Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Ekonomia**
Name in English: **Economics**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **EKZ000347**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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

1. No prerequisites

SUBJECT OBJECTIVES

C1. Providing knowledge and understanding economic theory on the microeconomic and macroeconomic scale, including different economic schools.
C2. Providing knowledge of categories and economic laws as well as institutions of market economy and their functions in economic system
C3. Providing knowledge of the rules of taking optimal decisions by market subjects on different markets, including factor production markets.
C4. Providing knowledge of government functions in economy in relation to development and economic growth
C5. Providing knowledge of factors belonging to macroeconomic environment of company and engineering activity in factual knowledge and regulation contexts (dimensions) linked to conducted economic policy. Explain the impact of these factors on the economic subjects' behaviours and their choices.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - PEK_W01 know and understand fundamental economic terms, laws and economic phenomena.
PEK_W02 know conditions and economic laws to make optimal decisions by market subjects (producers and consumers).
PEK_W03 know causal relationships in economic policy and economic phenomena as well as their influence on companies' operating conditions and other economic subjects.
PEK_W04 know the factors production markets

II. Relating to skills:

III. Relating to social competences:

PEK_K01 - be able to understand the economic causations of taken management and engineering decisions.
PEK_K02 - be able to think and act in entrepreneurial way

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Economics as science. Micro- and macroeconomics. Positive and normative economics. Fundamental terms connected with economics and economy. Range, aims and research tools. Seeking economic data. Economic inference.	2
Lec2	Decision in economics: terms, types and the assumptions of rationality of action. Short and long term in economics, production possibility frontier (type of choice: "trade off") and opportunity cost, law of increasing opportunity cost, total and marginal product, the law of diminishing product. Production possibility frontier and short-run and long-run decisions. Rules of decision optimization.	2
Lec3	Types of economies (including social market economy and mechanism of resources allocation in these economies)). Market. Competitiveness.	1
Lec4	Demand, supply, price. Market and its elements. Demand, demand curve, demand factors, quantity of demand and demand law. Untypical curves of demand Supply, supply curve and its factors, quantity of supply and supply law. Market mechanism.	2
Lec5	Elasticities of demand and supply.	2
Lec6	The theory of customers choice.	2
Lec7	The supply theory – production theory. The choice of optimal input combination in short-run and long-run. Marginal rate of technical substitution. Average product and marginal product.	2
Lec8	Costs in business (total, average, marginal costs). Cost in the short run and in the long run. Economic of scale. Economic costs.	2
Lec9	Revenue and financial results (profit/loss before tax). Marker structures and their general characteristics.	2
Lec10	Measuring the Value of Economic Activity. Fluctuation of GDP, production and income. The consumption demand and the investment demand. The equilibrium in economy. The aggregate demand in economy and its elements. The Equilibrium in basic model of economy. Multiplier. The equilibrium in open economy with government.	2

Lec11	Development and economic growth. The models of economic growth. Cycle fluctuations of market economy. Passive and active countercyclical policy	2
Lec12	Monetary and credit system. Capital market. Inflation.	3
Lec13	Labour market and unemployment.	2
Lec14	State budget. The budget debt and the public debt. Economic mean of public debt.	2
Lec15	Test	2
		Total hours: 30

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation
N3. problem lecture

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_W04 PEK_K01, PEK_K02	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1]Makro- i mikroekonomia. Podstawowe problemy współczesności, praca zb. pod red nauk. Marciniaka St. , Wydawnictwo Naukowe PWN, Warszawa 2013.
[2]Samuelson F. W., Marks S.(1998), Ekonomia menedżerska, Warszawa, PWE.
[3]Samuelson P.A., Nordhaus W.D.(2012), Ekonomia, Warszawa, PWN.

SECONDARY LITERATURE

[1]Czarny, B., Czarny, E., Bartkowiak, R., Rapacki R., Podstawy ekonomii, PWE, Warszawa 2000 i kolejne wydania.
[2]Kwaśnicki W., Zasady ekonomii rynkowej, Wrocław 2001.
[3]Podstawy ekonomii, pod red. Milewskiego R. Wydawnictwo Naukowe PWN, Warszawa 2004.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Economics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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_W04	K1ZIP_W13	C1-C5	Lec	N1-N3
PEK_K01-PEK_K02	K1ZIP_K02, K1ZIP_K05	C1-C5	Lec	N1-N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Rachunkowość i finanse**
Name in English: **Accounting and finance companies**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **FBZ000337.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15			
Number of hours of total student workload (CNPS)	30	30			
Form of crediting	Crediting with grade	Crediting with grade			
Group of courses					
Number of ECTS points	1	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

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 – Classes		Number of hours
Cl1		2
Cl2		2
Cl3		5
Cl4		2
Cl5		4
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. problem discussion
N3. tutorials
N4. problem lecture
N5. 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_W02, PEK_W03	
P = P		

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	
P = F		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Accounting and finance companies
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W19	C1, C2, C3		N1; N2
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U19	C1, C2, C3		N2; N3; N5
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K01, K1ZIP_K07, K1ZIP_K11	C1, C2, C3		N2; N3; N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Fizyka**
Name in English: **Physics**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **FZP001067**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15	15		
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					

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. Specific 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 1 Organizational matters. The physical quantities, their role in everyday life and in civilization progress. The bases of kinematics, reference frames, curvilinear motion. (1h) Lec 1,2 Physical quantities. Bases of kinematics and Newton's dynamics. Equations of motion (2h) Lec 2 Work and mechanical energy. The law of conservation of mechanical energy (1h) Lec 3 Dynamics of the material points system. The principle of conservation of momentum. Collisions.(2h) Lec 4,5 Kinematics and dynamics of rotational motion of the rigid body. The principle of conservation of the angular momentum. (4h) Lec 6,7 Oscillations around stable equilibrium state. (3h) Lec 7,8 Basic properties of mechanical waves. Elements of acoustics. Wave energy. (2h) Lec 8,9 First and second principles of thermodynamics. Ideal gas conversions. Entropy. Real gases (2h) Lec 9,10,11 Gravitational interactions, central field, potential and energy of gravitational field. (2h) Lec 11,12 Magnetostatic field. Interaction of magnetic field with current currying conductor. (2h) Lec 12,13 Electromagnetic induction. Maxwell equations. Electromagnetic waves. (3h) Lec 14 Elements of relativistic kinematics and dynamics. (2h) Lec 15 Physics of the atom, atomic nucleus, elementary particles. Elements of astrophysics (2h)	30
		Total hours: 30
Form of classes – Classes		Number of hours
Cl1		15
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1	Lab 1 Introduction to LPF: issues of organization and conducting of classes, introduction of student with: a) the safety rules for measurements (short health and safety training), b) how to prepare writing reports, c) the basics of the measurement uncertainty analysis. Performance of simple measurements.(2h) Lab 2 Making measurements using analog and digital gauges. Statistical processing of simple and complex results of measurements, estimation of simple and complex measurement uncertainty, graphical presentation of the results of measurements and measurement uncertainty, preparation of the report.(2h) Lab 3 Making measurements of selected mechanical quantities +++, developing reports (2h) Lab 4 Making measurements of selected thermodynamical quantities +++, developing reports (2h) Lab 5 Making measurements of selected electromagnetic quantities +++, developing reports (2h) Lab 6 Making measurements of selected optical or quantum quantities +++, developing reports (2h) Lab 7 Supplementary classes, crediting test concerning principles of calculation of measurements uncertainties (2h) Lab 8 Crediting of laboratory exercises. (1h)	15
		Total hours: 15

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	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.

LITERATURA UZUPEŁNIAJĄCA W JĘZYKU ANGIELSKIM:

[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
Management and Manufacturing Engineering

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	K1ZIP_W02, K1ZIP_W03	C1, C2, C4		N1, N6
PEK_U	K1ZIP_U02, K1ZIP_U06	C3		N3, N5, N6, N7, N8
PEK_K01÷PEK_K04	K1ZIP_K01, K1ZIP_K02, K1ZIP_K03, K1ZIP_K04, K1ZIP_K05	C4		N1÷N8
PEK_U	K1ZIP_U01, K1ZIP_U02	C1, C2		N2, N4, N6, N7, N8

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK HUMANISTYCZNY (Ochrona własności intelektualnej)**
Name in English: **Block of humanistic courses**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-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)	15				
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		15
		Total hours: 15

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
Block of humanistic courses
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W26	wg kart opracowanych przez SNH		wg kart opracowanych przez SNH

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK HUMANISTYCZNY (Podstawy filozofii i etyki w biznesie)**
Name in English: **Block of humanistic courses**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-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)	30				
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

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
Management and Manufacturing Engineering

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	K1ZIP_W24, K1ZIP_W25	wg kart opracowanych przez SNH		wg kart opracowanych przez SNH

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zintegrowane systemy zarządzania**
Name in English: **Integrated Management Systems**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **IPS**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
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					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of the principles of the use of database systems.
2. Basic knowledge of the operation of the business in terms of materials management.
3. The ability to acquire information from the product design documentation, eg. the structure of the product

SUBJECT OBJECTIVES

C1. The acquisition of basic skills using the capabilities of ERP systems.
C2. Getting the student basic knowledge about the mode of action of ERP systems.
C3. Introduction to the industry practice when using ERP systems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - The student is able to characterize the idea of integrated manufacturing systems.
PEK_W02 - The student is able to use the concepts of integrated management systems - the structure of product, the position of purchase, technological route and schedule.
PEK_W03 - Knowledge of the use of integrated production systems in industrial practice.

II. Relating to skills:
PEK_U01 - Ability to use integrated management system, for example IFS Application.
PEK_U02 - Ability to interpret reports, material requirements.
PEK_U03 - The ability to perform the technological structure of product.

III. Relating to social competences:
PEK_K01 - He raised its competence in the field of cooperation within the group.
PEK_K02 - It is aware of the importance of data quality in an integrated management system.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Preliminary information on IFS Application	1
Lec2	Overview of ERP systems available on the global market	2
Lec3	Summary of benefits for the enterprise implementation of ERP	2
Lec4	The Genesis of ERP	2
Lec5	Implementation of an integrated management system, part 1	2
Lec6	Implementation of an integrated management system, part 2	2
Lec7	The material requirements planning, the principle of action	2
Lec8	The essence of the approach OPT	2
		Total hours: 15

Form of classes – Project		Number of hours
Proj1	Preliminary information on the operation of IFS Applications.	2
Proj2	Defining the position of purchasing.	2
Proj3	Defining cost items. Sale.	2
Proj4	Entering stock items.	2
Proj5	Defining the structure of the product.	2
Proj6	Defining the position of products on individual production lines.	2
Proj7	Routes production.	2
Proj8	Entering item purchase.	2
Proj9	Generating schedule.	2
Proj10	Generating MRP report.	2
Proj11	Defining positions and purchase cost for the new designed product.	2
Proj12	Sales data and stock items for the new designed product.	2

Proj13	Defining the product structure and position of the product on individual production lines for the new designed product.	2
Proj14	Routes production and the introduction of item purchase for the new designed product.	2
Proj15	Entry of items in shopping for a new product designed and generating scheduling and MRP report.	2
		Total hours: 30

TEACHING TOOLS USED

N1. case study
N2. traditional lecture with the use of transparencies and slides
N3. problem 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_W02, PEK_W03	test
P =		

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_K02	Presentation and defense of the MRP report
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Zintegrowany system zarządzania przedsiębiorstwem IFS Applications, ćwiczenia z obsługi, wybrane moduły, praca zbiorowa/pod red. Leszka Kiełtyki, Politechnika Częstochowska

SECONDARY LITERATURE

SAP - zrozumieć system ERP / Jerzy Auksztol, Piotr Balwierz, Magdalena Chomuszko. Warszawa, Wydawnictwo Naukowe PWN, 2012.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Integrated Management Systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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 K1ZIP_W10, K1ZIP_W15		C1, C2, C3		N1, N3
PEK_U01, PEK_U02, PEK_U03, K1ZIP_U15, K1ZIP_U23		C2, C3		N2, N3
PEK_K01, PEK_K02 K1ZIP_K11		C3		N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Innowacje produktowe i technologiczne w przedsiębiorstwie**
Name in English: **Product and Technological Innovations in The Enterprise**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **IPS MMM006836**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				15
Number of hours of total student workload (CNPS)	30				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses					
Number of ECTS points	1				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

1. Basic knowledge in field of menagement in the enterprise
2. Basic knowledge in field of product commercialisation

SUBJECT OBJECTIVES

C1. Understanding of problems with implementation of product and technological innovations in the enterprise
C2. Understanding of innovations implementation and all-life learning necessity caused by progress in economy and science
C3. Understanding essence and principals of effective team work for creative searching for innovation based on own engineering knowledge

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has a knowledge about product and technological innovation area in the enterprise. Student knows and understands basic types of innovation, economical aspects of innovation implementation, models of innovation proces

PEK_W02 - Student understands necessity of innovations implementation and all-life learning caused by progress in economy and science

PEK_W03 - Student has basic knowledge about financing tools and models in the enterprise

II. Relating to skills:

PEK_U01 - Student knows and is able to implement basic metods of innowations evaluation in the enterprise

PEK_U02 - Student knows and is able to implement basic heuristic metods of innovations creation

PEK_U03 - Student is able to present multimedia presentation in field of innovations theoretical or practical problems

III. Relating to social competences:

PEK_K01 - Student is able to work as member of a group with understanding priorties in task development

PEK_K02 - Student understand necessity of all-life learning caused by progress in economy and science

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Theoretical base about product and technological innovation area in the enterprise, basic types of innovation, economical aspects of innovation implementation, models of innovation proces, sources of innovations, innovations creation	4
Lec2	Evaluation of innovations with risk analysis - case study	4
Lec3	Protection of the innovations in the enterprise	2
Lec4	Innovation financing models - case study	5
		Total hours: 15
Form of classes – Seminar		Number of hours
Sem1	Intorduction to the seminar, teams creation and case study choosing	2
Sem2	Case study discussion and consultations in groups and with a supervisor	8
Sem3	Results presentations	5
		Total hours: 15

TEACHING TOOLS USED

N1. multimedia presentation
N2. case study
N3. problem lecture
N4. problem 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_W02, PEK_Wo3	Test (closed and open questions)
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_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K_02	Activity and team work
F2	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K_02	Creativity evaluation
F3	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K_02	Evaluation of final presentation of the results
P = F1 x 0,2 + F2 x 0,6 + F2 x 0,2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Innowacyjność przedsiębiorstw. Pod red. nauk. Jerzego Bogdanienki. Wydawnictwo Uniwersytetu Mikołaja Kopernika. Toruń 2004.
2. Kelley T., Littman J. Sztuka Innowacji. Lekcja Kreatywności z IDEO, Czołowej Amerykańskiej Firmy Projektowej. MT Biznes, Warszawa 2009.
3. Krawiec F. Zarządzanie projektem innowacyjnym produktu i usługi. Difin. Warszawa 2001.
4. Levis K.. Twórcy i ofiary ery Internetu. MUSA SA, Warszawa 2010.
5. Zarządzanie innowacjami. System Zarządzania innowacjami. Praca zbiorowa pod red. Jerzego Łunarskiego. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2007.
6. Pomykalski A. Zarządzanie innowacjami. Wydawnictwo Naukowe PWN. Warszawa-Łódź 2001.
7. Zarządzanie kreatywnością i innowacją. Techniki twórczego myslenia.Harvard Business Essentials. Konstancin-Jeziorna, 2005.
8. Zarządzanie innowacjami technicznymi i organizacyjnymi. Red. Brzeziński M. Difin, Warszawa 2001.

SECONDARY LITERATURE

1. Crawford M., Di Benedetto A. New Product Management. Ninth Edition.McGraw-Hill/Irwin. 2008.
2. Sosnowska A. Łobejko S. Kłopotek A. Zarządzanie firmą innowacyjną. Difin. Warszawa 2001.
3. Świtalski Wł. Innowacje i konkurencyjność. Wydawnictwa Uniwersytetu Warszawskiego. Warszawa 2005.
4. Thomas R.J. Prawdziwe historie nowych produktów. Wydawnictwo Prószyński i S-ka S.A. Warszawa 2001.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Product and Technological Innovations in The Enterprise
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_K02, K1ZIP_K05, K1ZIP_K06, K1ZIP_K07, K1ZIP_K11	C1	Wy1	N1, N3
PEK_W02	K1ZIP_U14, K1ZIP_U15, K1ZIP_U16	C2	Wy2, Wy3, Wy4	N1, N3
PEK_W03	K1ZIP_K05, K1ZIP_U14, K1ZIP_U19	C3	Sem1, Sem2, Sem3	N2, N4
PEK_U01	K1ZIP_K01, K1ZIP_K02, K1ZIP_W23, K1ZIP_W25	C1, C2, C3	Sem1, Sem2, Sem3	N2, N4
PEK_U02	K1ZIP_K01, K1ZIP_K02, K1ZIP_K05	C1, C2, C3	Sem1, Sem2, Sem3	N2, N4
PEK_U03	K1ZIP_K01, K1ZIP_K02, K1ZIP_K03, K1ZIP_K04	C1, C2, C3	Sem1, Sem2, Sem3	N2, N4
PEK_K01	K1ZIP_K01, K1ZIP_K02, K1ZIP_K03, K1ZIP_K04	C3	Sem1, Sem2, Sem3	N2, N4

PEK_K02	K1ZIP_K01, K1ZIP_K02, K1ZIP_K03, K1ZIP_K04	C3	Sem1, Sem2, Sem3	N2, N4, N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK JĘZYKI OBCE**
Name in English: **Block of Foreign languages**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **JZL100655BK.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		120			
Number of hours of total student workload (CNPS)		150			
Form of crediting					
Group of courses					
Number of ECTS points		5			
including number of ECTS points for practical (P) classes		5			
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 – Classes		Number of hours
Cl1		120

	Total hours: 120

TEACHING TOOLS USED

N1.

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	wg kart przygotowanych przez SJO	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of Foreign languages
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_U13, K1ZIP_U28, K1ZIP_U29, K1ZIP_U31	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO
PEK_K01	K1ZIP_K01	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO

SUBJECT SUPERVISOR

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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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **MAT001405**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15			
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

1. It is recommended that the knowledge of mathematics is equivalent to high school certificate at the basic level.

SUBJECT OBJECTIVES

C1. Exposition of basic theorems and algorithms concerning the theory of linear equations.
C2. Exposition of basic notions concerning matrix calculus, eigenvalues and eigenvectors of matrices.
C3. Exposition of rudiments of the theory of complex numbers, polynomial and rational functions.
C4. Exposition of rudiments of analytic geometry in R3.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - PEK_W01 knows basic methods of solving systems of linear equations,
PEK_W02 knows basic properties of complex numbers,
PEK_W03 knows basic algebraic properties of polynomials,
PEK_W04 knows characterizations of lines, planes and conic sections,
PEK_W05 knows definitions of eigenvalues and eigenvectors of matrices

II. Relating to skills:

PEK_U01 - PEK_U01 can add and multiply matrices and calculate determinants,
PEK_U02 can solve systems of linear equations,
PEK_U03 can carry out calculations with use of complex numbers,
PEK_U04 can find line and plane equations in the space R3.

