation of arguments to justify, the rational translation and his own point of view using the knowledge about the casting, plastic forming and welding, machining and plastics
PEK_K03 - Observance with the customs and rules of the academic environment,

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. Basic concepts and terminology in systems to ensure product quality. The techniques used for quality control of products.	2
Lec2	Aspects of the application of non-destructive testing for quality control of products.	2
Lec3	The methods and principles for quality assessment of the castings.	2
Lec4	Methods of quality assessment of rolled, drawn and extruded products.	2

Lec5	Methods of quality assessment of forged, sintered and after the thermo-chemical treatment products	2
Lec6	Testing and quality control methods of welded products	2
Lec7	Testing and quality control methods of welded and brazed products	2
Lec8	Testing and quality control methods of glued and screwed products. Methods of quality assessment of plastic products	2
Lec9	Methods of quality assessment of products made by machining	2
Lec10	Coordinate measuring techniques in the assessment of product quality.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	The study of selected parameters of cast products and the assessment of their quality.	2
Lab2	The study of selected parameters of product manufactured by plastic processing technologies and the assessment of their quality.	2
Lab3	The study of selected parameters of product manufactured by welding processes and the assessment of their quality.	2
Lab4	Computed tomography in product quality control.	2
Lab5	The study of selected parameters of product manufactured by machining and the assessment of their quality.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. laboratory experiment
N4. self study - self studies and preparation for examination
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03, PEK_K01 - PEK_K03	Written - oral exam
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01 - PEK_K03	oral examination, short test
P = średnia z wszystkich ocen		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Praca zbiorowa. Zarządzanie jakością, T4. metody oceny jakosci wyrobów technicznych. Politechnika Krakowska. 2000r.
Łabanowski J. Ocena jakości wyrobów hutniczych. Wyd. PWSZ w Elblągu. 2008r.

SECONDARY LITERATURE

Zymonik Janusz i Zofia. Systemy jakości w wytwarzaniu maszyn. SIMPRESS, Wrocław, 1997r.
Mirski Z., Technologia i badanie materiałów inżynierskich : laboratorium. Oficyna Wydawnicza Politechniki Wrocławskiej, 2010r.
Subject standards PN-EN ISO.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Research of qualities of products
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W15	C1, C2	Lec 1 1-Lec5	N1, N4, N5
PEK_W02	K1MBM_W15	C1, C2	Lec1, Lec2, Lec7, Lec8	N1, N4, N5
PEK_W03	K1MBM_TSW_W04, K1MBM_W15	C1, C2	Lec1, Lec2, Lec9, Lec10	N1, N4, N5
PEK_U01	K1MBM_TSW_U04, K1MBM_U12	C1, C2, C3	Lab1, Lab2, Lab4	N2, N3
PEK_U02	K1MBM_U12	C1, C2, C3	Lab3, Lab4	N2, N3
PEK_U03	K1MBM_U12	C1, C2, C3	Lab4, Lab5	N2, N3
PEK_K01 - PEK_K03	K1MBM_K04	C3	Lec1 - Lec10, lab1 - Lab5	N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Utrzymanie ruchu maszyn i urządzeń wytwórczych**
Name in English: **Operation maintenance of manufacturing machines and devices**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032224**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10				
Number of hours of total student workload (CNPS)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge about structure and operation of machine components and assemblies, as well as principles of their selecting and designing
2. Basic knowledge about operation, reliability and safety of machines.
3. Well-grounded knowledge about basic manufacturing techniques and role of manufacturing machines.

SUBJECT OBJECTIVES

C1. Getting acquainted with principles of the Total Productive Maintenance (TPM) concept.
C2. Getting acquainted with basic TPM tools and methods allowing to increase efficiency of machine stock maintenance. Getting acquainted with principles of determining indices describing progress at implementing the TPM methodology.
C3. Getting acquainted with possibilities of CMMS-class computer systems to support planning operation and repair tasks, stock management and managing the operation/repair personel.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knowledge of scope and principles of selecting a maintenance strategy of manufacturing machines and devices.