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Mathematical induction. Newton’s binomial formula.	1
Lec2	The notion of a matrix. Operations on matrices. Transposition. Examples of matrices (triangular, symmetric, diagonal etc.).	2
Lec3	The determinant of a matrix. The Laplace expansion. Cofactor of an element of a matrix. Minors. Properties of determinants. Calculation of determinants by elementary row and column operations. Cauchy’s theorem. Nonsingular matrix.	3
Lec4	Inverse matrix. Computation of inverse matrix by cofactors or by elementary row operations. Properties of inverse matrices. Matrix equations. Rank of a matrix. Applications of determinants, their connections with rank and invertibility.	2
Lec5	Systems of linear equations. Rouché–Capelli theorem. Cramer’s formulas. Gaussian elimination. Solving arbitrary systems of linear equations.	3
Lec6	Complex numbers. Operations on complex numbers in algebraic form. Complex conjugate. Modulus. Argument.	2
Lec7	Geometric interpretation of a complex number. Polar form of a complex number. De Moivre’s formula. Roots of complex numbers.	2
Lec8	Polynomials. Polynomial remainder theorem. Fundamental theorem of algebra. Roots of polynomials with real coefficients.	2
Lec9	Linear and quadratic factors of a real polynomial. Decomposition of a polynomial into factors. Rational functions. Real partial fractions with irreducible denominators. Partial fraction decomposition of a real rational function.	2
Lec10	Analytic geometry in the space R3. Operations on vectors. Length of a vector. Scalar product, cross product and triple product of vectors - computing area and volume.	2
Lec11	Planes. Normal to a plane. Equations of a plane. Relative location of planes.	1

Lec12	Line in the space. Equations of a line (parametric, directional). Line as an intersection of planes. Relative location of two lines. Relative location of a line and a plane. Orthogonal projection of a point onto a line or a plane.	3
Lec13	Conic sections. Circle. Ellipse. Hyperbola. Parabola	2
Lec14	Applications of linear algebra. Eigenvalues and eigenvectors of a matrix.	3
		Total hours: 30
Form of classes – Classes		Number of hours
Cl1	Transformation of algebraic expressions. Newton’s binomial formula. Operations on matrices.	1
Cl2	Calculation of matrix determinants with use of their properties. Laplace expansion. Computation of an inverse matrix. Solving matrix equations. Cramer’s formulas. Gaussian elimination. Solving of arbitrary systems of linear equations. Rozwiązywanie równań macierzowych.	3
Cl3	Operations on complex numbers in algebraic form. Polar form. Geometric interpretation. Powers and roots of complex numbers. Solving simple equations and inequalities.	4
Cl4	Finding roots of polynomials. Decomposition of a polynomial into irreducible components. Partial fraction decomposition of a real rational function.	2
Cl5	Vector operations. Scalar, cross or triple product of vectors and their applications to calculating area and volume. Solving problems in analytic geometry in R3 – finding equations of lines and planes, finding projections of vectors etc.	4
Cl6	Test.	1
		Total hours: 15

TEACHING TOOLS USED

N1. Lecture - traditional method.
N2. Classes - traditional method (problems sessions and discussion).
N3. Student’s self-study with the assistance of mathematical packages.
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_W05	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_U04	oral presentations, quizzes, tests
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2015.
[2] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Definicje, twierdzenia, wzory. Oficyna Wydawnicza GiS, Wrocław 2014.
[3] P. Kajetanowicz, J. Wierzejewski, Algebra z geometrią analityczną, PWN 2008.
[4] M. Zakrzewski, Markowe wykłady z matematyki, Algebra z geometrią, Oficyna Wyd. GiS, Wrocław 2015.

SECONDARY LITERATURE

[1] B. Gleichgewicht, Algebra, Oficyna Wydawnicza GiS, Wrocław 2004.
[2] A. Mostowski, M. Stark, Elementy algebry wyższej, PWN, Warszawa 1963.
[3] W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, Cz. A, PWN, Warszawa 2003.
[4] F. Leja, Geometria analityczna, PWN, Warszawa 1972.
[5] E. Kącki, D. Sadowska, L. Siewierski, Geometria analityczna w zadaniach, PWN, Warszawa 1993.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Algebra and Analytic Geometry
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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_W05	K1ZIP_W01	C1 - C4	Lec1-Lec14	N1, N4
PEK_U01 - PEK_U04	K1ZIP_U01	C1 - C4	Cl1-C15	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Analiza matematyczna I**
Name in English: **Mathematical Analysis I**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **university-wide**
Subject code: **MAT001644**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	30			
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					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It is recommended that the knowledge of mathematics is equivalent to high school certificate at the advanced level.

SUBJECT OBJECTIVES

C1. Exposition of basic elementary functions and their properties.
C2. Exposition of basic notions and theorems of differential calculus of functions of a single variable.
C3. Introduction of the concept of the definite integral, its basic properties and methods of calculation.
C4. Presentation of practical applications of methods of differential and integral calculus of functions of a single variable.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - knows the graphs and properties of basic elementary functions,
PEK_W02 - knows basic notions and theorems of differential calculus of functions of a single variable,
PEK_W03 - knows the concept of the definite integral, its properties and the basic applications.

II. Relating to skills:

PEK_U01 - can solve typical equations and inequalities with elementary functions,
PEK_U02 - can examine a function and draw its graph,
PEK_U03 - PEK_U3 can evaluate typical indefinite integrals and calculate definite integrals,
PEK_U4 can apply differential and integral calculus to solve practical problems.

III. Relating to social competences:

PEK_K01 - understands the need for systematic and independent work on mastery of course material.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Definition of a function. Basic examples: linear, quadratic and polynomial functions. Rational functions. Composition of functions. Transformations of graphs of functions.	3
Lec2	Injective functions. The inverse function and its graph. Power and exponential functions and their inverses. Properties of logarithms.	2
Lec3	Trigonometric functions. Unit (trigonometric) circle. Inverse trigonometric functions.	2
Lec4	Sequences of real numbers. Finite and infinite limit of a sequence. Basic theorems on limits of sequences. Indeterminate expressions. The number e.	3
Lec5	The limit of a function at a point and the limit at infinity. Examples of the limits of certain indeterminate expressions. Asymptotes.	2
Lec6	Continuity of a function at a point and on an interval. Basic properties of continuous functions. Approximate solutions of equations.	2
Lec7	The derivative of a function. Geometrical and physical interpretations of the derivative. Tangent line. Differential of a function. Derivatives of basic elementary functions. Differentiation rules.	2
Lec8	Lagrange’s theorem. Intervals of monotonicity of a function. De l’Hospital’s rule.	2
Lec9	Local and global extrema. Examples of optimization problems.	2
Lec10	Definition and basic properties of indefinite integral. Basic rules. The substitution rule and integration by parts.	2
Lec11	Definition and basic properties of definite integral. Fundamental theorem of calculus (Newton-Leibniz theorem).	2
Lec12	Applications of integral calculus (e.g. average value of a function, area of a flat region, volumes of solids of revolution, arc length etc.)	2
Lec13	Integration of rational and trigonometric functions.	2

Lec14	Examples of applications of methods of mathematical analysis of a single variable (e.g. Taylor's theorem , convexity and inflection points of a function or other applications typical for the field of study).	2
		Total hours: 30
Form of classes – Classes		Number of hours
Cl1	Elements of mathematical logic (logical connectives, quantifiers). Determination of the domain of a function. Even and odd functions.	2
Cl2	Composition of functions. Transformations of graphs of functions. Polynomial and rational equations and inequalities.	2
Cl3	The inverse function. Typical equations and inequalities with exponential and logarithmic functions.	2
Cl4	Trigonometric and inverse trigonometric functions. Unit (trigonometric) circle. Typical trigonometric equations and inequalities.	2
Cl5	Monotonicity and boundedness of sequences. Computing proper and improper limits of sequences.	2
Cl6	Limits of functions. Asymptotes.	2
Cl7	Continuity of a function. Approximate solutions of equations.	2
Cl8	Derivative of a function. Rules of differentiation. Tangent line. Differentials and their applications.	2
Cl9	De l'Hospital's rule. Intervals of monotonicity of a function.	2
Cl10	Determining local and global extrema of a function.	2
Cl11	Evaluation of indefinite integrals of elementary functions. Integration by parts and by substitution.	2
Cl12	Calculating definite integrals. Area of a flat region as an application of definite integral.	2
Cl13	Applications of definite integral.	2
Cl14	Integration of rational and trigonometric functions.	2
Cl15	Test.	2
		Total hours: 30

TEACHING TOOLS USED

N1. Lecture - traditional method.
N2. Classes - traditional method (problems sessions and discussion).
N3. Student's self-study with the assistance of mathematical packages.
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	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_U03, PEK_K01	tests, oral presentations, quizzes
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1]G. Decewicz, W. Żakowski, Matematyka, Cz.1, WNT, Warszawa 2007.
[2]M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS, Wrocław 2015.
[3]M. Gewert, Z. Skoczylas, Analiza matematyczna 1. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2015.
[4]W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, Cz. I, PWN, Warszawa 2006.

SECONDARY LITERATURE

[1]F. Leja, Rachunek różniczkowy i całkowy, PWN, 2012.
[2]R. Leitner, Zarys matematyki wyższej dla studiów technicznych, cz.1-2, WNT, Warszawa 2006.
[3]M. Zakrzewski, Markowe wykłady z matematyki. Analiza, Oficyna Wydawnicza GiS, Wrocław 2013.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mathematical Analysis I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W01	C1-C4		N1-N4

PEK_U01- PEK_U04	K1ZIP_U01	C1-C4		N1-N4
PEK_K01	K1ZIP_K04	C1-C4		N1-N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Prawo gospodarcze**
Name in English: **Business Law**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **PRZ000337**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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. The student has a basic knowledge of the country and the making of law

SUBJECT OBJECTIVES

C1. Informing students about basic organizational and legal forms of enterprises
C2. Informing students about the requirements to start a business
C3. Informing students about basic consumer rights

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - He recognizes and understands basic terms, economic rules and phenomena as well as their effects in market economy, he knows conditions and principles of making optimal decisions by market entities (producers and consumers), he has knowledge about markets and production factors.

PEK_W02 - He has basic knowledge about economy law and running business, he knows legal regulations concerning establishing enterprises in Poland and their functioning, he knows issues of trade relations, he knows and understands basic terms of industrial property protection and author's law.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the course. Conditions of the course. The concept of law and the rule of law. Construction of a legal norm. The system of law. Business Law with other branches of the law. Solving practical examples. Sources of law.	2
Lec2	Presentation of the most important legal concepts related to the business activity (entrepreneur, natural or legal, economic activity). Sources of law related to the economic activity.	2
Lec3	Starting a business in Poland by individuals. Starting a business in the form of companies (place of business start). Starting a business in selected countries of the European Union. Doing business on the Internet.	4
Lec4	Insolvency and Restructuring - procedure	6
Lec5	Product liability - complaints of goods and services. New law on consumer rights part 1.	6
Lec6	Product liability - safety and health of consumer	4
Lec7	Product liability - Internet sales. New law on consumer rights part 2.	4
Lec8	Final test	2
		Total hours: 30
Form of classes – Seminar		Number of hours
Sem1	Introductory classes	1
Sem2	Presentation of the main bodies involved in the creation and exaction of economic law	2
Sem3	The most common contracts related to the business activity (sales, leasing, insurance)	2
Sem4	The most common contracts related to the business activity (leasing, transportation, errand)	2
Sem5	Najczęstsze umowy związane z prowadzoną działalnością gospodarczą (agencja, komis, franchising, faktoring)	2

Sem6	Basic organizational and legal forms of business (partnerships and equity)	4
Sem7	Completion of the course - Final test	2
		Total hours: 15

TEACHING TOOLS USED
N1. multimedia presentation N2. traditional lecture with the use of transparencies and slides N3. 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_W02	final test
P = F1+F2+F3		

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_K01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	the participation in discussions of problem, the defense of the project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Zymonik K., Product liability in the management of the innovative enterprise, Wydawnictwo Difin, Warszawa.
2. Nowińska E., Cybula P. (red), European consumer law and the polish law, Wydawnictwo Zakamycze.
3. Bogaczyk I., Krupski B., Lubińska H., Starting a business. Setting up and running a business, Wydawnictwo Forum.
4. Jeleńska A., Corporations, Wszechnica podatkowa, Kraków.
5. Jacyszyn J. (red), Commercial companies in questions and answers, LexisNexis.

SECONDARY LITERATURE

1.Koch A., Napierała J.,Agreement in trade, Wolters Kluwer Polska – LEX, 2011.
2.Gospodarek J., Agreement in trade, Szkoła Główna Handlowa, Warszawa 2010.
3.Zymonik K., Guarantee of producer, Problemy jakości nr 2/2008, s.30-34

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Business Law
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W13, K1ZIP_W26	C3	Lec1, Lec5, Lec6, Lec7	N1, N2, N3
PEK_W02	K1ZIP_W22, K1ZIP_W26	C1, C2	Lec1, Lec2, Lec3, Lec4	N1, N2, 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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **WFW000000BK.**
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
Management and Manufacturing Engineering

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_K01	K1ZIP_K11, xxxK1ZIP_K12xx	wg kart opracowanych przez SWFiS		wg kart opracowanych przez SWFiS

SUBJECT SUPERVISOR

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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **XXX**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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. 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, literature, what everyone can do to protect the environment.	2
Lec2	The sources of hazards arising from industrial activity and from the operation of machines, ecotoxins, the greenhouse effect, energy acquisition.	2
Lec3	The sources of hazards arising from industrial activity and from the operation of machines, ecotoxins, the greenhouse effect, energy acquisition.	2
Lec4	Environmental management, environmental management systems.	2
Lec5	Environmental management issues and the current standards: BS, EMAS, ISO 14000 and other.	2
Lec6	Environment-friendly methods and consequences of acquiring energy from conventional sources, hazards, trends.	2
Lec7	Environment-friendly methods of acquiring energy from renewable sources.	2
Lec8	Waste minimization, recycling, rational and eco-friendly methods of managing wastes; examples of recycling in selected branches of industry.	2
Lec9	Examples of recycling in selected branches of industry, recycling in the automotive industry.	2
Lec10	Waste management, waste sources, waste processing, energy recovery, safe storage, waste management monitoring.	2
Lec11	Environment-friendly materials in machine operation – oils, lubricants, greases.	2
Lec12	Biodegradability, toxicity, carcinogenicity and mutagenicity of consumable materials; polychlorinated biphenyls.	2
Lec13	New environment-friendly techniques in machine operation; sparing lubrication techniques, lubrication management in industry; seals and their effectiveness; the energy aspects of machine operation.	2
Lec14	The environmental aspects of the construction, use and modernization of machines.	2
Lec15	Final test	2
		Total hours: 30

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_W02, PEK_W03	Written final test, oral test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Ecology in industrial manufacturing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W20	C1, C2, C3	Wy1 - Wy14	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Projektowanie baz danych**
Name in English: **Database design**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **XXX**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			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 modeling - algorithms, processes
2. Basic knowledge of computer systems

SUBJECT OBJECTIVES

C1. The aim of the course is to get to know with the process database development
C2. correct identification and modeling needs of future RDBMS users
C3. transfer of the basic knowledge required to use the SQL queries language

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Has a basic knowledge of database design process
PEK_W02 - Has a knowledge of modeling and recognizing the needs of users.
PEK_W03 - Has a knowledge of relational database management systems

II. Relating to skills:

PEK_U01 - Can design a database and use SQL to communicate with databases
PEK_U02 - Can properly identify and model the needs of future users of the database
PEK_U03 - Able to use the relational database management system

III. Relating to social competences:

PEK_K01 - Think and act in a logical manner
PEK_K02 - Can draw logical conclusions and solve the stated problem in orderly manner.
PEK_K03 - Can appropriately define the priorities for implementation tasks specified by you or others.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The theory of databases - introduction	2
Lec2	Development of databases - data types	2
Lec3	The principle of operation of relational databases	2
Lec4	The theoretical basis of database design .	2
Lec5	Designing conceptual, logical and physical database structures	2
Lec6	Database normalization	2
Lec7	Getting to know the language (SQL commands: SELECT, INSERT, UPDATE, DELETE and administrative commands, definition of: tables, indexes, views, etc.). Test.	3
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Practical basics of database design .	2
Proj2	Designing conceptual, logical and physical database structures - practice	4
Proj3	Getting to know the basics of database administration (setting up a database, user administration, granting rights to objects in the database, backup, replication, etc.).	4
Proj4	Getting to know the language (SQL command SELECT, INSERT, UPDATE, DELETE and administrative commands, define tables, indexes, views, etc.). - Practice.	4
Proj5	Database design to meet defined criteria.	12
Proj6	Project testing	4
		Total hours: 30

TEACHING TOOLS USED

N1. problem discussion
N2. tutorials
N3. self study - preparation for project class
N4. project presentation
N5. 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	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 PEK_K01, PEK_K02, PEK_K03	project defense
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
Relacyjne bazy danych Autorzy: Mark Whitehorn, Bill Marklyn Data wydania: 2003/08
Bazy danych SQL. Teoria i praktyka Autor: Wiesław Dudek Data wydania: 2006/11

SECONDARY LITERATURE
SQL. Rusz głową! Autor: Lynn Beighley Data wydania: 2010/11

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Database design
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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;	K1ZIP_W10	C1, C2, C3	Wy1 - Wy7	N5, N2
PEK_U01- PEK_U03	K1ZIP_U10	C1, C2, C3	Pr1 - Pr6	N1, N2, N3, N4
PEK_K01- PEK_K03	K1ZIP_K04	C2	Pr1 - Pr6	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Proseminarium dyplomowe**
Name in English: **Diploma proseminar**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **XXX**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					15
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					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has the knowledge covered by the curriculum of the first level studies.

SUBJECT OBJECTIVES

C1. The students are to acquire skills in presenting the content of the diploma thesis and defending its theses.
C2. Preparation of the students for the diploma examination.
C3. Motivation of the students to do the diploma thesis on time.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - The student can prepare answers to the diploma examination problems and intelligently answer the questions asked.

PEK_U02 - The student can prepare a lucid presentation and discuss the progress in carrying out the diploma thesis.

PEK_U03 - The student can easily discuss topics relating to the main field of study.

III. Relating to social competences:

PEK_K01 - The student understands the need for lifelong learning within the range and improving her/his professional and social competences.

PEK_K02 - The student understands the need for critical discussion of the results of engineering work done as part of team.

PEK_K03 - The student is aware of the responsibility for her/his own work and its effect on the functioning of the enterprise.

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1	The discussion of the realization mode of proseminar, the assignment of diploma examination issues to which answers are to be prepared, the determination of the order in which the diploma thesis are to be presented.	1
Sem2	The discussion the rules for writing diploma thesis and anti-plagiarism actions.	2
Sem3	The discussion, by the students, of the diploma examination issues selected from group A.	2
Sem4	The discussion, by the students, of the diploma examination issues selected from group B.	2
Sem5	The discussion, by the students, of the diploma examination issues selected from group C.	2
Sem6	Reporting on the current progress of the diploma thesis and a discussion. Part 1.	2
Sem7	Reporting on the current progress of the diploma thesis and a discussion. Part 2.	2
Sem8	Reporting on the current progress of the diploma thesis and a discussion. Part 3.	2
		Total hours: 15

TEACHING TOOLS USED

N1. self study - self studies and preparation for examination
N2. self study - preparation for project class
N3. multimedia presentation
N4. problem discussion

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_K01 - PEK_K03	grading the prepared answers to the diploma examination questions
F2	PEK_U02 - PEK_U03, PEK_K01 - PEK_K03	grading the presentation and the ability to discuss
P = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Wiszniewski A.: Sztuka pisania. Videograf II, Katowice 2003
2. Wiszniewski A.: Sztuka mówienia. Videograf II, Katowice 2003
3.Internal Decree of the Rector No. 75/2015 of 2 October 2015. on the verification of the undergraduate, engineering and masters thesis by The University Anti-plagiarism System.

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Diploma proseminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_U24, K1ZIP_U25, K1ZIP_U26	C1-C3	S1-S8	N1-N4
PEK_K01-PEK_K03	K1ZIP_K01, K1ZIP_K05	C1-C3	S1-S8	N1-N4

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Analiza matematyczna**
Name in English: **Mathematical Analysis**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **university-wide**
Subject code: **XXX**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	45	30			
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		3
Lec2		2
Lec3		4
Lec4		2
Lec5		2
Lec6		3
Lec7		4
Lec8		3
Lec9		3
Lec10		3
Lec11		3
Lec12		2
Lec13		4
Lec14		2
Lec15		3
Lec16		2
		Total hours: 45
Form of classes – Classes		Number of hours
Cl1		8
Cl2		3
Cl3		2
Cl4		2
Cl5		3
Cl6		2
Cl7		4
Cl8		4
Cl9		2
		Total hours: 30

TEACHING TOOLS USED

N1.
N2.
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		

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	
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
Management and Manufacturing Engineering

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	K1ZIP_W01	C1, C4		N1, N3, N4
PEK_W02	K1ZIP_W01	C2, C4		N1, N3, N4

PEK_W03	K1ZIP_W01	C3, C4		N1, N3, N4
PEK_U01	K1ZIP_U01	C1, C4		N2, N3, N4
PEK_U02	K1ZIP_U01	C2, C4		N2, N3, N4
PEK_U03	K1ZIP_U01	C2, C4		N2, N3, N4
PEK_U04	K1ZIP_U01	C3, C4		N2, N3, N4
PEK_K01-K02	K1ZIP_K11	C1-C4		N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy elektrotechniki i elektroniki**
Name in English: **Fundamentals of Electrical Engineering and Electronics**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **XXX**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
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 the knowledge, skills and competence based on the Physics courses.

SUBJECT OBJECTIVES

C1. Comprehension of the issues related to the mathematical description and physical interpretation of the phenomena accompanying the production and usage of electric fields, magnetic and electromagnetic fields.
C2. Understanding the physical phenomena occurring in materials (including in semiconductors).
C3. Introduction to the analysis of DC and AC linear and nonlinear circuits, using basic electrical engineering concepts and laws (Ohm's law, I and II Kirchhoff law).
C4. Understanding the construction's principles and applications of selected electronic components, semiconductor devices and integrated circuits (analog and digital).
C5. Acquiring the ability to choose and measure the active and passive components used in electronic applications and ability to characterize their properties/parameters.

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.

II. Relating to skills:

PEK_U01 - The student has the ability to choice the materials, components and equipment's construction according to the technical requirements and operating conditions.

PEK_U02 - The student can operate the measuring equipment and can assemble measurement systems.

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The basic phenomena and laws of electrical engineering: electrification, electric charge, electric field, electric potential, voltage, source voltage: constant, variable, electric current, electric power, electrical circuits, linear, nonlinear, classical method of solving electrical circuits, magnetic fields, electric current: DC, AC, production and properties of alternating current.	2
Lec2	Signals applied in electronics: analog and digital (description of the fundamentals of the signals).	2
Lec3	Physical principles of semiconductor electronic components.	2
Lec4	P-N junction: the mechanism of the formation of the junction, the direct current I-V characteristics of the diode.	2
Lec5	Bipolar transistors: design, operation principles, configurations, static characteristics, small-signal parameters.	2
Lec6	Unipolar transistor: Field Effect Transistor, Junction Transistor - PNFET: the principle of operation, I-V characteristics, parameters.	2
Lec7	Digital Circuits: Basic logic functions, parameters. Logic gates of TTL and CMOS family: construction and parameters.	2
Lec8	Final test.	1
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1	Introduction. Basic methods and measuring instruments. Description of the electronic components properties. Passive Components.	3
Lab2	I-V characteristics of the p-n junction (diode: universal, stabilization, rectifier, LED).	3
Lab3	Static characteristics of the bipolar transistor.	3
Lab4	The measurements of unipolar transistors: JFET and MOSFET transistors.	3

Lab5	The measurements of digital circuits: TTL and CMOS.	3
		Total hours: 15

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_W02	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

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Electrical Engineering and Electronics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W09	C1 - C4	Lec1 - Lec8	N1 - N3
PEK_U01, PEK_U02	K1ZIP_U09	C4, C5	Lab1 - Lab5	N3 - N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie projektami**
Name in English: **Project management**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **XXX**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			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

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		4
		Total hours: 30
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		3
		Total hours: 15

TEACHING TOOLS USED

N1. informative lecture
N2. problem lecture
N3. self study - preparation for project class
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	colloquium
P = F1+F2		

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, PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Project management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W14	C1, C2		N1, N2
PEK_U01, PEK_U02	K1ZIP_U14	C2, C3		N2, N3
PEK_K01, PEK_K01	K1ZIP_K04, K1ZIP_K05	C4, C5		N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Logistyka produkcji**
Name in English: **Logistic of Production**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZMZ000391**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
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

SUBJECT OBJECTIVES

C1. To acquaint students with the most important concepts of logistics
C2. Acquaintance with the genesis and causes of dynamic development of Logistics
C3. Acquainted with system integration and the role of Logistics
C4. Outline the place of logistics both in the enterprise and throughout the supply chain

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knows and can describe basic logistics issues
PEK_W02 - Is able to identify basic aspects of customer service
PEK_W03 - can characterize the logistics system of an enterprise

II. Relating to skills:
PEK_U01 - is able to select well the literary issues to develop the topic
PEK_U02 - can use the literature to formulate descriptions and on the basis of them formulate substantive conclusions
PEK_U03 - can work in a design team relating to social competences

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	1. The origin of logistics, the definition of logistics taking into account its integration and systemic role 2. Discussion of changes in the environment in terms of: • Globalization of the economy and competition • Exponential development of technology, information and knowledge • Market changes caused by the evolution of needs and changes in legislation	1
Lec2	3. New business challenges resulting from changes in the environment 4. Traditional logistics functions 5. New challenges for logistics that take account of changes in the environment and allow for a competitive advantage: • New strategies: ECR, CRM • Out of production • Increased product availability: supply chain concept, logistics networks	2
Lec3	6. New logistics functions: logistic geographic, sectoral, functional and system integration 7. The impact of logistics on ROI and balance sheet items2	2
Lec4	8. Factors determining the importance of enterprise logistics, hypotheses on the importance of customer service, supply and logistics costs 9. The position of logistics in the enterprise depending on the industry and the type of physical stream	2
Lec5	10. Logistics in the company strategy, strategies of organization of production and distribution: • Customized and advance strategy • Mixed strategy • Strategy for rationalizing production and distribution • Strategy of distribution specialization • Logistic consolidation strategy • Logistic deferral strategy 11. Customer service as one of the most important elements of the marketing mix 12. Basic requirements for the management system Customer Service	2

Lec6	13. Time intervals Customer Service. 14. Transactional, procedural logic to build the right value Customer Service. 15. Characteristics of subsequent stages of Service ofCustomer Service construction	2
Lec7	16. Customer service, and customer retention, buyer value concept Include integration and system logistics requirements in logistics cost calculation 18. Difficulties and problems in calculating logistic costs 19. Principles of determining logistic costs	2
Lec8	20. Methods of calculating logistic costs: • ABC analysis • Link costs to the distribution mission • Customer profitability analysis, attributed costs, profitability calculation, customer margin calculation • Customer profitability matrix, resulting in customer strategies • Direct profitability of the product (DPP) 21. Total distribution costs (TDC) 22. Customer Service Level, the concept of cyclical and buffer stocks, inventory costs	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Selection and design of the product	4
Proj2	Selection and design of the production process	4
Proj3	Design of the spatial structure of the logistic system.	4
Proj4	Selection of suppliers, cost-effectiveness analysis.	2
Proj5	Pass the course	1
		Total hours: 15

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. project presentation
N3. tutorials
N4. traditional lecture with the use of transparencies and slides
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_W02, PEK_W03	test
P = 1		

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 credit
P = 1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Abt S., Systemy logistyczne, Wydawnictwo AE w Poznaniu, Poznań 2001.
2. Bozarth C.C., Handfield R.B., Wprowadzenie do zarządzania operacjami i łańcuchem dostaw: kompletny podręcznik logistyki i zarządzania dostawami, Helion, Gliwice 2007.
3. Coyle J.J., Bardi E.J., Langley Jr C.J., Zarządzanie logistyczne, PWE, Warszawa 2002.
4. Kasperek M., Planowanie i organizacja projektów logistycznych, Wydawnictwo AE w Katowicach, Katowice 2006.
5. Phohl H-Ch., Systemy logistyczne. Podstawy organizacji i zarządzania, Biblioteka ILiM , Poznań 1998.
6. Simchi-Levi D., Kaminsky P., Simchi-Levi E., Designing and Managing the Supply Chain. Concepts, Strategies and Case Studies, The McGraw-Hill Companies, Inc. 2000.
7. Waters D., Zarządzanie operacyjne. Towary i usługi, PWN, Warszawa 2001

SECONDARY LITERATURE

1. Ciesielski M. (red.), Logistyka we współczesnym zarządzaniu, Wydawnictwo AE w Poznaniu, Poznań 2003.
2. Ciesielski M. (red.), Sieci logistyczne, Wydawnictwo AE w Poznaniu, Poznań 2002.
3. Gołembska E. (red.), Kompendium wiedzy o logistyce, Wydawnictwo Naukowe PWN, Warszawa 2001.
4. Heizer J., Render B., Production and Operations Management. Strategies and Tactics, Allyn and Bacon, a division of Simon & Schuster Inc. 1993.
5. Logistics: The strategic issues, Edited by M. Christopher, Chapman & Hall 1992.
6. Harrison A., van Hoek R., Logistics Management and Strategy, FT Prentice Hall, Pearson Educatio Limited 2005.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Logistic of Production
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W17	C1, C2, C3, C4	Lec1 - Lec8	N4

PEK_U01, PEK_U02, PEK_U03	K1ZIP_U17, K1ZIP_U24, K1ZIP_U25	C1, C2, C3, C4	Pr1 - Pr5	N1, N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Logistyka systemów produkcyjnych**
Name in English: **Logistics of Production Systems**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZMZ001494.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	Crediting with grade
Group of courses					
Number of ECTS points	1			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

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		1
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		4
Proj2		4
Proj3		4
Proj4		2
Proj5		1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. tutorials
N3. self study - preparation for project class
N4. report preparation
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	
P = 1		

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	
P = 1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Logistics of Production Systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W17	C1, C2, C3, C4		N4
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U17, K1ZIP_U24, K1ZIP_U25	C1, C2, C3, C4		N1, N2, N3, N5

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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM000000.**
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

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_U21, K1ZIP_U27	C1, C2, C3		
PEK_K	K1ZIP_K01, K1ZIP_K03, K1ZIP_K04	C2, C3		

SUBJECT SUPERVISOR

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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031001**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15	30			
Number of hours of total student workload (CNPS)	30	60			
Form of crediting	Crediting with grade	Crediting with grade			
Group of courses					
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 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 (engineering drawing).
C2. Knowledge in the field of the geometric structures restitution based on Monge's projections.
C3. Preparation for the design recording (engineering drawing) application.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

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

PEK_W02 - Student can indicate an appropriate solution algorithm of mapping of the position and the relationship of the geometric formations in the space, as well as identifying the measures relationship.

PEK_W03 - Student can interpret the drawing, made by the Monge's method, showing localization of the element or geometric structure in the space.

II. Relating to skills:

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

PEK_U02 - Student can set the size of the dimensions characterized measuring tasks of geometry.

PEK_U03 - Student can provide restitution of the geometric structure on the basis of Monge's projection and submit the result by axonometric projection.

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic definitions and principles of the parallel, rectangular projection by Monge's projection, the mapping of basic geometric elements (points, line, plane).	2
Lec2	Common elements - edges and breakdown points; parallel and perpendicular elements.	2
Lec3	Transformation of the position (rotation, revolved section, increasing of the revolved section) and the reference system transformation (additional projection plane).	2
Lec4	Solids - definitions; solid section as a set of common elements of the solid cutting plane, solid's breakdown points by a straight line.	2
Lec5	Cutting of the solids with projecting planes set - a modification of the initial solid's view, developed views.	2
Lec6	Penetration of the solids - transmission lines definition, the use of auxiliary cutting planes and reference system transformation.	2
Lec7	Projection in the three orthogonal planes; axonometry basis; completion of the missing solid projection - use of the axonometric projection.	2
Lec8	Final test.	1
		Total hours: 15
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 straight line, the mapping of a plane using her traces, identification of the basic elements localization in space using two orthogonal projection planes.	2

Cl2	Belonging of the basic geometric elements, completion of the missing projection; particular localization of the geometric elements.	2
Cl3	Edge as common element of two planes. Breakdown point as common element of straight line and plane. Particular cases of a common elements.	2
Cl4	Edge between flat figures (auxiliary projection planes application); breakdown point of the flat figure by straight line. Identification and construction of the parallel and orthogonal relationship between basic geometrical elements.	2
Cl5	Rotation and revolved section of the basic geometrical elements (rotation of a line's segment and plane); application of the localization transformation for measuring tasks (determination of the real size of a line's segment, angle, flat figure).	2
Cl6	Determination of the projections of plane geometrical structures with selected parameters and the desired position in space (increasing of revolved section of a plane figure). Application of the reference system transformation in measuring tasks and identification of the position (angle relative to the projecting plane, distance of the point from the plane, setting the points projections at a set distance from the plane).	2
Cl7	Test K1 (includes classes's 1 - 6 material)	2
Cl8	The mapping of the elementary solids using Monge's projection, points and lin's segments belonging to the solid's walls identification; determination of the cross sections of polyhedra with projection planes.	2
Cl9	Determination of the polyhedra cross sections cutted by arbitrary planes. Determination of the cross section of the solids with surfaces. Solid's breakdown points by lines (use of auxiliary cutting planes containing penetrating straight line) determination.	2
Cl10	Developed view of a polyhedron and solid containing ruled surface. Cutting of the solid with projection planes as a modification of the initial form of solid - cutting of the polyhedron.	2
Cl11	Cutting of a solid of revolution. Polyhedra transmission lines determination.	2
Cl12	Solids (containing surfaces) transmission lines determination.	2
Cl13	Solid mapping onto three orthogonal projection planes. Solid modyfying using projection plane.	2
Cl14	Solid mapping using axonometric projection. Determination of the missing solid projection modified by cutting planes. Relationship between Monge's projection and axonometric projection.	2
Cl15	Test K2 (includes classes's 8 - 14 material)	1
		Total hours: 29

TEACHING TOOLS USED

N1. problem lecture
N2. problem exercises
N3. tutorials
N4. self study - preparation for project 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_W02, PEK_W03	Final teat
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	test no. 1, good rating is nedeed (min. 3.0)
F2	PEK_U01, PEK_U02, PEK_U03	test no. 2, good rating is nedeed (min. 3.0)
P = [(F1+F2)/2]*4/5+F3*1/5		

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
Management and Manufacturing Engineering

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	K1ZIP_W04	C1, C2, C3		N1, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U04	C1, C2, C3		N2. 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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031007**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
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 basic knowledge of matematic, chemistry and physics of solids. Ability of transpositon of equations into graphs and their interpretation.

SUBJECT OBJECTIVES

C1. Students' familiarization with criteria of engineering materials types and kinds of such materials.
C2. Acknowledgements with state, properties and applications of metallic materials, polymers, ceramics and composites.
C3. Learning of interpretation and usage of equilibrium phase graphs in planning of properties of engineering materials.
C4. Ability of usage of system analysis to solving materials-related problems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knows groups of engineering materials and criteria of their clasiffication.

PEK_W02 - Can specify the basis properties and fields of usage and kinds of polymers, composites, ceramics and non-iron alloyed metals.

PEK_W03 - Knows types of iron alloys, can interprete their microstructures and specify their properties.

II. Relating to skills:

PEK_U01 - Can choose constructional materials to specified application.

PEK_U02 - Can analyse the influence of material chemical composition and its microstructure on strength properties and others (corrosive resistance, cracking ability, wear resistance).

PEK_U03 - Can present and give alternative option in reference to specified part of construction

III. Relating to social competences:

PEK_K01 - Broads the knowledge about the role of materials in social life

PEK_K02 - Gets acquainted with metodology on system analysis not solely in the area of technical issues

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Systems and criteria of materials classification	2
Lec2	overall characteristic of materials groups	2
Lec3		2
Lec4	Metals and alloyed metals. Crystal latticed and defects of structure.	2
Lec5	Polymers	2
Lec6	ceramics, glass	2
Lec7	Composite materials.	2
Lec8	System analysis in solving technical issues	2
Lec9	Equilibrium and equilibrium criteria. Crystallization	2
Lec10		2
Lec11	Phase equilibrium graphs - part 1	2
Lec12	Iron-carbon diagrams - part 2	2
Lec13	Iron-carbon diagram	2
Lec14		2
Lec15	Test	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2	Macroscopic investigations of surfaces and fractures	2
Lab3	Macroscopic and microscopic investigations of composites with polymer matrix	2
Lab4	Analysys of equilibrium dual-phases diagrams	2

Lab5	Microscopic investigations of single- and multiplephases metals	2
Lab6	The analysis of structures in the iron-carbon diagram	2
Lab7	Summary and passing of laboratory classes	3
		Total hours: 15

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. tutorials
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_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	The report from laboratory class
F2	PEK_K01, PEK_K02	The report from laboratory class
P = F1+F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1]Haimann.R; Metaloznawstwo; Wyd.PWr;2000 [2]Grabski.M.W;Kozubowski.J.A; Inżynieria materiałowa - geneza, istota, perspektywy;Wyd.PW;2003 [3]Dudziński.W, Widanka.K, Ćwiczenia laboratoryjne z materiałoznawstwa,Wyd.PWr,2005

SECONDARY LITERATURE

[4]Dobrzański.L.A, Podstawy nauki o materiałach,WNT,2002 [5]Pękalski.G, Materiały dydaktyczne z materiałoznawstwa,2012

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Materials Science I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W02	C1, C2, C3, C4		N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U02	C3, C4		N1, N3, N5
PEK_K01, PEK_K02	K1ZIP_K11	C1, C4		N1, N4

SUBJECT SUPERVISOR

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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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031011**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
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 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.	2

Lec2	Measurement, measurement types, method and measurement principle.	2
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.	3
Lec5	GPS - geometrical tolerance according to ISO 1101. Geometrical deviations mesurements.	3
Lec6	Description of geometric structure of surfaces - roughness and waviness, and their measurement.	2
Lec7	Tolerance and machine parts measurement.	6
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	Mehods and means of mechanization and automation of measurements.	2
Lec11	Analysis of dimension. Fundamentals of statistical control of dimensions.	2
Lec12	Fundamentals of coordinate measurement techniques.	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Organizational matters. General principles for the use of measuring equipment.	2
Lab2	Errors of measurement and assasement methods of measurement uncerteinaty.	2
Lab3	Measurements of linear dimensions.	2
Lab4	Measurements of angular dimensions.	2
Lab5	Direct and indirect measurements of cones.	2
Lab6	Identification and measurement of threads.	2
Lab7	Project of a tests.	2
Lab8	Assessment of the geometrical structure of the surface.	2
Lab9	Identification and measurement of cylindrical gears.	2
Lab10	Measurements of selected shape deviations.	2
Lab11	Measurements of selected displacement.	2
Lab12	Cams measurement.	2
Lab13	Measurements of machine parts with pneumatic measurement equipment.	2
Lab14	Verification of measuring instruments	2
Lab15	Coordinate masurements of machine parts.	2
		Total hours: 30

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
Management and Manufacturing Engineering

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	K1ZIP_W06	C1; C2; C3; C4; C5; C6	Wy1 - Wy12	N1; N5
PEK_U01; PEK_U02; PEK_U03	K1ZIP_U06	C1; C2; C3; C4; C5; C6	La1 - La15	N2; N3; N4; N5
PEK_K01; PEK_K02; PEK_K03	K1ZIP_K04, K1ZIP_K05	C1; C2; C3; C4; C5; C6	La1 - La15	N2; N3; N4; N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Statystyka inżynierska**
Name in English: **Statistic for Engineers**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031014**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			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. Have basic knowledge in mathematics confirmed positive assessments on the certificate of completion of secondary school

SUBJECT OBJECTIVES

C1. Gaining basic knowledge of probability and mathematical statistics, taking into account the aspects of the application.
C2. The acquisition of numerical data mining skills in the field of construction and operation of machinery, organization and management, and optimization of design, technology and systems.
C3. Gaining skills development (reduction) of data using statistical software (STATISTICA, MatLab, Gretl, R) and the possibility of a spreadsheet (Excel).
C4. Acquisition and consolidation of social competencies including emotional intelligence skills involving the cooperation in the group of students aiming to effectively solve problems, taking into account the responsibility, honesty and fairness in the proceedings.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - It has a basic knowledge of statistical methods for analyzing databases knows the basic descriptive statistics characterizing the results of measurements of engineering, knows the principle of grouping data and creating a series of distribution

PEK_W02 - Knows basic theoretical distributions characteristics of discrete and continuous, has a basic knowledge of rules of estimation of confidence intervals for the average value characteristics and its dispersion has knowledge of the methods for verifying parametric statistical hypotheses about the mean value, of the equality of two values of the average of the value of variance and the homogeneity of many variance.