PEK_W02 - Knowledge of basic TPM tools and indices.

PEK_W03 - Knowledge of basic features and possibilities of CMMS-class computer systems to support planning operation and repair tasks, stock management and managing the operation/repair personel.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic problems related to maintenance of manufacturing machines and devices: service requirements, cause and effect analysis of machine failure, role and significance (benefits) of maintenance organization and planning.	2
Lec2	History and development of the TPM concept (characteristics of basic TMP pillars). Characteristics of basic TPM tools – exemplary applications.	2
Lec3	Maintenance strategies – idea of systematic and system-related attitude to maintenance problems. Measures and indices determining efficiency of implementing the TPM methodology.	2
Lec4	CMMS-class computer systems supporting maintenance management (requirements and functions of selected systems, system selection criteria).	2
Lec5	Implementing the TPM methodology to industrial practice (exemplary solutions of implementing). Crediting the course.	2
		Total hours: 10

TEACHING TOOLS USED

N1. Traditional lecture with use of transparencies and slides.
N2. Own work – preparation for crediting the lecture.
N3. Consultancies.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03	Credit colloquium
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Legutko S.: Basics of operation of machines and devices. Editorial Office WSiP. Warsaw, 2007 (in Polish).
Słowiński B.: Engineering of machine operation. Editorial Office of Koszalin University of Technology. Koszalin, 2011 (in Polish).
Kaźmierczak J.: Operation of technical systems. Editorial Office of Silesian University of Technology. Gliwice, 2000 (in Polish).

SECONDARY LITERATURE

Hebda M.: Elements of the theory of technical systems operation. Editorial Office MCNEMT. Radom, 1990 (in Polish).
Żółtowski B.: Basics of machine diagnostics. Editorial Office ATR Bydgoszcz, 1996(in Polish).
Honczarenko J.: Flexible automation of manufacture. Machine tools and machining systems. WNT Warsaw, 2000 (in Polish).

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Operation maintenance of manufacturing machines and devices
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W03	K1MBM_W18, K1MBM_W26	C1 - C3	Wy1 - Wy5	N1 - N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologie laserowe w wytwarzaniu**
Name in English: **Laser Technology in Manufacturing**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032225**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	90		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	3		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of optics and optical systems impact on the light beam
2. Basic knowledge of electromagnetic radiation's interaction with matter
3. Knowledge of the heat treatment's issues and its impact on the changes taking place in the material

SUBJECT OBJECTIVES

C1. Acquiring knowledge of the construction and the laser processing operation's
C2. Acquiring the ability to select the appropriate laser system to the task in
C3. Independent acquisition of information and its use to solve engineering problems

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - He knows the principles of operation and construction of high-power lasers
PEK_W02 - He knows the laser beam forming systems and the interaction of radiation with matter
PEK_W03 - He is familiar with the scope of lasers in manufacturing

II. Relating to skills:

PEK_U01 - He can choose the right laser system for a given treatment process
PEK_U02 - Acting in an appropriate way with the specialized laser equipment
PEK_U03 - Depending on the desired process he is able to select the appropriate beam forming system

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The basics of high-power lasers	2
Lec2	Laser beam forming systems and laser safety	2
Lec3	Impact of the laser beam with matter	2
Lec4	Laser cutting and wellding	2
Lec5	Laserl cladding and micromachining	2
		Total hours: 10
Form of classes – Laboratory		Number of hours
Lab1	Overview of laser radiation generators	2
Lab2	Laser cutting	2
Lab3	Welding using the laser beam	2
Lab4	Laser cladding	2
Lab5	Engraving and laser micromachining	2
		Total hours: 10

TEACHING TOOLS USED

N1. multimedia presentation
N2. self study - preparation for laboratory class
N3. self study - self studies and preparation for examination
N4. demonstration of laser processes
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 - PEK_W03,	Test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03,	shortl exam
P = średnia F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

J. Kusiński: ”Lasery i ich zastosowanie w inżynierii materiałowej”, Wydawnictwo Naukowe Akapit, 2000.
A. Klimpel: "Technologie laserowe w spawalnictwie" Wydawnictwo Politechniki Śląskiej, 2011.