PEK_W03 - He knows the basic methods of verification nonparametric statistical hypotheses concerning the significance of differences in the data structure and independence of random variables categorized knows methods of correlation and regression analysis for two or more continuous variables and methods of analysis of time series.

II. Relating to skills:

PEK_U01 - Unable to correctly carry out a statistical analysis of the results of research, formulate hypotheses and, based on tests carried out to draw the appropriate conclusions: able to perform data reduction on the prior corresponding selection of statistics describing the average value, its dispersion and shape of the distribution, it can from raw data to create a series of distribution and illustrate collection of data using the histogram, empirical distribution and graph frameset.

PEK_U02 - Able to fit empirical data and theoretical distribution on the basis of the estimate quantile values for given probabilities, and estimate the probability for given quantile, unable to correctly select the type of statistical test and perform testing hypotheses about the average and distribution characteristics.

PEK_U03 - He can analyze the correlation characteristics in multivariate categorical data table can perform regression analysis and correlation of two and more variables to estimate the values of parameters characterizing the strength and shape of the relationship.

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Statistical methods of data analysis - the essence of statistical modeling. Descriptive analysis of data: forms of representation of statistical data, measures of association, variability, asymmetry and concentration.	2
Lec2	Preparation and presentation of statistical material. The grouping of data - ranks easy and distribution. Histogram and empirical cumulative distribution.	2
Lec3	Random variables and their distributions. Numerical characteristics of the distribution. Selected discrete and continuous distributions. Inequality Czybyszewa. Elements of the theory of estimation - the point estimate. Interval estimation of the mean value and variance. The confidence intervals.	2
Lec4	Parametric statistical hypothesis. Testing hypotheses about the mean value, of the equality of two average values. Testing hypotheses about the rate structure and the equality of two indicators structure. Testing hypotheses about the variance and the equality of two variances.	2
Lec5	Nonparametric hypothesis testing. Chi-squared test, Kolmogorov-Smirnov. Test of independence Pearson chi-square. Depending measures based on chi-square. The odds ratio. Non-parametric tests: test the Wald-Wolfowitz, Wilcoxon signed-rank test Mann-Whitney.	2

Lec6	Analysis of correlation and regression. The method of least squares. Pearson correlation coefficients and Spearman. Linear regression function. Multivariate regression analysis and correlation. Estimation of linear multiple regression function. Test of significance for multiple regression coefficients. Estimation of multiple correlation coefficient. The coefficient of determination.	2
Lec7	Univariate analysis of variance and post-hoc tests: Tukey, Duncan and least significant difference. Kruskal-Wallis test and post-hoc test: Test Dunn. Methods of analysis of the dynamics of phenomena - time series. The methods of smoothing time series. Analysis of periodic fluctuations. Presentation of selected computer programs supporting statistical analysis STATISTICA, R, Gretl.	3
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Organizational matters. Introduction to using a spreadsheet. Mathematical and statistical functions Excel. Generating the vector of continuous variables with normal distribution. Descriptive statistics - calculating measures of association, variability, asymmetry and concentration. Construction ranks distribution. Graphical presentation of data collection - Histogram and empirical cumulative distribution and box plot.	2
Proj2	Basic distributions encountered in mathematical statistics: the normal distribution, Student, chi-square, F Snedecor. The probability density function and cumulative distribution. Point and interval estimation of the expected value, the rate structure (faction), variance and standard deviation.	2
Proj3	Verification of statistical hypotheses. Parametric tests of significance to the expected value and the variance of the general population. Test for two variances, two medium and two indicators of the structure. Student test for paired test the homogeneity of many of variance test of homogeneity of many schools.	2
Proj4	Non-parametric tests of significance - Pearson compatibility test, compatibility test Kolmogorov,. Test of independence chi-square panels - kontyngencyjne. Mann-Whitney test. Median test and Wilcoxon signed-ranks test. Rank-sum test Kruskal-Wallis assess the relationship between the two zmiennymiDwuwymiarowa regression analysis and correlation. A scatterplot. The strength of the correlation relationship - the correlation coefficient estimation, test of significance for the correlation coefficient, parameter estimation of linear regression function, significance test for the regression coefficient (slope of the regression line), the confidence interval for the regression coefficient.	2
Proj5	Multivariate analysis of correlation and regression. The estimation of multiple regression function. Test of significance 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
Proj6	One-way analysis of variance (ANOVA). Table analysis of variance of one variable for the jednoczynnikowego. Analysis of the dynamics. Time series without any periodicity and periodicity. Methods of prediction. Development trend - a trend.	2

Proj7	Sampling methods. Stratified sampling, collaborative, systematic. Non-random selection of trial and error load. Analysis of the history of the event. The distribution, density function, survival function, hazard function. Life tables. Kaplan-Meier curves. Cox proportional hazards model. Rating overall uncertainty of the measurement result. Disclosure of systematic errors. Disclosure errors (errors thick). Assessment of overall uncertainty resulting from the impact of random and systematic effects	3
		Total hours: 15

TEACHING TOOLS USED

N1. informative lecture
N2. tutorials
N3. self study - preparation for laboratory class
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_U02, PEK_U03	entry test, the evaluation part of the computing project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Bobrowski D: Probabilistyka w zastosowaniach technicznych. Warszawa 1986, WNT[2] Nowak R.: Statystyka dla fizyków. Warszawa 2002, Wydawnictwo Naukowe PWN[3] Ostasiewicz W. (red.): Statystyczne metody analizy danych. Wrocław 1999, Wydawnictwo AE we Wrocławiu[4] Zeliaś A., Pawełek B., Wanat S.: Metody statystyczne. Zadania i sprawdziany. Warszawa 2002, PWE

SECONDARY LITERATURE

[1] Bąk I., Markowicz I., Mojsiewicz M., Wawrzyniak K.: Statystyka w zadaniach. Część I i II. Warszawa 2001. Wydawnictwo Naukowo-Techniczne[2] Cieciura M., Zacharski J.: Metody probabilistyczne w ujęciu praktycznym. Warszawa 2007, VIZJA PRESS&IT Sp. z o. o.[3] Dobosz M.: Wspomagana komputerowo statystyczna analiza wyników badań. Warszawa 2001, Akademicka Oficyna Wydawnicza EXIT.[4] Frątczak E., Gach-Ciepiela U., Babiker H.: Analiza historii zdarzeń. Elementy teorii, wybrane przykłady zastosowań. Warszawa 2005, Szkoła Główna Handlowa w Warszawie.[5] Kukiełka L: Podstawy badań inżynierskich. Warszawa 2002, Wydawnictwo Naukowe PWN. [6] Maliński M.: Statystyka matematyczna wspomagana komputerowo. Gliwice 2000, Wydawnictwo Politechniki Śląskiej [7] Paleczek W.: Metody analizy danych na przykładach. Częstochowa 2004, Politechnika Częstochowska[8] Turzeniecka D.: Ocena niepewności wyniku pomiarów. Poznań 1997, Wydawnictwo Politechniki Poznańskiej

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Statistic for Engineers
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W01	C1, C2, C3	Wy1, Wy2, Wy3	N1, N2
PEK_W02	K1ZIP_W01	C1, C2, C3	Wy4, Wy5	N1, N2
PEK_W03	K1ZIP_W01	C1, C2, C3	Wy1, Wy6, Wy7	N1, N2
PEK_U01	K1ZIP_U01	C1, C2, C3	Pr1, Pr2, Pr3	N3, N4
PEK_U02	K1ZIP_U01	C1, C2, C3	Pr4, Pr5	N3, N4
PEK_U03	K1ZIP_U01	C1, C2, C3	Pr6, Pr7	N3, N4

SUBJECT SUPERVISOR

dr inż. Artur Kierzkowski tel.: 71 320-20-04 email: artur.kierzkowski@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Materiałoznawstwo II**
Name in English: **Matrials Science II**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031015**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
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. The passed lecture Materials Science I and laboratory classes Materials Science I (the requirement does not have formal character - it is related with knowledge and abilities given in course card - Materials Science I)

SUBJECT OBJECTIVES

C1. The familiarization (with details) with microstructures, properties and applications of metallic constructional materials
C2. Presentation (with theoretical background) of strengthening methods of such materials through heat treatment, chemical-heat treatment, solution strengthening and plastic deformation
C3. Presentation of the influence of alloying elements on microstructure, specific properties and application of metal alloys

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knows kinds and symbols (according to current International and Polish Standards) of metal alloys.
PEK_W02 - Is able to determine the microstructure and properties in the equilibrium state basing on proper eqiulibrium diagrams.
PEK_W03 - Can specify and explain the chosen type of alloy strengthening

II. Relating to skills:
PEK_U01 - Can choose alloy grade to specified application, basing on chemical composition and its microstructure in the equilibrium conditions
PEK_U02 - Can propose 'technology card' of heat treatment (or another), with alloy properties appropriate to specified usage.
PEK_U03 - Can explain different kind of alloys, chosen for similar application.

III. Relating to social competences:
PEK_K01 - Broads the knowledge in the field of new materials in the daily usage.
PEK_K02 - Learn the economic background and the applications of new metallic materials in the industry

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Microstructures of steels, liquid steels and cast iron	2
Lec2	Theoretical basics of heat treatment - the introduction	2
Lec3	Pearlite-austenite transition	2
Lec4	Austenite-pearlite transition	2
Lec5	Bainitic and martensitic transformations	2
Lec6	TTTi and TTTc diagrams and their interpretation	2
Lec7	Tempering processed	2
Lec8	The influence of heat treatment on structures, properties and applications of steel	2
Lec9	Chosen issues of technology of steels heat treatment	2
Lec10	The basics of theory of chemical heat-treatment	2
Lec11	The influence of alloying elements on steels structures	2
Lec12	The heat treatment of alloying steels and their application	2
Lec13	Alloys of non-iron metals - part 1	2
Lec14	Alloys of non-iron metals - part 2	2
Lec15	Metallic materials dedicated to special purposes	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Microstructures and properties of alloys of Fe-Fe3C	2
Lab2	Cast iron - microstructures and properties	2
Lab3	The influence of heat treatment on microstructures and steels properties	2

Lab4	Alloying steels with special properties - microstructures, properties	2
Lab5	Microstructures and properties of aluminium alloys	2
Lab6	Microstructures and properties of cuprum alloys	2
Lab7	Summary and passing of laboratory classes	3
		Total hours: 15

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. tutorials
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_W02, 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	Report from laboratory classes, intro test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Haimann.R, Metalznawstwo, Wyd.PWr,2000; [2] Przybyłowicz. K, Metaloznawstwo, WNT, 2007[3] Dudziński. W, Widanka.K, Ćwiczenia laboratoryjne z materiałoznawstwa, Wyd. PWr2009

SECONDARY LITERATURE

[4]Pękalski. G, Materiały dydaktyczne z materiałoznawstwa,2012

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Matrials Science II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W02	C1, C2, C3	Lecture1-Lecture14	N1, N2, N4
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U01, K1ZIP_U02	C1, C2, C3	Laboratory1-Laboratory6	N3, N4, N5
PEK_K01, PEK_K02	K1ZIP_K06, K1ZIP_K11	C2, C3	Laboratory1-Laboratory6	N1, N2, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Procesy i techniki wytwarzania I**
Name in English: **The processes and manufacturing techniques I**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031017**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
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 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. 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 read and interpret the drawings and diagrams used in technical documentation

SUBJECT OBJECTIVES

C1. To familiarize students with the processes and manufacturing techniques of production from the liquid metal, through the plastic molding and welding techniques.
C2. Acquisition of knowledge about the basic techniques of chipless processing and skills of parameters selection of these processes.
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 technologies of casting
PEK_W02 - Knows the basic technologies of plastic forming of elements
PEK_W03 - Knows the basic methods of welding and process parameters, and has the knowledge about the applications of welding processes, bonding and brazing in the manufacture of products.

II. Relating to skills:
PEK_U01 - Can choose a suitable casting technology and define the basic parameters of the process.
PEK_U02 - Can choose the technology of plastic forming and define the basic parameters of the process.
PEK_U03 - Can choose the appropriate method of joining the elements of the product and to determine the basic parameters of the process.

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.
PEK_K03 - Observance the customs and rules of the academic environment,

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. Description of the specifics of the manufacturing techniques, basic concepts and algorithms for the manufacture of casts	2
Lec2	Materials used for the production of molding and core sands as well as methods for producing and testing the properties of these sands.	2
Lec3	Methods for manual and automatic production of foundry molds and mold cores. Production of molds and cores from the chemo-and thermohardening sands	2
Lec4	Production of castings in permanent molds,	2
Lec5	Melting of the casting alloys and heat treatment of castings. Test.	2
Lec6	Effect of the strain on the structure and properties of the material.	2
Lec7	Cold and hot forming	2
Lec8	Sheet metal,	2

Lec9	volume machining	2
Lec10	Metal Forming Tools	2
Lec11	The types of joints and welds, welding positions, gas welding	2
Lec12	Arc welding with coated electrode, in protective gases (MAG, MIG, TIG) and under the flux	2
Lec13	Soldering and Brazing	2
Lec14	Resistance and friction welding	2
Lec15	Thermal cutting and welding stresses	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Sprawy organizacyjne. Study of the materials and molding sands. Technology of full mold.	2
Lab2	Hand and machine production of foundry molds and cores.	2
Lab3	Production of castings in forms of chemo-and thermohardening sands	2
Lab4	Production of castings in permanent molds	2
Lab5	Study the properties of alloys.	2
Lab6	Cold deformation and annealing of metals	2
Lab7	Rolling the metal sheets and profiles	2
Lab8	Metallurgical extrusion of machinery parts	2
Lab9	Manufacturing the metal products in the process of drawing	2
Lab10	Punching-cutting, bending and stamping	2
Lab11	Health and safety of welding, gas welding, thermal cutting	2
Lab12	Arc welding with coated electrode, in protective gases (MAG, MIG, TIG) and under the flux	2
Lab13	Resistance and friction welding.	2
Lab14	Soldering and Brazing	2
Lab15	Hidden arc welding, Welding stresses	2
		Total hours: 30

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_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	entrance test- short test, quiz, oral answers, written tests
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Perzyk M. i inni; Odlewnictwo WNT Warszawa 2000Granat K. Laboratorium z odlewnictwa, skrypt PWr., Wrocław 2007 Gronostajski J., Obróbka plastyczna metali, Wrocław 1974 http://www.metalplast.pwr.wroc.pl/instrukcje.html Ambroziak A. (red.): Techniki Wytwarzania. Spawalnictwo. Laboratorium. Pwr, Wrocław 2011, http://Www.Dbc. Wroc.Pl/Content/7156/Techniki_Wytwarzania_Spawalnictwo_A.Ambroziak_Linkowane.Pdf

SECONDARY LITERATURE

Poradnik inżyniera – Odlewnictwo WNT Warszawa 1986Romanowski P., Poradnik obróbki plastycznej na zimno, Wydawnictwo Naukowo- Techniczne, W-wa 1976Pilarczyk J. (red.): Poradnik Inżyniera. Spawalnictwo. T. I i II, WNT Warszawa, 2003, 2005Klimpel A.: Spawanie, Zgrzewanie i Ciecie Metali., WNT, Warszawa, 1999

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
The processes and manufacturing techniques I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W08	C1, C2	Lec1 - Lec15	N1, N4, N5

PEK_U01, PEK_U02, PEK_U03	K1ZIP_U08	C1, C2, C3	Lab1-Lab15	N2, N3
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K04	C3	Lab1-Lab15	N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Wytrzymałość materiałów**
Name in English: **Strength of Materials**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031018**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	2	1	1		
Number of hours of total student workload (CNPS)	90	30	60		
Form of crediting	Examination	Crediting with grade	Crediting with grade		
Group of courses					
Number of ECTS points	3	1	2		
including number of ECTS points for practical (P) classes		1	2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.8	0.7	1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of higher mathematics
2. Knowledge of the elements of material engineering
3. Knowledge of rigid body mechanics

SUBJECT OBJECTIVES

C1. Understanding of the basics and applications of deformable body mechanics in homogeneous and heterogeneous bodies
C2. Performing strength analysis of machine components and calculating stresses and strains
C3. Students are able to experimentally determine the mechanical properties of materials and calculate permissible stresses

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Understanding of the basics of vector analysis and its application in continuum theory
PEK_W02 - Students know the most important group of mechanics equations describing a continuum: geometric relationships,
constitutive equations and equilibrium equations
PEK_W03 - Students know the most useful failure criteria and their application and possess the knowledge necessary to solve the classic tasks of mechanics

II. Relating to skills:
PEK_U01 - Students can use vector analysis in solving problems of strength of materials
PEK_U02 - Students can calculate stress and displacement in prismatic or thin-walled rods, simply or complex loaded, as well as in detachable and non-detachable joints
PEK_U03 - Students can design a rod under compression that is resistant to loss of stability

III. Relating to social competences:
PEK_K01 - Students can use vector analysis in solving problems of strength of materials
PEK_K02 - Students able to objectively evaluate arguments, rationally explain and justify their own point of view using knowledge of strength of materials
PEK_K03 - Students shall observe the rules and regulations of the academic community

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Basic assumptions and concepts. Experimental basics in Strength of Materials	2
Lec2	Tension and compression. Static and hyperstatic cases. Thermally stressed rods systems. Stress concentration	2
Lec3	Stress theory. Mohr's circle for a state of plane stress. Physical relationships in spatial stress	2
Lec4	Theory of strain. Engineering measurements of strain	2
Lec5	Torsion of circular shafts	2
Lec6	Torsion of shafts with arbitrary cross-section. Torsion of thin-walled members	2
Lec7	Pure shearing. Technical shearing. Calculation of detachable and non-detachable joints - examples	2
Lec8	General case of beam bending. Symmetrical bending. Beams with uniform bending strength	2
Lec9	Unsymmetrical bending. Bending with shear force. Shear centre	2
Lec10	Beam displacements. The differential equation for the elastic curve of a beam	2
Lec11	Buckling of rods under compression	2
Lec12	Combined loading: bending and tension or compression. Cross-section core	2
Lec13	Failure criteria	2
Lec14	Combined modes of loading - examples	2
Lec15	Fatigue of materials. Introduction to Fracture Mechanics	2

		Total hours: 30
Form of classes – Classes		Number of hours
Cl1	Static rods systems under tension and compression	2
Cl2	Hyperstatic cases under tension and compression. Thermally stressed rods systems	2
Cl3	Torsion of circular shafts	2
Cl4	Pure and technical shearing. Calculation of detachable and non-detachable joints	2
Cl5	Bending - normal stresses	2
Cl6	Deflection line of beams	1
Cl7	Buckling of rods under compression	2
Cl8	Written test	2
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1	Introduction	1
Lab2	Investigation of mechanical properties of metals. Tensile test	2
Lab3	Strain gauge analysis	2
Lab4	Determination of fatigue limit	2
Lab5	Combined loading - torsion and bending. Strength hypotheses testing - torsion and bending. Determination of Kirchohoff modulus - pure torsion test	2
Lab6	Loss of rod stability - buckling. Compression test	2
Lab7	Symmetrical and unsymmetrical bending - model tests	2
Lab8	Summary of laboratories and examination	2
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. calculation exercises
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	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_U02,	Oral answers, (written) 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_K01	Entrance test, report on laboratory classes
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Niezgodziński M. E., Niezgodziński T.: Wytrzymałość materiałów. PWN, Warszawa 1998.Niezgodziński M. E., Niezgodziński T.: Wzory, wykresy i tablice wytrzymałościowe. WNT, Warszawa 1996.Niezgodziński M. E., Niezgodziński T.: Zadania z wytrzymałości materiałów. WNT, Warszawa 1997..Neimitz A.: Mechanika pękania. PWN, Warszawa 1998.Dzidowski E. S.: Mechanizm pękania poślizgowego w aspekcie dekohezji sterowanej metali. Wyd.PWr., Wrocław 1990.Dzidowski E. S.: Physical concept of shear fracture mesomechanism and its applications. Central European Journal of Engineering, 2011, nr 1(3), s. 217-233.Dzidowski E. S.: Jak projektować, wytwarzać i eksploatować rury do bezpiecznej pracy pod ciśnieniem. Rudy i Metale, 2008, nr 11, s. 714-721.

SECONDARY LITERATURE

Broek D.: Elementary engineering - fracture mechanics. Noordhoff Int. Publishing, Leyden, 1974.Ashby M. F.: Jones D. R.: Materiały inżynierskie. Własności i zastosowania. WNT, Warszawa 1995.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Strength of Materials
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W03	C1	lec1-lec15	N1
PEK_U01, PEK_U02	K1ZIP_U03	C2	cl1-cl7, lab1-6	N2

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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031019**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				30	
Number of hours of total student workload (CNPS)				30	
Form of crediting				Crediting with grade	
Group of courses				X	
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. 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 the use of CAD systems to creative and innovative design

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 – Lecture		Number of hours
Lec1	CAx systems for design. Virtual prototyping.	2
Lec2	3D geometry modeling - parts. Solid and surface models.	2
Lec3	3D modeling - assemblies. Relationships, bonds, adaptability and variability of the model.	2
Lec4	The analysis of the virtual prototype. The analysis of the prototype on the virtual model (kinematic, dynamic).	2
Lec5	The model presentations. The methodology of the engineer work. Organization of work of the design team (data exchange formats, teamwork)	2
Lec6	Creative design	2
Lec7	Innovation and quality in the design	2
Lec8	Completion of the course	1
		Total hours: 15
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	Basic solid modeling - Advanced operations on 2D sketches - function relationships of parameters, solid modeling with rotation, solid editing - shell models	2
Proj5	Basic solid modeling - solid modeling with rotation, one and multibody modeling	2
Proj6	Advanced solid operations - sweep, loft, split, scroll	2
Proj7	The project of assembly: the concept, the construction of the parts by using the known solid modeling methods	2

Proj8	The project of assembly: preparing to create an assembly- parts assembling, bonds and relationships in the assembly	2
Proj9	The project of assembly: parts assembling, parts editing in an assembly, a library of standard parts	2
Proj10	The project of assembly: parts modeling in the assembly environment, the adaptability of the parts	2
Proj11	The project of assembly: analysis of the functional correctness of the assembly (parameters analysis, kinematic analysis, analysis of collision) rectify design faults, loads analysis	2
Proj12	The project of assembly: loads analysis, reactions and forces at the nodes, the presentation of the model	2
Proj13	The project of assembly: 2D technical drawings of parts - manufacturing parts drawings	2
Proj14	The project of assembly: 2D technical drawings of assembly - assembly drawings	2
Proj15	Completion of the course: work during classes	2
		Total hours: 30

TEACHING TOOLS USED

N1. problem discussion
N2. self study - preparation for project class
N3. 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 PEK_K01	test, participate in problem discussions
P = 0,4*F1+0,6*FW		

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
Management and Manufacturing Engineering

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	K1ZIP_U04, K1ZIP_U05, K1ZIP_U35	C1, C2	Pr1 - Pr14	N3, N4
PEK_K01	K1ZIP_K07	C3	Pr1 - Pr14	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy projektowania maszyn**
Name in English: **Fundamentals of Machine's Engineering Design**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031020**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			30	
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. Knowledge:
- student has knowledge on the fundamentals of mechanics, strength of materials and materials technology;
- student knows the basic rules of the technical drawing.
2. Skills:
- student can use the knowledge on mechanics, strength of materials and materials technology in practice;
- the student can graphically present technical objects.
3. Competences:
- the student understands and is aware of what the technological activity is and how it influences the environment.

SUBJECT OBJECTIVES

C1. To familiarize students with the design and operation principle of basic machine components, units and systems.
C2. To familiarize students with the rules of the engineering design process.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - As a result of the classes, the student is supposed to be able to recognize and select the basic machine elements, units and systems.

PEK_W02 - As a result of the classes, the student is supposed to be able to present the basic rules of the engineering design process.

II. Relating to skills:

PEK_U01 - As a result of the course, the student should be able to prepare the technical drawings of basic mechanical components, units and systems.

PEK_U02 - As a result of the classes, the student is supposed to be able select and to make engineering calculations of the basic machine elements, units and systems .

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Engineering design process.	2
Lec2	Welded joints.	2
Lec3	Load-carrying structures.	2
Lec4	Screw joints and mechanisms.	2
Lec5	Axes and shafts.	2
Lec6	Bearings and sealings.	2
Lec7	Machine shaft system.	2
Lec8	Couplings.	2
Lec9	Cylindrical gears.	2
Lec10	Bevel and worm gears.	2
Lec11	Belt transmissions.	2
Lec12	Drive systems.	2
Lec13	Fluid power elements and systems.	2
Lec14	An example of practical designing of a machine or a device.	2
Lec15	Reserve.	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Development of the design assumptions for the built machine or device	2
Proj2	Analysis of the problem (group work): -determination of the quantitative data and the operational conditions, -generation of the conceptual solutions, -selection of the criteria and evaluation of the concepts, -selection of the final solution.	8
Proj3	Making the basic engineering calculations (individual work)	8

Proj4	Making the technical documentation (individual work): -assembly drawing (handwritten draft and a CAD software drawing), -working drawings (made by means of CAD software).	10
Proj5	Summary and conclusions	2
		Total hours: 30

TEACHING TOOLS USED
N1. informative lecture N2. problem lecture 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	Examination
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	Partial evaluation of the project
P = F2 + F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Osiński Z. i inni: Podstawy konstrukcji maszyn, PWN, Warszawa 1999,
2. Dietrich M. i inni: Podstawy konstrukcji maszyn. T.1-3, WNT, Warszawa 1995

SECONDARY LITERATURE

1. Pahl G., Beitz W.: Nauka konstruowania, WNT, Warszawa 1984,
2. Kurmaz L., Kurmaz O.: Projektowanie węzłów i części maszyn, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2003.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Machine's Engineering Design
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W04, K1ZIP_W05	C1, C2	Lec2-Lec13, Lec15	N1, N2, N3, N4
PEK_U01, PEK_U02	K1ZIP_U05	C1, C2	Proj1-Proj5	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Procesy i techniki wytwarzania II**
Name in English: **Manufacturing Processes and CAM II**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031021.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
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	1.8		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
Lab11		2
Lab12		2
Lab13		2
Lab14		2
Lab15		2
		Total hours: 30

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. laboratory experiment
N3. 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	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Manufacturing Processes and CAM II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W08, K1ZIP_W12	C1; C2; C3		N1
PEK_U01; PEK_U02; PEK_U03	K1ZIP_U08, K1ZIP_U12	C1; C2; C3		N2; N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Maszyny i urządzenia technologiczne**
Name in English: **Technological machines and devices**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031023**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
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	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has basic knowledge relating to the design-construction process and the structure and working of machine components and units.
2. The student has sound knowledge relating to the basic manufacturing techniques and the role of technological machines.
3. The student can read and interpret the figures and schematics used in machine engineering documentation.

SUBJECT OBJECTIVES

C1. The student is to learn the structure of principal technological machines, especially their drive, control and measuring systems.
C2. The student is to learn the basic technical-operational characteristics of modern technological machines.
C3. The student is to learn the principles and possibilities of using technological machines to perform specific machining tasks.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student knows the structure and principles of operation of modern technological machines, especially their kinematics and the principles of controlling their operation

PEK_W02 - The student knows the principles of selecting technological machines to perform specific machining tasks.

PEK_W03 - The student knows the basic testing methods used to assess the condition of technological machines.

II. Relating to skills:

PEK_U01 - The student can evaluate technological machines from the point of view of their suitability for specific machining tasks.

PEK_U02 - The student can define how a technological machine is to function.

PEK_U03 - The student can determine the basic parameters characterizing the operation of a technological machine.

III. Relating to social competences:

PEK_K01 - The student knows how to search for and use the literature recommended for the course and acquire knowledge on her/his own.

PEK_K02 - The student can exploit basic knowledge relating to the methods of controlling the operation of technological machines.

PEK_K03 - The student understands the necessity of systematic and unassisted work in order to master the course material.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Significance and development of manufacturing technology. General characteristics of manufacturing machines and their classification. Technical and operational parameters. Basic requirements.	2
Lec2	Geometrical and kinematic structures of the machines. Parts, mechanisms and components of manufacturing machines: bodies, spindle and guiding assemblies, tooling and workpiece systems.	2
Lec3	Main drive and feeding systems of modern manufacturing machines (basic requirements, exemplary solutions). Measurement, diagnostics and supervision systems.	4
Lec4	Basics of automatic control of manufacturing machines. Classification of control systems (NC, CNC, DNC, AC and PLC systems). Elements of programming CNC machines.	2
Lec5	Cutting machine tools for machining rotating surfaces - lathes. The technical and utility characteristics and function of the machines. Automated turning machines	4
Lec6	Cutting machine tools for machining rotating and flat surfaces - drills, milling machines, boring machines. The technical and utility characteristics and function of the machines.	2
Lec7	Cutting machine tools for machining rotating and flat surfaces - grinders, planers and slotters. The technical and utility characteristics and function of the machines.	2

Lec8	Machine tools for special technical shapes (threads and teeth) – their structural components and technological function. Multitasking machines (in-line transfer machines).	2
Lec9	Machines for electrical discharge and laser machining - technical & usable features and purpose of the machines.	2
Lec10	Selected structures of NC machines for chipless machining (technical & usable features and purpose of the machines).	2
Lec11	CNC machining centres, autonomous machining stations. The role of robots and manipulators in production automation.	2
Lec12	Multimachine robotized manufacturing systems. Computer-integrated manufacturing systems (CIM).	2
Lec13	Trends in development of CNC manufacturing machines (machines for HSC machining, hexapods, intelligent and hybrid machine tools).	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	The checking of the geometric accuracy of the cutting machine tool, using the lathe as an example.	2
Lab2	The measurement of power losses during non-load operation and the overall efficiency of a machine.	2
Lab3	The assessment of machine loudness.	2
Lab4	The change of rotational motion to rectilinear motion in technological machines.	2
Lab5	Measurements of energy losses in spindle rolling bearings.	2
Lab6	The accuracy of fixing the slidable machine units.	2
Lab7	Selected problems relating to the dynamic properties of machine tools.	2
Lab8	Laboratory crediting.	1
		Total hours: 15

TEACHING TOOLS USED

N1. the 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. 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	Written examination.
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_U02, PEK_K03	Short tests on the particular laboratory topics.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Honczarenko J.: Flexible automation of manufacture. Machine tools and machining systems. WNT Warszawa, 2000.
Kosmol J.: Automation of machine tools and machining. WNT, Warszawa, 2000.
Honczarenko J.: Numerically controlled machine tools. WNT, Warszawa, 2009.
Wrotny L. T.: Machine tools for metal cutting. WNT, Warszawa, 1979.
Białek M. : Technological machines. Oficyna Wydawnicza Politechniki Warszawskiej, 1995.

SECONDARY LITERATURE

Paderewski K.: Vademecum of machine tools. WNT, Warszawa, 1979.
Dmochowski J., Uzarowicz A.: Machining operations and machine tools. PWN, Warszawa, 1980.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technological machines and devices
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W08	C1, C2, C3	Wy1 - Wy13	N1, N2, N4
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U12	C1, C2, C3	La1 - La7	N2, N3
PEK_K01, PEK_U02, PEK_K03	K1ZIP_K04	C1, C2, C3	La1 - La8	N1 -N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie produkcją i usługami I**
Name in English: **Production and Services Management I**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031024.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
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

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		3
Lec5		2
Lec6		4
Lec7		5
Lec8		2
Lec9		4
Lec10		2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1		3
Proj2		2
Proj3		4
Proj4		2
Proj5		4
		Total hours: 15

TEACHING TOOLS USED

N1. multimedia presentation
N2. self study - preparation for project class
N3. tutorials
N4. 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_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_K02, PEK_K03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Production and Services Management I
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W14, K1ZIP_W15	C1, C2		N1, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U14, K1ZIP_U15	C1, C2, C3		N2, N3, N4
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K01	C1, C2, C3		N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologie rozwoju produktu**
Name in English: **Technologies of product development**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031028**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
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				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge on organisation of engineering in a company - tasks of construction designer and technology designer
2. Knowledge and skills from courses of "Engineering graphics", "Geometrical drafting", "Construction drafting" or similar
3. Knowledge and skills from courses of "Engineering graphics 3D", "CAD modeling" or similar

SUBJECT OBJECTIVES

C1. Teaching students the METHODS of new product design with computer aided technologies
C2. Teaching students the TECHNOLOGIES of computer aided design and verification of new products
C3. Allowing the students to acquire skills of using selected technologies supporting new product development

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Students knows the stages of new product development and computer technologies utilised there
PEK_W02 - Students have the knowledge on methods of product design and are aware of their progress
PEK_W03 - Students have basic knowledge on creating and processing 3D models of products

II. Relating to skills:

PEK_U01 - Students can indicate the steps leading to designing new product
PEK_U02 - Students use some modern methods and computer technologies in new product development
PEK_U03 - Students can use selected methods of creating and processing 3D models of products

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Applications of computer technologies in product development	2
Lec2	2D and 3D wireframe models, surface models. Solid and CAD models and methods of their representation. Higher level functionality of CAD systems. Advanced modeling and analysis tools in CAD systems. Geometric data exchange.	8
Lec3	Visualisation of CAD models. Virtual reality.	4
Lec4	Techniques of creating concepts, creativity, aspects influencing product development. Bionics - designing technical systems patterned or mimicking the nature.	4
Lec5	New product management, criteria of product modeling: esthetics-functionality-technology. Methods of product design based on technology criteria for injection molding, sheet metal forming, etc.	4
Lec6	Applications of reverse engineering in product development	4
Lec7	Introduction to additive manufacturing technologies	2
Lec8	Written exam	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Organisation of the laboratory. Rules of modeling in selected CAD system	2
Lab2	Product modeling in a CAD system with higher level functions, e.g. assemblies, part families, etc.	4
Lab3	Basic methods of design analysis in a CAD system, e.g. kinematics modeling	4
Lab4	Using imported geometry, e.g. surface models, in designing new products	4
Lab5	Complementary tasks and grading	1
		Total hours: 15

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation
N3. case study
N4. 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_W02, PEK_W03	written 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	report from laboratory classes
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

E. Chlebus, "Techniki komputerowe CAx w inżynierii produkcji", WNT, Warszawa 2000

SECONDARY LITERATURE

E. Chlebus, T. Boratynski, B. Dybała, M. Frankiewicz, P. Kolinka, "Innowacyjne technologie Rapid Prototyping - Rapid Tooling w rozwoju produktu", Oficyna Wydawnicza, Wrocław 2003

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technologies of product development
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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,	K1ZIP_W23	C1-C2	Lec1-Lec15	N1-N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U18, K1ZIP_U20	C3	Lab1-Lab5	N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy automatyzacji**
Name in English: **Fundamentals of Automation**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031032.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
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. Fundamentals of mathematical analysis

SUBJECT OBJECTIVES

C1. Knowledge of the basic problems of automation.
C2. Knowledge of the construction, operation and application principles of automation equipment.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - It has knowledge in the basics of automation, robotics and automation.
PEK_W02 - Can describe the construction of automation components
PEK_W03 - Can explain the operation of control systems

II. Relating to skills:
PEK_U01 - Can apply automation components for process automation
PEK_U02 - Can program the selected control elements
PEK_U03 - Is able to operate automated manufacturing processes

III. Relating to social competences:
PEK_K01 - Searching information and their critical analysis
PEK_K02 - Work in a team and relying on improving methods for the selection of a strategy to optimally solve the problems assigned to the group.
PEK_K03 - Respect the traditions and rules in academia and society

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the course, signal concept, types of signals.	2
Lec2	Building automation systems and their classification.	2
Lec3	Description of linear automation systems: transfer function, time characteristics, frequency response, frequency characteristics.	2
Lec4	Boolean algebra, logic (combination and sequential), examples.	2
Lec5	Logic combinational systems.	2
Lec6	Logic sequential systems.	2
Lec7	Two-sided and three-sided control	2
Lec8	Industrial control system. PLCs	2
Lec9	Controllers: PI, PD, PID	2
Lec10	HMI and SCADA systems	2
Lec11	Discrete automatic control.	2
Lec12	Analog electric actuators. Digital servo drives.	2
Lec13	Direct linear drives, properties and examples.	2
Lec14	Control systems for industrial robots, their construction, operation and tasks (functions). Interfejsy HMI i systemy SCADA	2
Lec15	Test	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Training of health and safety, organizational matters.	1
Lab2	Components and systems jointed relay	2

Lab3	Static and dynamic characteristics of automation components	2
Lab4	Components of hydraulics and pneumatics	2
Lab5	Combinatorial synthesis of control systems	2
Lab6	Synthesis of sequential control systems	2
Lab7	Simulation testing of components and automation systems in Matlab-Simulink	2
Lab8	Two-sided and three-sided control	2
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. problem exercises
N3. calculation exercises
N4. self study - self studies and preparation for examination
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_W02, 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_U02, PEK_U03	
P = F1+F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of Automation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W07	C1, C2, C3		N1, N2, N3, N4
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U07	C1, C2, C3		N1, N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologia montażu**
Name in English: **Technology of Assembly**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031034**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
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	1.2			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge of description and analysis processes. He knows the rules of process engineering design and construction and operation of basic components, assemblies and systems machine. It has a basic knowledge about methods of design and analysis of the various mechanisms found in machine and plant construction. It has a basic knowledge of manufacturing and shaping properties of engineering materials, processes shaping the structure and properties of metal alloys. He has ordered knowledge about treatment of erosive and other technologies shaping geometric form and surface treatment and thermo-chemical.
2. It has the skills writing design and creation of technical documentation of mechanical structures and to read it. Can measure the specific machine parts, quantities characterizing the quality of the surface and estimate the errors of measurements and develop measurement results. He can use the manufacturing technologies in order to shape the form, structure and properties of the products.
3. He is aware of the responsibility for own work and a willingness to comply with the principles of teamwork and responsibility for jointly implemented tasks.