SECONDARY LITERATURE

E. Kannatey-Asibu: “Principles of Laser Materials Processing”, Wiley, 2009.
J.C. Ion: „Laser Processing of Engineering Materials”, Elsevier, 2005.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Laser Technology in Manufacturing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_TSW_W03, K1MBM_W21	C1, C2	Lec1-Lec5	N1- N3, N5
PEK_U01-PEK_U03	K1MBM_TSW_U03, K1MBM_U26, K1MBM_U28	C2, C3	Lab1-Lab5	N2-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Komputerowa symulacja procesów odlewania**
Name in English: **Casting process simulation**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032226**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			10	
Number of hours of total student workload (CNPS)	90			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	3			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for project class
N3. self study - self studies and preparation for examination
N4. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-PEK_W03, PEK_U01-PEK_U03, PEK_K01-PEK_K03	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement

F1	PEK_W01-PEK_W03, PEK_U01-PEK_U03, PEK_K01-PEK_K03	
F2	PEK_W01-PEK_W03, PEK_U01-PEK_U03, PEK_K01-PEK_K03	
P = średnia wszystkich ocen F1+F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Casting process simulation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K1MBM_TSW_W02, K1MBM_W23	C1, C2, C3		1, 2, 3, 4
PEK_U01-PEK_U03	K1MBM_U05, K1MBM_U14, K1MBM_U27	C1, C2, C3		1, 2, 3, 4
PEK_K01-PEK_K03	K1MBM_K01	C1, C2, C3		1, 2, 3, 4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Narzędzia skrawające**
Name in English: **Cutting tools**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032227**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10		10		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge of manufacturing in machining
2. He has skills in measurement methods, techniques for measuring and evaluating the results of measurement
3. Can obtain information from literature, databases and other sources, and to draw conclusions and formulate and justify opinions

SUBJECT OBJECTIVES

C1. Expanding knowledge of cutting tools, cutting edge geometry, tools materials and coatings used on the cutting edge.
C2. Knowing the rules of proper tool selection, due to working conditions, treatment efficiency and manufacturing costs.
C3. Gaining knowledge of wear and regeneration blunted cutting tools.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Student is able to correctly classify cutting tools, know their structure and geometry.
PEK_W02 - Student can choose the modern technological processes cutting tools due to the efficiency and cost of production.
PEK_W03 - The student is able to explain the physical and chemical phenomena occurring at the cutting edge during machining.

II. Relating to skills:
PEK_U01 - Students can choose the tool materials due to optimal cutting.
PEK_U02 - Student can determine what is the influence of cutting edge geometry on the effects of machining technology.
PEK_U03 - Students should be able to use the computer programs used for the selection of tools set machining conditions.

III. Relating to social competences:
PEK_K01 - Is aware of the importance of behavior in a professional way, well-defined and resolve dilemmas.
PEK_K02 - Recognize the effects of the impact of technology on the environment and related social responsibility of science and technology.
PEK_K03 - Is aware of the necessity of individual and group activities that go beyond the activities of engineering.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The role of tools and equipment in the production of machine parts	2
Lec2	Tool materials and their selection	2
Lec3	The geometry of the cutting edge. Reference systems and dimensioning of the blade. The role and importance of the angles of the blades in the cutting process.	2
Lec4	Characteristics and application of tools	2
Lec5	Cutters and cutter heads. Thread Tools and gears. Colloquium	2
		Total hours: 10

Form of classes – Laboratory		Number of hours
Lab1	Measurement and tool setting in flexible production system.	2
Lab2	The measurement tool components.	2
Lab3	Turning with inserts WIPER type.	2
Lab4	Machinability determination for choosen tools.	2
Lab5	The choice of cutting tools with the use of computer programs.	2
		Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. report preparation
N4. self study - self studies and preparation for examination
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03 PEK_K01, PEK_K02, PEK_K03	Colloquium
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	report on laboratory exercises
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
Autor: Piotr Cichosz, tytuł: Narzędzia skrawające, wydawnictwo: WNT , rok: 2006
Autor: Mieczysław Feld, tytuł: Uchwyty obróbkowe, wydawnictwo: WNT, rok: 2002