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge about the methods and organization of production processes
C2. Gaining the ability to analyze the structure of the team and select the right technology, combining elements and basic principles of the organization of the assembly process
C3. Search for information and the ability to analysis and evaluation methods of the assembly process
C4. Acquiring the ability to design process uncomplicated installation team

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - The student has ordered knowledge of the design of production processes
PEK_W02 - The student knows the methods and techniques of the organization of production processes
PEK_W03 - The student has ordered knowledge of methods, techniques and tools for the reorganization and optimization of technological processes assembly

II. Relating to skills:
PEK_U01 - The student has the ability to develop a record of creating and reading technical documentation logical assembly of mechanical structures
PEK_U02 - The student is able to analyze the manufacturability of the design due to the installation and use appropriate methods of shaping and joining components
PEK_U03 - Student can design a technological process uncomplicated installation team

III. Relating to social competences:
PEK_K01 - search for information and its critical analysis
PEK_K02 - awareness of responsibility for own work and a willingness to comply with the principles of teamwork and responsibility for jointly implemented tasks
PEK_K03 - objective evaluation of arguments, rational translation and justifying their own point of view, the use of knowledge in the field of production processes

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The assembly process in the production process	2
Lec2	Description of the structure of products, assembly seqence planning and the development schemes and plans of assembly	2
Lec3	Producibility machines due to assembly	4
Lec4	Methodology "Design for Assembly" as a tool for structural analysis	4
Lec5	Stages of the assembly process planning	2
Lec6	Assembly operations, connection types, classes part-mounted	2
Lec7	General issues of accuracy of assembly, assemblability, basing assembly methods	2
Lec8	Organization of manual assembly and ergonomics issues	2
Lec9	Software tools supporting the design of assembly systems	2

Lec10	Manual assembly, ergonomics and mechanization of work as the primary design criteria assembly stands	2
Lec11	The methodology and analysis of standardization work time: MTM	4
Lec12	Methodologies and analysis of the standardization work time: MOST, RENAULT	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Analysis of the input data and the structure of the unit to be mounted	2
Proj2	Analysis of the requirements and conditions of technical and technological	2
Proj3	Evaluation of manufacturability product design	2
Proj4	Assembly sequence planning and the development schemes and plans of assembly	2
Proj5	Determining the content of operations and assembly operations, the selection of time standards and the preparation of technical documentation assembly	2
Proj6	The design assessment of the product due to the installation of DFA method	2
Proj7	Standardization of the assembly process using the MTM method and direct time measurment	3
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for project class
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	Written 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	evaluation of the final project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Bruno Lotter: Wirtschaftlische Montage, VDI Verlag 1992
[2] Jerzy Łunarski, Wiktor Szabajkowicz: Automatyzacja procesów technologicznych montażu maszyn, WNT Warszawa 1993
[3] T. Sawik, „ Planowanie i sterowanie produkcji w elastycznych systemach montażowych” . WNT Warszawa 1993
[4] G. Boothyroyd: „Assembly Automation and Product Design”, Marcel Dekker., NewYork, 1992

SECONDARY LITERATURE

[1] Kwartalnik Technologia i automatyzacja montażu
[2] H.J.Warnecke: „Die Montage im flexiblen Produktionsbetrieb”, Springer-Verlag Berlin 1996

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technology of Assembly
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W08	C1	Wy1 - Wy15	N1, N3, N4
PEK_U01, PEK_U02, PEk_U03	K1ZIP_U08	C2, C3	Pr1 - Pr7	N2, N3
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K08, K1ZIP_K09	C4	Pr1 - Pr7	N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Rachunek kosztów dla inżynierów**
Name in English: **Engineering Economy: Costs Analyses for Engineers**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031036**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			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				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. a basic knowledge on accounting, production proces organization and production organization
2. ability of using spreadshit (Excel) and simple model designing
3. a basic knowledge on free market economy

SUBJECT OBJECTIVES

C1. to learn basic terms and problems of the managerial decisions making based on costs; to gain knowledge on techniques and methods product costing and proces costing
C2. to gain ability of distinguishing product and proces cost categories and apply them in decision making
C3. To learn budgeting and how to use cost in decision making analysis (buy or manufacture; sell now or proces further, should an old machine be reaplaced by a new one).

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Student has a knowledge on costs, expenses and expenditures.
PEK_W02 - Student knows cost accounting for direct and indirect production costs and cost accounting for decision making; knows the place of costs in pro-forma financial statements
PEK_W03 - Student knows the budgedting methods and variance analysis of the budget.

II. Relating to skills:
PEK_U01 - Student is able to select and analyse costs relevant for decision making
PEK_U02 - Student is able to build a model based on costs that helps to make short- and long- term decisions
PEK_U03 - Student is able to prepare pro forma financial statements

III. Relating to social competences:
PEK_K01 - Student is able to cooperate with the representatives of different organization units while gethering data for cost analysis
PEK_K02 - Student is able to evaluate managerial decision from the economic and social points of view

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction - the essence of cost accounting in an entreprise, managerial accounting and financial accounting, designing production costs - cost engineering.	2
Lec2	The idea of cost; expense vs cost; expenditure vs cost.	2
Lec3	Systematic cost accounting; cost accounting for decision making; criteria and cost categories. Cost behavior patterns.	2
Lec4	Cost accounting models; total manufacturing costing, variable costing; costs in financial statements.	2
Lec5	Costs on decision making; Cost-Volume-Profit analysis; Break Even Point analysis; BEP for one and many products.	2
Lec6	Acytivity Based Costing method. The difference betwen "traditional" one driver costing and ABC method.	2
Lec7	Target costing and kaizen costing.	2
Lec8	Standard costing; variance analysis of observed and standard costs.	2
Lec9	Service departament costs allocation; transfer price.	2
Lec10	Period costs; fixed assets depreciacion; costs of direct material usage.	2
Lec11	Budgetig - how to prepare budget - from sales forecast to cash budget in a manufacturing and marchandise company.	2
Lec12	Budget variance analysis; static budget, flexible budget; levels of analysis.	2
Lec13	Budgeting organizational projects; budgeting investment projects; evaluating investment/capital projects.	2
Lec14	Cost accounting, income statement - pro forma financial statements.	2
Lec15	Final test.	2
		Total hours: 30

Form of classes – Project		Number of hours
Proj1	Introduction: contents of the project; class schedule and methods used in the class; evaluation criteria.	2
Proj2	What will be produced and sell; production process, resourses required by the product and the proces.	2
Proj3	Fixed and variable costs, introduction to quantity model of BEP.	2
Proj4	Midterm: required BEP model prepared in Excel.	2
Proj5	Budgeting model for operational activities.	2
Proj6	Model of budgeted income statement.	2
Proj7	Model of budgeted balance sheet and budgeted cash flow statement.	2
Proj8	Projects presentation in the classroom, project evaluation and grading.	1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. cases and numerical examples
N3. work in a small groups - working together on projects
N4. self study and preparation for the final test

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_K02	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_K01	midterm for the project evaluation
F2	PEK_U03	final project evaluation
F3	PEK_K02	project presentation at the classroom and peer review
P = F1+F2+F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] J.Matuszek, M.Kołosowski, Z.Krokosz-Krynke; Cost Accounting for Engineers. PWE Warszawa 2011 - in Polish
[2] Lecture handouts available on instructor's web page
[3] Project handouts available on instructor's web page.

SECONDARY LITERATURE

[1] Atkinson A.A., Management Accounting. IRWIN, 2004
[2] Bruns W., J. Jr., Accounting for Managers, South-Western, 1994
[3] Garrison R.H., Noreen E.W., Managerial Accounting, IRWIN, 1994
[4] Horngren Ch.T., Datar S.M., Foster G., Cost Accounting. A Managerial Emphasis. Prentice Hall, 2003
[5] Krokosz-Krynke Z., Simulation in managerial accounting - model of BEP, in : Symulacja systemów społecznych i gospodarczych II, Oficyna Wyd. PWr, 2007 - in Polish
[6] Vanderbeck E.J., Principles of Cost Accounting, South-Western, 2002

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Engineering Economy: Costs Analyses for Engineers
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_U19	C1; C2; C3	Pr2 – Pr7	N1; N2; N3; N4
PEK_W01, PEK_W02, PEK_W03	K1ZIP_W19	C1; C2; C3	Lec1 - Lec14;	N1; N2; N3; N4
PEK_K01, PEK_K02	K1ZIP_K02, K1ZIP_K05	C1; C2; C3	Lec1-Lec15; Pr2-Pr8	N1; N2; N3; N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie jakością**
Name in English: **Quality management**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031038**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				15
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. Has got the knowledge on fundamentals of organization management.
2. Has got the basic knowledge on product design and production processes.
3. Is able to use computer tools to prepare presentation on given topic.

SUBJECT OBJECTIVES

C1. The goal of the course is to achieve the educational effects PEK_W01-PEK_W03; PEK_U01-PEK_U02; PEK_K01-PEK_K02.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Has got the basic knowledge on terms used in quality management and on contemporary concepts in quality management.
PEK_W02 - Knows and understands the role of quality management standards in organisations and in quality assurance in supply chain.
PEK_W03 - Knows the basic methods and tools for quality management.

II. Relating to skills:
PEK_U01 - Is able to prepare and present selected issue on quality management.
PEK_U02 - Is able to use computer tools to present given topic.

III. Relating to social competences:
PEK_K01 - Is aware of the significance of quality management in organisation and in the society.
PEK_K02 - Is willing to express opinion and to take part in discussion.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Historical development of quality management. Total Quality Management (TQM) vs. traditional approach to quality. Video film: "Business of Paradigms".	2
Lec2	Defining Quality. The process of quality delivery in the chain of internal suppliers and customers. 8 dimensions of quality. Kano Model. Self-directed work teams.	2
Lec3	Intra-organizational culture and its TQM elements. Video film "Power of Vision ".	2
Lec4	The importance of the organization's mission with examples. Quality policy according to ISO 9001: 2015 and examples. Video film "Pioneers of paradigms". Kaizen. The EFQM excellence model.	2
Lec5	Quality Function Deployment (QFD) method.	2
Lec6	Why should an engineer have knowledge about quality management systems? - Quality systems and the labor market, spread of use and globalization; Contemporary recognized concepts of quality management as the basis for the development of QMS standards - standardized quality management systems as an achievement and as a source of quality culture; Legal conditions in the EU and Poland which conducts to the implementation of quality management systems - a new approach to technical harmonization and standardization in the EU, conformity assessment procedures and quality systems, new approach directives and CE marking, conformity assessment system and general product safety and liability for damage caused by dangerous product;	2
Lec7	Standardization - principles and organization of standardization; Standards of the ISO 9000 family - history, purpose and scope of use, reference to TQM, quality management principles and their reflection in standards; derivative standards, terminology in quality management systems acc. to ISO 9000: 2015;	2

Lec8	Quality management systems acc. to ISO 9001: 2015 - process approach vs. PDCA cycle and risk-based thinking, general discussion of requirements (Contextof the organization, Leadership, Planning, Support, Operation, Performance evaluation, Improvement);	2
Lec9	Quality management systems acc. to ISO 9001: 2015 - a more detailed discussion of requirements regarding: processes, system documentation, improvement tools built into the system (reaction to non-compliance, corrective actions, internal audit, management review); Certification of QMS;	2
Lec10	Problem solving - what is the problem, PDCA cycle application, selected quality improvement tools (from 7 classic and 7 new ones)	2
Lec11	Introduction to quality management methods. Understanding of process and its variation. The role of data in quality management. Importance of statistical thinking in analysis of process variation.	2
Lec12	Statistical Process Control (SPC) method. Understanding of process stability and process capability. Basic control charts and its applications.	2
Lec13	Risk analysis in quality management. FMEA method as an example of risk analysis method in supporting quality management.	2
Lec14	Role of prevention in quality management. Methods for prevention of nonconformities (Poka-Yoke). Role of measurement systems in quality management and basic methods of their capability assessment.	2
Lec15	Final test.	2
		Total hours: 30
Form of classes – Seminar		Number of hours
Sem1	Organizational matters.	1
Sem2	Quality gurus. Selected quality management concepts (Kaizen, Six Sigma, etc.).	2
Sem3	Quality awards. Financial aspects of quality management. Customer's satisfaction.	2
Sem4	Quality of services. Legal aspects of metrology. Laboratory accreditation. Information security management. Good Manufacturing Practice.	2
Sem5	Producer's responsibility for the product. Benchmarking. Quality planning. Selected statistical techniques in quality management.	2
Sem6	System for measurement management. Innovations in quality management. Taguchi methods.	2
Sem7	Selected aspects of risk management. Quality management standards for selected industries	2
Sem8	Grading combined with the control of the acquired knowledge according to the needs.	2
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. multimedia presentation
N3. 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	Test
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_U01, PEK_U02; PEK_K02	Assessment of presetation, answers to questions Participation in discussion
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Hamrol A. - Zarządzanie jakością z przykładami. PWN, 2012.
2. Zymonik Z., Hamrol A., Grudowski P. Zarządzanie jakością i bezpieczeństwem. PWE, 2013.
3. Lecture slides.

SECONDARY LITERATURE

1. W. J. Latzko, D. M. Saunders, Cztery dni z dr. Demingiem. Nowoczesna teoria zarządzania., Warszawa: Wydawnictwa Naukowo-Techniczne, 1998.
2. J. Oakland, P. Morris, "TQM. Ilustrowany przewodnik menedżera", Warszawa: Centrum Informacji Menedżera, 2000.
3. Szczepańska K., Zarządzanie jakością : koncepcje, metody, techniki, narzędzia. 2015
4. ISO standards on quality management.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Quality management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W16	C1	Lec1-Lec15	N1
PEK_U01, PEK_U02,	K1ZIP_U16	C1	Sem1-Sem8	N2, N3
PEK_K01, PEK_K02	K1ZIP_K10	C1	Sem1-Sem8	N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy zarządzania**
Name in English: **Essentials of Management**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031039**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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

1. No initial prerequisites are required.

SUBJECT OBJECTIVES

C1. Acquiring knowledge about the process of management and basic trends and concepts of management.
C2. Acquiring knowledge about the nature and mechanisms of an organization.
C3. Acquiring knowledge about 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 the process of management and 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	Organization and its resources. Introduction of the process of management.	2
Lec2	Organization's environment. Manager and manager's work.	2
Lec3	The evolution of the theory of management.	2
Lec4	The function of planning in organization. Decision making process.	2
Lec5	Strategy and strategic management.	2
Lec6	The function of organizing. Organizational structures.	2
Lec7	Human resources management.	2
Lec8	The function of leading. Human behaviors in organizations.	2
Lec9	Motivating.	2
Lec10	The function of controlling. Steps and levels of control.	2
Lec11	Knowledge in organization as a basis of competitive advantage. Knowledge management.	2
Lec12	Changes in organizations. Change management. Innovations and innovations management.	2
Lec13	Entrepreneurship. Creating new ventures.	2
Lec14	The culture of organization. Intercultural management and international management.	2
Lec15	Test.	2
		Total hours: 30

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_W03	Test.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Griffin R.W., Podstawy zarządzania organizacjami, PWN, Warszawa 2017.
2. Koźmiński A.K., Piotrowski W., Zarządzanie. Teoria i praktyka, PWN, Warszawa, 2013.
3. Masłyk-Musiał E., Rakowska A., Krajewska-Bińczyk E., Zarządzanie dla inżynierów, PWE, Warszawa, 2012.

SECONDARY LITERATURE

1. DeCenzo D.A., Robbins S.P., Podstawy zarządzania, PWE, Warszawa, 2002.
2. Hatch M.J., Teoria organizacji, PWN, Warszawa, 2002.
3. Hopej M., Kamiński R., Struktury organizacyjne współczesnych organizacji, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2010.
4. Malara Z., Przedsiębiorstwo w globalnej gospodarce. Wyzwania współczesności, PWN, Warszawa 2013.
5. Miesięcznik Harvard Business Review Polska.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Essentials of Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W14	C1, C2, C3		N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Ekologia**
Name in English: **Ecology**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031040**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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

1. Has the basic knowledge of chemistry, biology and ecology.
2. Makes use of reference literaturę, exploits available sources, both via the Internet and in print form.

SUBJECT OBJECTIVES

C1. To get the student acquainted with the basic problems of ecology and environmental protection.
C2. To get to know threats resulting from human activity.
C3. Familiarisation with modern solutions serving environmental protection.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Has the basic knowledge of the hazards arising from the industrial activities
PEK_W02 - Has theknowledge of the international conventions and Polish environmental regulations.
PEK_W03 - Can characterize modern solution for environmental protection.

II. Relating to skills:

III. Relating to social competences:

PEK_K01 - Has the awareness regarding the importance of non-technical impacts of anthropogenic activity.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Basic concepts and definitions of ecology and environmental protection.	2
Lec2	Opportunities and threats associated with non-renewable energy resources.	2
Lec3	Unconventional non-renewable energy resources.	2
Lec4	Fuel combustion processes.	2
Lec5	The negative environmental effects related with atmosphere pollution.	2
Lec6	Ways to reduce emissions from fuel combustion processes.	2
Lec7	Renewable energy resources	5
Lec8	Energy storage.	3
Lec9	Waste management.	4
Lec10	Environmental management in the scope of sustainable development.	2
Lec11	Final test.	4
		Total hours: 30

TEACHING TOOLS USED

N1. multimedia presentation
N2. tutorials
N3. 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_W03	Written final test.
F2	PEK_K01	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
1. Authoritative internet sources.

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Ecology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W20	C1 - C3	Lec1 ÷ Lec10	N1, N2, N3
PEK_K01	K1ZIP_K08	C1 - C3	Lec1 ÷ Lec10	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Informatyka w zastosowaniach inżynierskich**
Name in English: **Computer engineering applications**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031043**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				30	
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. Knowledge of building and solving mathematical models of engineering problems.
2. Basic knowledge of computer and computer programming.

SUBJECT OBJECTIVES

C1. Preparation of the modern engineer to work according to the latest requirements of the application of computational tools.
C2. Gaining knowledge in the application of informatics and numerical computational techniques in tehnique.
C3. Gaining skills in selected functional programming environments, spreadsheets and computing environments for engineering applications.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - Ability to program IT environment to carry out engineering calculations.
PEK_U02 - Ability to configure the IT supported calculation environment to perform engineering calculations.
PEK_U03 - The ability to connect the user interface to the database.

III. Relating to social competences:

PEK_K01 - Awareness of the role of the engineer in the manufacturing process and the need for accountability and involvement in one of the most important links of the production process in the company.
PEK_K02 - Awareness of the legal aspects and impacts of engineering.
PEK_K03 - Understands the need for lifelong learning in the field of business engineering and professional as well social skills development.

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Application of MAXIMA calculation tool.	7
Proj2	Application of GOOGLE DOCUMENTS tools	7
Proj3	EXCEL in engineering application	8
Proj4	Engineering application in Visual C++ environment	4
Proj5	Engineering application in Visual Basic environment	4
		Total hours: 30

TEACHING TOOLS USED

N1. problem exercises
N2. self study - preparation for project class

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_K02, PEK_K03	Completion of project tasks and project defense
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Zbigniew Smogur, Excel w zastosowaniach inżynieryjnych, ISBN: 83-7197-641-0, HELION
2. Andrzej Stanisz, Przystępny kurs statystyki (w oparciu o program STATISTICA Pl)
3. Bogumiła Mrozek, Zbigniew Mrozek, MATLAB i Simulink. Poradnik użytkownika, HELION

SECONDARY LITERATURE

1. Maciej Gonet, Excel w obliczeniach naukowych i inżynierskich Wydanie II, ISBN: 978-83-246-3066-0, HELION
2. Dokumentacja do programu Statistica

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Computer engineering applications
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_U10	C1 - C3	Pr1 - Pr5	N1, N2
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K09	C1 - C3	Pr1 - Pr5	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy projektowania mechanizmów**
Name in English: **Basics of mechanisms design**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031045**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
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. knowledge of mathematics, physics and mechanics
2. ability to solve basic problems of mathematical analysis and the ability to describe the basic physical phenomena

SUBJECT OBJECTIVES

C1. Understanding the basic principles of construction and methods of analysis, modeling and design machines
C2. Understanding the properties of selected groups of planar and spatial mechanisms (linkages, gears, cams and manipulators)

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - has a theoretical knowledge of analysis of kinematic system
PEK_W02 - has a theoretical knowledge of design of kinematic systems

II. Relating to skills:
PEK_U01 - The ability to define the basic elements of mechanism
PEK_U02 - The ability to build a computer model of the mechanism and ability to perform simulation researches
PEK_U03 - Ability to analyze of kinematics and kinetostatics of mechanisms using vector, analytical and computer methods

III. Relating to social competences:
PEK_K01 - a sense of responsibility for their own work and the willingness to comply with the rules work in a team and to take responsibility for collaborative tasks
PEK_K02 - Understands the impact of engineering

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Overview of machines and mechanisms, basics of structural analysis	2
Lec2	Structural analysis of mechanisms - mobility, local mobility, constraints	2
Lec3	Methods for the type synthesis of mechanisms	2
Lec4	Kinematic analysis of mechanisms - methods for determining the new positions, centers of rotation	2
Lec5	Kinematic analysis of mechanisms - methods for determining the velocity and acceleration	2
Lec6	Elements of dynamic analysis - forces in kinematic systems (inertial forces, the active forces, the forces in joints)	2
Lec7	Elements of dynamic analysis - Kinetostatics (vector method)	3
Lec8	Linkage mechanisms - property characterization, analysis and application	3
Lec9	Planetary gear mechanisms - analysis, characteristics, applications	2
Lec10	Manipulators (serial, parallel) -construction, characteristics, applications, kinematics manipulators	3
Lec11	Cam mechanisms- characteristics, applications, analysis and design	3
Lec12	The geometric synthesis of linkage mechanisms	2
Lec13	Test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Structural analysis of mechanisms (class of joints, rules of schematization, mobility of mechanisms (project and short test)	3
Proj2	Basics of computer modeling of mechanisms in program SAM (Simulation and Analysis of Mechanism)	2
Proj3	Advanced modeling of mechanisms in the program SAM (dimensions, drives)	2

Proj4	Linkages mechanisms - kinematic analysis (vector method), (project and short test)	2
Proj5	Modeling and computer simulations of linkage mechanisms (project)	2
Proj6	Linkages mechanisms - kinetostatic analysis (vector method), (project and short test)	2
Proj7	Modeling and computer simulations of planetary gear mechanisms (project)	2
		Total hours: 15

TEACHING TOOLS USED

N1. problem lecture
N2. multimedia presentation
N3. tutorials
N4. self study - preparation for project 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_W02	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 PEK_K01, PEK_K02	Evaluation of the project, Evaluation of the short test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Basics of mechanisms design
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W05	C1, C2	Le1-Le12	N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U05	C1, C2	Pr1-Pr7	N2, N3, N4
PEK_K01, PEK_K02	K1ZIP_K04, K1ZIP_K09	C1, C2	Pr1-Pr7	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Przetwórstwo tworzyw sztucznych**
Name in English: **Processing of plastics**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031048**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses	X				
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 knowledge of the material and mechanical properties of engineering materials

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge on the classification, properties, and methods of processing plastics.
C2. Acquisition of skills identification and selection of polymeric materials for technical applications.
C3. The acquisition and consolidation of social skills including emotional intelligence skills relying on cooperation in the group of students with a view to effective problem solving. Responsibility, honesty and fairness in the procedure observance force in academia and society.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - knows the types and basic properties of polymeric materials
PEK_W02 - knows the basic method of processing of polymeric materials
PEK_W03 - has knowledge of the basics and applications of polymeric materials processing

II. Relating to skills:
PEK_U01 - able to identify polymeric materials
PEK_U02 - processing method is able to select the type of polymeric material
PEK_U03 - able to select a polymer material for technical applications

III. Relating to social competences:
PEK_K01 - search for information and its critical analysis
PEK_K02 - objectively examine the arguments, rational translations and justify their own point of view, using knowledge of plastic processing
PEK_K03 - observance and rules in academia

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. Definitions of polymers and plastics. Methods for the preparation of polymers. The chemical and physical structure of polymers. Basic concepts of polymer materials.	2
Lec2	Modification of polymers. Types and effects of additives on the properties of plastics. Properties of polymeric materials for the metal.	2
Lec3	Construction, variety, properties and applications of selected polymers.	4
Lec4	Classification of methods of plastics processing. Methods of preparation. Selected methods of direct forming.	2
Lec5	Plastic extrusion technology. Variations of the process extrusion. Calendering.	2
Lec6	Plastic injection molding technology.	2
Lec7	Defects of injection molding products. Influence of process parameters on defect injection molded parts.	2
Lec8	Methods for forming the intermediate plastics.	2
Lec9	Processing of plastics - finishing methods.	2
Lec10	Polymer composites.	2
Lec11	Issues relating to the exploitation and consumption of polymeric materials.	4
Lec12	The problem of plastic waste. Classification of waste. Methods of polymer waste.	4
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Organizational matters. Identification of plastics.	2
Lab2	Methods of joining of plastic products.	2
Lab3	Molding of plastics products.	2

Lab4	Extrusion technology.	2
Lab5	Compression and thermoforming technology.	2
Lab6	Injection molding technology.	2
Lab7	The study of friction and abrasive wear of polymeric materials.	2
Lab8	Supplementary classes.	1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. self study - preparation for laboratory class
N3. self study - self studies and preparation for examination
N4. tutorials
N5. laboratory experiment, showing methods of plastics processing, display selected research methods

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 and 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_U02, PEK_U03; PEK_K01, PEK_K02, PEK_K03	quick quiz, oral answer, laboratory reports, written tests
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Robert Sikora, tytuł: Processing of macromolecular materials, Wydawnictwo Edukacyjne Zofii Dobkowskiej, rok: 1993

SECONDARY LITERATURE

K.Wilczynski, tytuł: Processing of plastics

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Processing of plastics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W02, K1ZIP_W08, K1ZIP_W27	C1	Lec1-Lec12	N1, N3, N4
PEK_U01, PEK_U02, PEK_U03;	K1ZIP_U02, K1ZIP_U08	C1, C2	Lab1-Lab8	N2, N4, N5
PEK_K02	K1ZIP_K02	C3	Lab1-Lab8	N2, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Struktury danych w inżynierii produkcji**
Name in English: **Data structures in production engineering**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031049**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
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					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of modeling - algorithms, processes
2. Basic knowledge of computer systems

SUBJECT OBJECTIVES

C1. The aim of the course is to get acquainted with the process of designing data structures for engineering data modeling
C2. Correct identification and modeling needs of future users of database systems
C3. transfer of the basic knowledge required to use the SQL queries language
C4. The ability to create complex data structures

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Has basic knowledge of the process of designing data structures
PEK_W02 - Has a knowledge of modeling and recognizing the needs of users.
PEK_W03 - Has a knowledge of relational database management systems

II. Relating to skills:
PEK_U01 - Can design a data structures and use SQL to communicate with databases
PEK_U02 - Can properly identify and model the needs of future users of the database
PEK_U03 - Able to use the relational database management system

III. Relating to social competences:
PEK_K01 - Think and act in a logical manner
PEK_K02 - Can draw logical conclusions and solve the stated problem in orderly manner.
PEK_K03 - Can appropriately define the priorities for implementation tasks specified by you or others.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Theory of management / data collection - introduction	2
Lec2	Development of databases - data types	2
Lec3	The principle of operation of relational databases	2
Lec4	The theoretical basis of data structures design .	2
Lec5	Designing conceptual, logical and physical data structures	2
Lec6	Database normalization	2
Lec7	Getting to know the language (SQL commands: SELECT, INSERT, UPDATE, DELETE and administrative commands, definition of: tables, indexes, views, etc.). Test.	3
		Total hours: 15

Form of classes – Project		Number of hours
Proj1	Practical basics of data structures design .	2
Proj2	Designing conceptual, logical and physical data structures - practice	4
Proj3	Getting to know the basics of database administration (setting up a database, user administration, granting rights to objects in the database, backup, replication, etc.).	4
Proj4	Getting to know the language (SQL command SELECT, INSERT, UPDATE, DELETE and administrative commands, define tables, indexes, views, etc.). - Practice.	4
Proj5	Data structure design to meet defined criteria.	12
Proj6	Project testing	4
		Total hours: 30

TEACHING TOOLS USED

N1. problem discussion
N2. tutorials
N3. self study - preparation for project class
N4. project presentation
N5. 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	Final test
P =		

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_K02, PEK_K03	project defense
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
Relacyjne bazy danych Autorzy: Mark Whitehorn, Bill Marklyn Data wydania: 2003/08
Bazy danych SQL. Teoria i praktyka Autor: Wiesław Dudek Data wydania: 2006/11

SECONDARY LITERATURE
SQL. Rusz głową! Autor: Lynn Beighley Data wydania: 2010/11

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Data structures in production engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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;	K1ZIP_W10	C1, C2, C3	Wy1 - Wy7	N5, N2
PEK_U01- PEK_U03	K1ZIP_U10	C1, C2, C3	Pr1 - Pr6	N1, N2, N3, N4
PEK_K01- PEK_K03	K1ZIP_K04	C2	Pr1 - Pr6	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Systemy informatyczne w zarządzaniu przedsiębiorstwem ERP**
Name in English: **Information systems in the enterprise management**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031050**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
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. Basic knowledge of the operation of the business in terms of materials management.
2. The ability to acquire information from the documents and their interpretation.
3. Computer skills.

SUBJECT OBJECTIVES

C1. Introduction to the problems of integrated management systems
C2. Getting the student from the basic knowledge of the mode of action and implementation of MRP II and ERP
C3. Acquisition of basic umiętności using MRP II and ERP

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knowledge of integrated manufacturing systems
PEK_W02 - Knowledge of the concepts used in Integrated Information System - stuktura production, purchasing position, route and schedule of technology
PEK_W03 - Knowledge of Integrated Information System applications in production

II. Relating to skills:
PEK_U01 - Ability to use integrated management system, for example IFS Application
PEK_U02 - Ability to use technology production structure
PEK_U03 - Ability to design a technological route in Integrated Information System

III. Relating to social competences:
PEK_K01 - Able to work in a group, went through various roles in the organization of enterprises
PEK_K02 - Recognizes the importance of data quality in Integrated Information System

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Batch, Characteristics of the production cycle	2
Lec2	Stocks Production, Production Planning	2
Lec3	Management Information Systems, MRP I and MRP II	4
Lec4	Workflow systems	2
Lec5	CASE * Method, function hierarchy diagrams	2
Lec6	Methods for identifying the functions of the company, depending on the function diagrams, entity relationship diagrams	3
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Preliminary information on the operation of IFS Applications. Generating companies in IFS Applications. Defining the structure of production.	2
Proj2	Defining the position of purchase. Defining costs. Sales.	2
Proj3	Entering data storage products. Define the product structure.	2
Proj4	Defining the position of product in different production lines. Routes production.	5
Proj5	Entry of items in shopping. Generate schedule. Generating MRP report.	2
Proj6	Generating MRP report.	2
		Total hours: 15

TEACHING TOOLS USED

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

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_U02, PEK_U03 PEK_K01, PEK_K02	Presentation and defense of the MRP report
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Zintegrowany system zarządzania przedsiębiorstwem IFS Applications : ćwiczenia z obsługi : wybrane moduły : praca zbiorowa / pod red. Leszka Kiełtyki ; Politechnika Częstochowska.
2. Oracle : system zarządzania bazą danych : podręcznik użytkownika / Michał Lentner. Warszawa : Akademicka Oficyna Wydawnicza EXIT, 2001.

SECONDARY LITERATURE

SAP - zrozumieć system ERP / Jerzy Auksztol, Piotr Balwierz, Magdalena Chomuszko. Warszawa : Wydawnictwo Naukowe PWN, 2012.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Information systems in the enterprise management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W10, K1ZIP_W15	C1, C2, C3	Lec1 - Lec6	N1, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U15, K1ZIP_U23	C2, C3	Pr1 - Pr6	N3
PEK_K01, PEK_K02	K1ZIP_K11	C3	Pr1 - Pr6	N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie produkcją i usługami II**
Name in English: **Production and Services Management II**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031052.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
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	1.2			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		3
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		2
Proj2		4
Proj3		3
Proj4		6
		Total hours: 15

TEACHING TOOLS USED

N1. multimedia presentation
N2. self study - preparation for project class
N3. case study
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	
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_K02, PEK_K03	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Production and Services Management II
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W14, K1ZIP_W15	C1, C2, C3		N1, N3, N4
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U14, K1ZIP_U15	C2, C3		N2, N3, N4
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K01, K1ZIP_K02	C2, C3		N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy logistyki**
Name in English: **Fundamentals of logistics**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031053**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15			
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. Basic knowledge of the organization and operation of the production enterprise

SUBJECT OBJECTIVES

C1. To familiarize students with the basic tasks of logistics business processes.
C2. Some specific models and methods used in the design and evaluation of logistics systems.
C3. Characterization of core technology and material flow logistics information systems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - He knows the structure of the logistics system, its components and the relationships between them.

PEK_W02 - He knows the methods and strategies of managing logistics processes in the enterprise

II. Relating to skills:

PEK_U01 - It can be used for selected models and methods for the design, management and evaluation of logistics system.

PEK_U02 - He can choose the material flow technology and information flow

III. Relating to social competences:

PEK_K01 - Able to present opinions on the social and environmental impact of the operation of the supply chain.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	History of the development of logistics. Basic concepts and definitions.	2
Lec2	System and logistics process, structure. classification criteria	2
Lec3	Strategies for managing logistics processes; Just In Time.	2
Lec4	Logistics supply. Inventory management.	2
Lec5	Logistics of production. Range of computer support: MRP I, MRP II, ERP.	2
Lec6	Logistics distribution. Demand forecasting	2
Lec7	Reverse logistics. Ecologistics	2
Lec8	Information technology, automatic identification method.	2
Lec9	Information Technology, Electronic Data Interchange.	2
Lec10	Packaging. Basic functions. Logistic label.	2
Lec11	Technologies of storage.	2
Lec12	Handling technology	2
Lec13	Transport technologies. Linear infrastructure .	2
Lec14	Logistics centers. Point infrastructure .	2
Lec15	Logistics optional; examples: peacekeeping, health, public events.	2
		Total hours: 30
Form of classes – Classes		Number of hours
Cl1	Introduction to exercise. Overview of the exemplary embodiment of the supply chain	2
Cl2	Inventory management. Classification ABC / XYZ.	2
Cl3	Forecasting demand	2
Cl4	Selection of inventory control system	2
Cl5	Simulation of a Kanban production system	2
Cl6	Transport management in the context of supply chain	2

Cl7	Storage. Summary of activities.	3
		Total hours: 15

TEACHING TOOLS USED
N1. traditional lecture with the use of transparencies and slides N2. problem exercises 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_W02	Written exam - 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_K01	test, oral answer
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Ballou R.H. Business :ogistics / Supply Chain Management. Pearson Education Inc. 2004.
Logistyka. Red. D. Kisperska_Moroń, S. Krzyżaniak. ILiM, Poznań 2009.
Logistyka. Teoria i praktyka.Tom I i II. Red. S. Krawczyk. Difin, Warszawa 2011.

SECONDARY LITERATURE

Zając P.: CRM - Zarządzanie relacjami z klientem w logistyce dystrybucji. Navigator 17. Oficyna Wydaw. Politechniki Wrocławskiej, Wrocław 2007.
Kwaśniowski S., Nowakowski T., Zając M.: Trasnport intermodalny w sieciach logistycznych. Navigator 18. Oficyna Wydaw. Politechniki Wrocławskiej, Wrocław 2008.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fundamentals of logistics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W17	C1, C3	Lec1, Lec2, Lec8 - Lec15	N1
PEK_W02	K1ZIP_W17	C2	Lec2 - Lec7	N1
PEK_U01	K1ZIP_U17	C2	Cl1 - Cl7	N2, N3
PEK_U02	K1ZIP_U17	C2	Cl1 - Cl7	N2, N3
PEK_K01	K1ZIP_K02	C1	Cl1 - Cl7	N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Lean Management**
Name in English: **Lean Management**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031055**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				15
Number of hours of total student workload (CNPS)	60				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses	X				
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				

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	Presentation of Toyota history and Lean Manufacturing roots and how it was popularized worldwide. Explanation of "Toyota Production System house".	3
Lec2	Presentation of 8 types of wastes in production processes. Explanation of value adding activities. Presenting 5 Lean principles of Womack and Jones. Explaining Value Stream Mapping method.	3
Lec3	System 5S. Total Productive Maintenance.	3
Lec4	Setup time reduction methodology. Designing continuous flow production lines and cells. Definitions of takt time, cycle time, planned cycle time, operator cycle time and lead time.	3
Lec5	Standardized Work.	3
Lec6	Designing Lean internal plant logistics. Methodology for calculating the maximum stock level for each purchased part in the supermarket.	3
Lec7	Designing pull system for the control of the production flow. Different types of pull system: replenishment pull, sequential pull, mixed pull system. Methodology for calculating the maximum stock level for both finished product and central supermarkets. Types of kanbans. Hejiunka.	3
Lec8	Lean Transformation Framework. Lean Product and Process Development.	3
Lec9	Introduction to Six Sigma. Design for Six Sigma.	3
Lec10	Final test.	3
		Total hours: 30
Form of classes – Seminar		Number of hours
Sem1	Explaining the seminar organizational framework, rules to prepare presentation and guidelines for discussions. Assigning presentation topics and dates to students.	3
Sem2	1. Toyota Way - 14 Toyota's Management Principles. 2. Glenday sieve and improving high mix production in batches. 3. Employee suggestion system. 4. TWI (Training within Industry) Job Instruction.	3
Sem3	5. TWI (Training within Industry) Job Method. 6. TWI (Training within Industry) Job Relation. 7. A3 method. 8. Mapping the consumption and provision stream.	3
Sem4	9. Lean Office. 10. Lean healthcare. 11. Lean dealership. 12. Lean Government. 13. Toyota Kata.	3
Sem5	13. Toyota Kata. 14. Hoshin Kanri. 15. Extended Value Stream Mapping. 16. Implementing Lean in company – case study.	3
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. multimedia presentation
N3. problem discussion

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Liker, Jeffrey K. Droga Toyoty: 14 zasad zarządzania wiodącej firmy produkcyjnej świata / Warszawa: Wydawnictwo MT Biznes, cop. 2005.
2. Glenday, Ian. Przejdź na logikę przepływu: przestań gasić pożary i popraw obsługę klienta / Wrocław: Lean Enterprise Institute Polska, 2010.
3. Kaizen na hali produkcyjnej / Wrocław: ProdPublishing.com, 2010.
4. Imai, Masaaki (1930-). Kaizen: klucz do konkurencyjnego sukcesu Japonii / Warszawa: Wydawnictwo MT Biznes, cop. 2007
5. Imai, Masaaki (1930-). Gemba kaizen: zdroworozsądkowe, niskokosztowe podejście do zarządzania / Warszawa: Wydawnictwo MT Biznes, cop. 2006.
6. Łukasz Dekier, Adrian Grycuk: PROGRAMY SUGESTII PRACOWNICZYCH: Doświadczenia polskich przedsiębiorstw, Wrocław 2014: http://leanpolska.org/wp-content/uploads/Raport-SLMP-Programy-sugestii-pracowniczych-2014.pdf
7. Graupp, Patrick., Wrona, Robert J. Podręcznik TWI: doskonalenie niezbędnych umiejętności przełożonych / Wrocław: Wydawnictwo Lean Enterprise Institute Polska, 2010.
8. Liker, Jeffrey K., Meier, David. Toyota talent: rozwijaj swoich pracowników na sposób Toyoty / Warszawa: MT Biznes, cop. 2008.
9. Shook, John. Zarządzać znaczy uczyć: rozwiazywanie problemów i rozwój pracowników z wykorzystaniem metody A3 / Wrocław: Lean Enterprise Insititute Polska, 2010.
10. Sobek, Durward K., Smalley, Art. Understanding A3 thinking: a critical component of Toyota's PDCA management system / Boca Raton [etc.]: CRC Press/Taylor & Francis Group: Productivity Press, cop. 2008.
11. Womack, James P., Jones, Daniel T. Szczupłe rozwiązania czyli Jak przedsiębiorstwa i ich klienci mogą pomnażać korzyści ze wzajemnej współpracy stosując zasady Lean Mangement / Wrocław: Wydawnictwo Lean Enterprise Institute Polska, 2010.
12. Fabrizio, Tom., Tapping, Don. 5S w biurze: organizacja miejsca pracy i eliminacja marnotrawstwa / Wrocław: ProdPublishing, 2010.
13. Tapping, Don., Shuker Tom Zarządzanie strumieniem wartości w biurze / Wrocław: ProdPublishing
14. Locher, Drew. Lean w biurze i usługach: przewodnik po zasadach szczupłego zarządzania w środowisku pozaprodukcyjnym / Warszawa: MT Biznes, 2012.
15. Keyte, Beau. Locher, Drew. The complete lean enterprise: value stream mapping for administrative and office processes / New York: Productivity Press, cop. 2004.
16. Locher, Drew. Tworzenie szczupłego przepływu w procesach biurowych oraz usługowych: http://lean.org.pl /tworzenie-szczuplego-przeplywu-procesach-biurowych-uslugowych/
17. 5S na produkcji i w biurze, czyli jak systemowo wdrożyć ład i porządek w miejscu pracy: http://lean.org.pl/5s-na-produkcji-i-w-biurze/
18. Lean Office i Lean Administration – filozofia Lean Management na gruncie administracyjnym i biurowym: http://lean.org.pl/lean-office-i-lean-administration/
19. Graban, Mark. Lean Hospitals - doskonalenie szpitali. Poprawa jakości, bezpieczeństwo pacjentów i satysfakcja personelu / Wrocław: ProdPublishing
20. Jackson, Thomas L. 5S w służbie zdrowia / Wrocław: ProdPublishing
21. Baker, Marc., Taylor, Ian., Mitchell, Alan. Making Hospitals Work / Lean Enterprise Academy Limited 2009
22. Dave Brunt and John Kiff Creating Lean Dealers: The Lean Route to Satisfied Customers, Productive Employees and Profitable Retailers / Lean Enterprise Academy Limited 2007
23. Rother, Mike. Toyota Kata: zarządzanie ludźmi w celu doskonalenia, zdobywania umiejętności adaptacji oraz osiągania ponadprzeciętnych wyników / Wrocław: Lean Enterprise Institute Polska, cop. 2011.
24. Hutchins, David C. Hoshin Kanri: strategiczne podejście do nieustannego doskonalenia / Warszawa: Oficyna a Wolters Kluwer Business, 2010.
25. Jackson, Thomas L. Hoshin Kanri w Szczupłym Przedsiębiorstwie - Budowanie Przewagi Konkurencyjnej i Zarządzanie Zyskami / Wrocław: ProdPublishing 2012
26. Jones, Daniel T. , Womack, James P. Zobaczyć całość: mapowanie rozszerzonych strumieni wartości: podręcznik wdrażania przełomowych zmian wg LEI / Wrocław: Learn Enterprise Institute Polska, cop. 2007.
27. Materiały Konferencji Lean Management i Konferencji Lean Manufacturing (edycje II – XV)
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SECONDARY LITERATURE

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Lean Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W14, K1ZIP_W16			
PEK_U01	K1ZIP_U14, K1ZIP_U16			

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Grafika inżynierska - zapis konstrukcji**
Name in English: **Engineering Graphics - Engineering Drawing**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031056**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			30	
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. Basic knowledge of descriptive geometry.
2. Basic drawing skills and use of computer equipment.
3. The skill to use the Internet digital resources

SUBJECT OBJECTIVES

C1. The acquisition of knowledge and skills in axonometric projection and rectangular in mapping the elements of space on the plane and the rules for engineering drawing with the use of views, sections, and lays in the engineering drawings.
C2. The acquisition of knowledge and skills in the dimensioning and tolerancing of dimensions of machine parts, as well as the identification of their surface features and shape and position tolerances.
C3. The acquisition of knowledge and skills in the field of graphic representation of connections of machines and rules for standardization in constructions drawings, as well as elements drawings (manufacturing drawings) and complex systems (assembly drawings) and the principles of schematization.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student knows and is able to explain the rules of constructions drawings and creating the technical documentation of elements and mechanical components.