SECONDARY LITERATURE
Autor: Henryk Żebrowski, tytuł: Przyrządy i uchwyty obróbkowe, , wydawnictwo: Oficyna Wyd. PWr., rok: 1983

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Cutting tools
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K1MBM_TSW_W01, K1MBM_W22	C1, C3	Lec1 - Lec5	N1, N4, N5
PEK_U01, PEK_U02, PEK_U03	K1MBM_TSW_U01, K1MBM_U26, K1MBM_U31	C1, C2, C3	La1 - La5	N2, N3, N5
PEK_K01, PEK_K02, PEK_K03	K1MBM_K02, K1MBM_K03, K1MBM_K07	C1	Lec1, La1, La5	N1, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Komputerowa symulacja procesów kształtowania plastycznego**
Name in English: **Computer simulation of plastic forming processes**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032228**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	10			10	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic understanding of the processes and machinery for plastic forming.
2. It has a basic understanding of the foundations of the theory of finite element methods.
3. It has a basic understanding of the strength of materials, mechanics and the theory of machines and mechanisms.

SUBJECT OBJECTIVES

C1. To gain insight into the field of modern engineering tools for analysis and optimization of plastic forming processes.
C2. To gain basic knowledge and skills to build mathematical models of forming processes
C3. To know the influence of the process parameters on the forming forces.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - It knows the construction of mathematical models of plastic forming processes.
PEK_W02 - It has a basic knowledge of the possible applications of the finite element method to the process analysis and optimization of forming processes.
PEK_W03 - It knows the basic relationships between material properties and parameters of forming process.

II. Relating to skills:

PEK_U01 - It gain the skills necessary to build mathematical models of plastic forming processes.
PEK_U02 - Is able to perform the calculation and initial optimization of the plastic forming process.
PEK_U03 - Is able to identify which of the process parameters significantly affect the forming forces.

III. Relating to social competences:

PEK_K01 - It acquires beliefs about the responsibility for the work.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Plastic forming - types of processes, the basic process parameters.	1
Lec2	The model of the process, geometry transfer, calculation model building.	1
Lec3	Fundamentals of plastic deformation.	2
Lec4	Models of materials, stress-strain curves, yield criterion.	1
Lec5	Modelling of bulk metal forming processes.	3
Lec6	Modelling of sheet metal forming.	2
		Total hours: 10

Form of classes – Project		Number of hours
Proj1	Introduction to computer simulation of the plastic forming processes in the computing environment.	1
Proj2	Modelling of selected examples of plastic forming processes.	2
Proj3	Analysis and determination of the influence of process parameters on the forming forces (friction, temperature, speed).	2
Proj4	Preparation of design assumptions for the selected item shaped by forming processes.	1
Proj5	Description of the process geometry and its export to the FEM program.	1
Proj6	Building the model in the FEM program.	1
Proj7	Making calculations for the various process parameters and/or the geometry of the process.	2
		Total hours: 10

TEACHING TOOLS USED

N1. multimedia presentation
N2. problem exercises
N3. self study - preparation for project class
N4. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03	final test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03	project rating
F2	PEK_U01, PEK_U02, PEK_U03	test
P = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Joseph R. Davis: Metals handbook. Vol. 14, Forming and forging ASM International Handbook Committee.
Altan, Taylan; Tekkaya, A. Erman: Sheet Metal Forming - Processes and Applications, ASM International.
Hosford, William F.; Caddell, Robert M.: Metal Forming - Mechanics and Metallurgy, Cambridge University Press

SECONDARY LITERATURE

Gronostajski Z.: Badania stosowane w zaawansowanych procesach kształtowania plastycznego. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2003
Morawiecki M., Sadok L., Wosiek E.: Przeróbka plastyczna- podstawy teoretyczne. Wydawnictwo Śląsk 1986
Gabryszewski Z., Gronostajski J.: Mechanika procesów obróbki plastycznej, PWN, Warszawa 1991

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Computer simulation of plastic forming processes
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01,PEK_W02,PEK_W03	K1MBM_TSW_W05	C1, C2, C3	Wy1-Wy6	N1,N4
PEK_U01, PEK_U02, PEK_U03	K1MBM_TSW_U05	C1, C2, C3	Pr1-Pr7	N2,N3
PEK_K01	K1MBM_K04	C3	Pr3	N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA**
Name in English: **MASTER THESIS**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **MMM032250**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				20	
Number of hours of total student workload (CNPS)				450	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				15	
including number of ECTS points for practical (P) classes				15	
including number of ECTS points for direct teacher-student contact (BK) classes				15.0	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has knowledge of manufacturing techniques and production systems documented by positive marks in all subjects in within the specialty of Technologies and Manufacturing Systems
2. Can apply their knowledge. Carry out experimental research, seek an information from the literature. Speak a foreign language at the level which let to express self-opinions and write master's thesis in the field of production techniques and production systems. Can analyze the results of the research and specify the conclusions.
3. Is aware of the importance of non-technical aspects and impacts of engineering, to respect the principles of ethics and social role of technical college graduate.

SUBJECT OBJECTIVES

C1. Based on the acquired knowledge while studying, preparation of master thesis by the solution of research problem in the field of the specialty of Technologies and Manufacturing Systems.
C2. Writing a master thesis and presentation of its achievements in relation to current information in literature.
C3. Acquisition and consolidation of independent work skills, determination of the priorities to tackle the task and awareness of responsibility for own work.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Has a necessary knowledge of realization the engineering tasks, their description, documentation and presentation.

PEK_W02 - Has a basic knowledge of the organization and implementation of master thesis, on issues related to the specialty of Technologies and Manufacturing Systems.

PEK_W03 - Has a basic knowledge in methodology of presenting the results of done work and background skills needed for the communicating in engineering teamwork.

II. Relating to skills:

PEK_U01 - Can critically analyze and evaluate existing manufacturing processes, production systems and technological machines. Can work independently to realize the degree of master's thesis, using research techniques and methods known during studies.

PEK_U02 - Can acquire concrete information from the literature also in foreign languages. Can to interpret and critically evaluate the research results.

PEK_U03 - Knows how to edit a master's thesis complying with prevailing requirements of method and style of writing. Can present it orally to a wider audience using multimedia capabilities, including the occurrence to the diploma committee.

III. Relating to social competences:

PEK_K01 - As a graduate student is aware of being the next leader, who knows how to organize the work and determine the self-priorities for the others, can manage a team of people as well as work together in the group taking the different roles.

PEK_K02 - Is gaining characteristics of a person working alone, according to the principles of ethics with an awareness of the responsibility for their own work.

PEK_K03 - Acquires attention to style and form of expression of own views in native and a foreign languages, especially in English, understands the need of continuing education and developing professional skills throughout their live.

PROGRAMME CONTENT

TEACHING TOOLS USED

N1. case study
N2. self study - self studies and preparation for examination
N3. multimedia presentation
N4. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement

F1	PEK_W01 - PEK_W03 PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	Working in the semester, preparing master's thesis as a work.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Literature of the master's thesis topic agreed with the promoter.

SECONDARY LITERATURE

1. Kozłowski R.: Praktyczny sposób pisania prac dyplomowych; Wolters Kluwer Polska sp. z o.o. 2009;
2. Kalita C.: Zasady pisania licencjackich i magisterskich prac badawczych; Poradnik dla studentów; Wyd. ARTE 2011

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
MASTER THESIS
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 - PEK_W03	K1MBM_W25, K1MBM_W30	C1 - C3		N1, N2, N4
PEK_U01 - PEK_U03	K1MBM_U41, K1MBM_U42, K1MBM_U45	C1, C2		N1 - N4
PEK_K01 - PEK_K03	K1MBM_K01, K1MBM_K04, K1MBM_K05, K1MBM_K06, K1MBM_K09	C1 - C3		N1 - N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Elektrotechnika**
Name in English: **Electrical engineering**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **obligatory**
Subject code: **MMR032001**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows and understands basic principles of physics, especially electrostatics and electromagnetism.
2. Student is able to compute differential and integral calculus.
3. Student defines and solves correctly problems connected with the profession.

SUBJECT OBJECTIVES

C1. Basic knowledge about electrical circuits and electromagnetic fields.
C2. Knowledge about construction and work of the electrical machines and devices.
C3. Ability for team work and measurements of electrical machines and devices.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student knows basic principles of electrical circuits and electromagnetism and their utilization in electrical machines and devices.

PEK_W02 - Student knows principles, construction and destination of transformers and chokes.

PEK_W03 - Student knows construction and characteristics of electrical machines.

II. Relating to skills:

PEK_U01 - Student is able to build measurement circuit and make measurements of basic electrical quantities.

PEK_U02 - Student is able to make simple laboratory measurements of electrical devices.

PEK_U03 - Student is able to determine of characteristics of basic electrical motors.

III. Relating to social competences:

PEK_K01 - Student is aware of their own responsibility for their work and a willingness to comply with the principles of teamwork.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Literature. Basic principles of electrical engineering. Principles of circuit theory. AC and DC current. Power and work.	2
Lec2	Electromagnetism- basic quantities, magnetic properties, magnetic circuits. Electromagnetic induction phenomenon. Self and mutual inductance.	2
Lec3	R, L, C elements in AC circuits. Resonance circuits, real power, reactive power, power factor correction, filters.	2
Lec4	AC circuits. Three-phase voltage generation. Four-cable system. Wye and delta connections.	2
Lec5	Transformers and chokes- construction, principles and work analysis. Types of transformers and their applications, autotransformers and current transformers.	2
Lec6	Induction motor- construction, principles of work.	2
Lec7	Types of induction motor works, load characteristics.	2
Lec8	Starting, braking, speed control. Application of induction motors.	2
Lec9	Synchronous machines- construction, principles of work, applications.	2
Lec10	DC machines- construction, principles of work, load characteristic, starting, braking and speed control, applications.	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Introduction, safety instructions.	1
Lab2	Real power in AC three-phase systems.	2
Lab3	Three-phase transformer measurement.	2
Lab4	Squirrel-cage induction motor supplied with frequency converter.	2
Lab5	DC shunt motor measurement.	2
Lab6	Grades.	1

	Total hours: 10

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. multimedia presentation
N3. laboratory experiment

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 PEK_W02 PEK_W03	writing test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 PEK_U01 PEK_U01 PEK_K01	laboratory reports
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Elektrotechnika, skrypt P.Wr. pod redakcją P. Zielińskiego (1990)
Elektrotechnika dla nieelektryków. Ćwiczenia laboratoryjne, Zbiór zadań, skrypt P.Wr. pod redakcją P. Zielińskiego (2000)

SECONDARY LITERATURE

Elektrotechnika i elektronika dla nieelektryków. Podręczniki akademickie, Praca zbiorowa, WNT 2004
E. Koziej, B. Sochoń: Elektrotechnika i elektronika. PWN 1986

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Electrical engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W05	C1		N1,N2
PEK_W02	K1MBM_W05	C2		N1,N2
PEK_W03	K1MBM_W05	C2		N1,N2
PEK_U01	K1MBM_U13, K1MBM_U35	C2, C3		N3
PEK_U02	K1MBM_U13	C2, C3		N3
PEK_U03	K1MBM_U13	C2, C3		N3
PEK_K01	K1MBM_K04	C3		N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK ZAJĘCIA SPORTOWE**
Name in English: **Block of Sports Activities**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, part-time**
Kind of subject: **optional**
Subject code: **WFW010000BK**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					
Number of hours of total student workload (CNPS)					
Form of crediting					
Group of courses					
Number of ECTS points					
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

TEACHING TOOLS USED

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of Sports Activities
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_K	K1MBM_K07, K1MBM_K12	wg kart przygotowanych przez SWFiS		wg kart przygotowanych przez SWFiS