PEK_W02 - The student knows how to call the basic parameters characterizing the geometric features of a product and propose how to save these information.

PEK_W03 - The student knows the principles of graphic representation of joint of machine elements and drawing the standard machine elements.

II. Relating to skills:

PEK_U01 - Student is able to make in a handwritten way, or by using the drawing instruments and computer drawing software (AutoCAD) construction drawing and schematization of technical systems.

PEK_U02 - The student knows how to read the record of the technical documentation of the machine component and complex technical systems and schematic drawing.

PEK_U03 - Student can identify and record the basic standardized connection of machine parts.

III. Relating to social competences:

PEK_K01 - The student has the ability to critically assess the correctness in drawing the technical documentation of machine component and complex technical systems.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. The importance of the engineering drawing. Rules for structure drawings. The basics of creating handwritten drawings and using them Computer programs (CAD).	2
Lec2	Rectangular and axonometric projections.	2
Lec3	The views, sections and lays in the engineering drawing.	2
Lec4	Principles of dimensioning in the engineering drawing.	2
Lec5	Test - rectangular projections.	2
Lec6	Tolerances and fits of machine parts.	2
Lec7	Surface roughness of machine parts, deviations of form and position.	2
Lec8	Drawing of joints of machine elements - rules for drawing disconnect connections.	2
Lec9	Drawing of joints of machine elements - rules for drawing inseparable connections.	2
Lec10	Types of drawings in the engineering drawing.	2
Lec11	Saving complex systems.	2
Lec12	Rules of schematization.	2
Lec13	Drawing of standard machine elements.	2
Lec14	Final test.	2
Lec15	Discussion of the colloquium and the course summary.	2
		Total hours: 30

Form of classes – Project		Number of hours
Proj1	Introduction: the rules and organization of activities, the purpose of the course, a framework program of the course, credit conditions. Basics AutoCAD – performing the simple drawings: the organization of the graphical editor, create the prototype drawing. Basic drawing functions (line, circle, arc, etc.) - Exercises in drawing.	2
Proj2	Issue of topic I: based on axonometric drawing from the chapter 6 [3] should the freehand drawing element in three rectangular views be drawn. Fundamentals of AutoCAD CD, editing tools (erase, trim, extend, etc.).	2
Proj3	On the basis of freehand drawing element from the chapter 6 [3] the drawing of this element in AutoCAD should be made. Apply the respective sections in order to see the inside of the element.	2
Proj4	Principles of dimensioning in AutoCAD. AutoCAD dimensioning styles. Dimensioning of the drawing from previous classes (from Ch. 6 [3]).	2
Proj5	Draw the element specified in the 1st topic in isometric using AutoCAD. Use a isometric jump, switching planes and isometric drawing in those planes. Task assesment - the 1st subject. topic II issue: the task from chap. 3 [3] – freehand drawing.	2
Proj6	Drawing topic II in AutoCAD, dimensioning with taking the tolerated dimensions into consideration, explicitly specify the size of tolerated deviations, entering the text in AutoCAD - notes, drawing attention.	2
Proj7	Colloquium about the existing material (1 hr.). Receive task - the subject II. Topic III: drawing of construction elements that are more complex in geometric form, tasks from the chapter. 5.1 [3].	2
Proj8	Correcting the freehand drawing (roller type) from Ch. 5.1 [3] and starting the drawing in AutoCAD. (dimensioning rules - subordinate to the plans, views, sections, examples).	2
Proj9	Continuation of topic III from chapter III. 5.1 [3] - dimensioning of element in AutoCAD. Building Blocks, broadcast attributes (Determination of surface roughness).	2
Proj10	Continued topic III - deviations of form and position in AutoCAD, explicitly specify the size deviations tolerated, additional information (as due) - Enter text in AutoCAD.	2
Proj11	Topic IV: the construction task. Any subject - set by the teacher. Recommendations: little complicated engineering system, consisting of several parts (5 to 10), eg .: hinge bolt from the chapter 4 [3], the flexible coupling inseparable PN, bearing puller, a car jack (indicated models of these bands). Performing its documentation - exploded view drawings and selected 3 interacting with each other elements.	2
Proj12	Execution of assembly drawing of machine assembly using AutoCAD (discussing the substance of an assembly drawing, a drawing tablet, saving the typical connections and machinery components of standardization in the record structure).	2
Proj13	Execution of drawings of components of the machine assembly using AutoCAD.	2
Proj14	Subject V - performing the schematic drawing of the kinematic assembly of the subject VI or a new topic - based on the assembly drawing (by hand and by AutoCAD).	2
Proj15	Pick the subject IV and V. A course.	2
		Total hours: 30

TEACHING TOOLS USED

N1. Traditional lecture with the use of transparencies and slides.
N2. Consultations.
N3. Own work - preparing the draft.
N4. Independent work on the computer under the guidance of lecturer.
N5. Presentation of the project.

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 = 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_U01 , PEK_U02 , PEK_U03	Quiz, oral answers, assessment of individual work in the design class.
F2	PEK_U01 , PEK_U02 , PEK_U03 , PEK_K01	Evaluation of project preparation.
F3	PEK_U01 , PEK_U02 , PEK_U03 , PEK_K01	Test.
P = 0,4*F1 + 0,3*F2 + 0,3*F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Dobrzański T., Rysunek Techniczny Maszynowy. WNT, Warszawa, 2009.
[2] Rydzanicz I., Zapis konstrukcji. Podstawy. Oficyna Wyd. PWr., Wrocław 2000.
[3] Rydzanicz I., Rysunek techniczny jako zapis konstrukcji. Zadania. WN-T, Warszawa 2004.

SECONDARY LITERATURE

[4] Rysunek techniczny i rysunek techniczny maszynowy. Zbiór Polskich Norm.
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[6] Potrykus J., red. Poradnik mechanika (praca zbiorowa). Wyd. REA s.j., Warszawa 2008.
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Engineering Graphics - Engineering Drawing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W04, K1ZIP_W05	C1, C2, C3	Lec1-7	N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U04	C1, C2, C3	Pr1-14	N2, N3, N4, N5
PEK_K01	K1ZIP_K10	C1, C2, C3	Pr1-14	N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechanika**
Name in English: **Mechanics**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031057**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	30			
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 knowledge, skills and competences on the level after Mathematics I and Linear algebra

SUBJECT OBJECTIVES

C1. Solving technical problems based on 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 based quantities in Mechanics (Force and momentum).
PEK_W02 - He knows the solving methods of beams and frames
PEK_W03 - He knows the Centroid of Area, the center of Gravity of a Mass, Moments of inertia

II. Relating to skills:

PEK_U01 - He is able to calculate the inner forces in the beams and frames with their diagrams
PEK_U02 - He can calculate the joints constructures (strusses)
PEK_U03 - He can determine the centroidal and principal Moments of inertia

III. Relating to social competences:

PEK_K01 - He can search information and is able to critical review it.
PEK_K02 - He can objectively evaluate the arguments and rationally explain and justify own point of view on the base of knowledge from Mechanics
PEK_K03 - He can observe the customs and rules of the academic community

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Curriculum. Requirements. Literature.Theory of vectors algebra, statics, degrees of freedom, supports of the rigid body	2
Lec2	Force and momentum. Principal vector and principal momentum of forces system. Statics. Conditions of static equilibrium of forces system. The change of momentum point.	2
Lec3	The resultant of any set of forces.	2
Lec4	Plane forces system. Reactions in the statically determinate systems	2
Lec5	Concurrent forces system.	2
Lec6	Conditions of static equilibrium of forces system. Plane forces system reduction.	2
Lec7	Trusses. Method of Joints.	2
Lec8	Internal forces in Beams (analytical methods, diagrams).	2
Lec9	Centroid of Area. The center of Gravity of a Mass.	2
Lec10	Moments of inertia. Product of inertia. Parallel–axis theorem.	2
Lec11	Rotation transformation of Moments of inertia, Iinertia tensor, inertia ellipsoid. The principal axes.	2
Lec12	Kinematics, motion of particle, trajectory, one–dimensional model. Velocity, acceleration.	2
Lec13	Velocity and acceleration in natural coordinates. Classification of motions	2
Lec14	Velocity and acceleration in the plane motion.	2
Lec15	Test	2
		Total hours: 30
Form of classes – Classes		Number of hours

Cl1	The examples for Conditions of static equilibrium of forces system. Plane forces system reduction.	2
Cl2	Plane forces system. Determination of reactions in the supports.	2
Cl3	Resultans for Plane forces systems. Equations of equilibrium.	2
Cl4	Analytical methods of trusses solving. Ritter’s methods.	2
Cl5	Internal forces in beams (analytical methods, diagrams).	2
Cl6	Internal forces in beams (analytical methods, diagrams). Beams with Joints.	2
Cl7	Resultant using for Internal forces in Frames.	2
Cl8	Internal forces in Frames (analytical methods, diagrams).	2
Cl9	Test 1	2
Cl10	Centroid of Area. The center of Gravity of a discrete Multi-mass structures.	2
Cl11	Determination of Moments of inertia & inertia products. Parallel–axis theorem.	2
Cl12	Determination of the centroidal and principal axes and Moments.	2
Cl13	Kinematics of particle in orthogonal coordinates.	2
Cl14	Velocity in the plane motion.	2
Cl15	Test 2	2
		Total hours: 30

TEACHING TOOLS USED

N1. Traditional lecture with the use of transparencies and slides.
N2. Calculation exercises.
N3. Self study - preparation for project 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	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	Test 1, Test 2.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. J.L. Meriam, L.G. Kraige, Engineering Mechanics, volume 1, Statics, John Wiley & Sons, Inc., New York, 1998
2. J.L. Meriam, L.G. Kraige, Engineering Mechanics, volume 2, Dynamics, John Wiley & Sons, Inc., New York, 1998

SECONDARY LITERATURE

1. Mary Lunn, A First Course in Mechanics, Oxford Science Publications, Oxford 1991
2. Philip Dyke, Roger Whiteworth, Guide to Mechanics, MacMillan Press, London 1992
3. Herbert Goldstein, Classical Mechanics, Addison-Wesley Publishing Company, London

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W03	C1	Lec1 - Lec15	N1, N4, N5
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U01, K1ZIP_U03	C2	Cl1 - Cl15	N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Planowanie technologiczne CAD/CAM**
Name in English: **Technology planning CAD/CAM**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031059**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
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					

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 related to project management in the field of structural design and technology.
C4. Discussion of issues of selection, implementation and integration of CAD/CAM systems.

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	Integration of CAD/CAM systems.	2
Lec3	Project management in an environment of CAD/CAM system. Relationship between documents. Generating the documentation.	2
Lec4	Technological design in CAM systems. The steps and tasks performed.	2
Lec5	Technological design in CAM systems. Functions of CAM.	2
Lec6	Presentation of selected machining strategy.	2
Lec7	Processes verification through computer simulation.	2
Lec8	Final test.	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Presentation of the selected environment of CAD/CAM system.	2
Proj2	Preparation of geometric data. Developing a plan of treatment for the sample.	4
Proj3	Generating tool paths for 2.5D machining. Machining simulation. Management of the project.	4
Proj4	Generating technical documentation. NC code generation.	2
Proj5	Generating tool paths for 3D models where 3 axes control is required.	2
Proj6	Receive and evaluation of projects.	1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. multimedia presentation
N3. problem discussion
N4. self study - preparation for project 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 (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_K02	Evaluation of a project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1.Kief, Hans B.: FFS-Handbuch : Einfuhrung in flexible Fertigungssysteme und deren Komponenten : CNC, DNC, CAD, CAM, FFS, FMS, CAQ, CIM. 1998 r.
2.Kief, Hans B.: NC/CNC handbuch 2007/08 : CNC, DNC, CAD, CAM, CIM, FFS, SPS, RPD, LAN, NC-Maschinen, NC-Roboter, Antriebe, Simulation, Fach- und Stichwortverzeichnis . 2007r.
3.Singh, D. K.: Fundamentals of manufacturing engineering. 2008r.

SECONDARY LITERATURE

1.Kief, Hans B.: FFS-Handbuch : Einfuhrung in flexible Fertigungssysteme und deren Komponenten : CNC, DNC, CAD, CAM, FFS, FMS, CAQ, CIM. 1998 r.
2.Kief, Hans B.: NC/CNC handbuch 2007/08 : CNC, DNC, CAD, CAM, CIM, FFS, SPS, RPD, LAN, NC-Maschinen, NC-Roboter, Antriebe, Simulation, Fach- und Stichwortverzeichnis . 2007r.
3.Singh, D. K.: Fundamentals of manufacturing engineering. 2008r.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technology planning CAD/CAM
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W23	C1, C3, C4	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7	N1, N2, N5
PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	K1ZIP_K04, K1ZIP_U20	C2, C3	Proj1, Proj2, Proj3, Proj4, Proj5, Proj 6	N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Modelowanie i symulacja procesów**
Name in English: **Modeling and simulation of processes**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM031101**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
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				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic programming skills in any object-oriented programming language (preferably Java)
2. Expanded knowledge of the structure and organization of the production system

SUBJECT OBJECTIVES

C1. Acquiring knowledge and skills in object-oriented modeling of production systems
C2. Acquiring knowledge and skills in the development, execution and analysis of the simulation project results (taking into account the specifics of the manufacturing environment), and perform optimisation experiments using multiple criteria optimisation

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - The student has basic knowledge in the area of object-oriented modeling of production systems

PEK_W02 - The student has basic knowledge in the area of design, execution and analysis of results of the project simulation using multi-criteria optimization

PEK_W03 - The student has a general knowledge of object-oriented modeling language UML, and detailed in terms of three basic diagrams (Use Case, Class and State Machine)

II. Relating to skills:

PEK_U01 - The student is able to independently develop a simple object model of the production system on selected examples using UML language

PEK_U02 - The student is able to use (extended range) the "AnyLogic" simulation package and develop a models of systems in continuous and discrete version

PEK_U03 - The student is able to design and perform an simulation experiment in "AnyLogic" package using the built-in optimizer OptQuest and then perform the analysis of the results of the experiment

III. Relating to social competences:

PEK_K01 - The student is able to work in a team of three persons, to take over the leading role and objectively evaluate their colleagues

PEK_K02 - The student is able to prepare and present an analysis of project results

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	- Discussion of the course, presentation of credit conditions. - Elements of UML - class diagram - Object Model System	2
Lec2	- Elements of UML - Use Case and State Machine diagram	2
Lec3	- Java Basics - Presentation of the package "AnyLogic"	2
Lec4	- Introduction to the theory of the experiment - Basic statistical tools - Introduction to methods of optimizing production problems - Presentation of the package "AnyLogic" - continued	2
Lec5	- Methods of modelling and simulation systems (continuous, discrete event, system dynamics, agents, hybrid) - Continuous systems - modelling approach	2
Lec6	- Discrete systems - modelling approach	2
Lec7	- AnyLogic - Library "Process" Part 1 - Basic objects	2
Lec8	- AnyLogic - Library "Process" Part 2 - Extended objects	2
Lec9	- AnyLogic - Library "Process" Part 3 - Resources modelling	2
Lec10	- AnyLogic - Library "Process" Part 4 - Warehouses modelling	2
Lec11	- AnyLogic - Modeling using SD diagrams	2
Lec12	- AnyLogic - Agent-based modelling - part. 1	2
Lec13	- AnyLogic - Agent-based modelling - part. 2	2

Lec14	- Summary of knowledge about the AnyLogic package - presentation of real projects	2
Lec15	- End test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	- The organization of classes, - Discussion of the course, scoring system presentation and assessment methodology. - Presentation of the schedule for individual projects and introduction to the subject. - Introduction to the package AnyLogic	2
Proj2	- Introduction to Java - Introduction to UML	2
Proj3	Project 1. Object Model of continuous system	4
Proj4	Project 2. Object Model of discrete system	7
		Total hours: 15

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. laboratory experiment
N3. report preparation
N4. problem lecture
N5. 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_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_U02, PEK_U03 PEK_K01, PEK_K02	Project mark
P = F1 + F2 + F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] G. Booch, J. Rumbaugh, i I. Jacobson, „UML - przewodnik użytkownika”, Wyd. 2. Warszawa: Wydawnictwa Naukowo-Techniczne, 2002.
[2] „AnyLogic Help”, Xjtek, http://www.xjtek.com/anylogic/help/
[3] „Learning the Java Language”, Oracle, http://docs.oracle.com/javase/tutorial/java/index.html
[4] I. Grigoryev, AnyLogic 6 in three days: a quick course in simulation modeling. AnyLogic North America, 2012.
[5] A. Borshchev, The Big Book of Simulation Modeling. Multimethod Modeling with AnyLogic 6. AnyLogic North America, 2013.

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Modeling and simulation of processes
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_IRP_W01	C1, C2, C3	Lec1 - Lec14	N4, N5
PEK_U01, PEK_U02, PEK_U03	K1ZIP_IRP_U01	C1, C2, C3	Proj1 - Proj4	N1 - N3
PEK_K01, PEK_K02	K1ZIP_K04, K1ZIP_K08	C1, C2, C3	Proj1 - Proj4	N1 - N3

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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031102**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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

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	2
Lec3	estimate of professional risk on work positions	2
Lec4	Ergonomics as interdisciplinary science	2
Lec5	Labor biomechanics - science about threats for employee health discovering, being result of executable work	2
Lec6	Dangerous and harmful agents in work environment - mechanical agents and electric power	2
Lec7	Dangerous and harmful agents in work environment - noise, vibrations and lighting	2
Lec8	Dangerous and harmful agents in work environment - chemical and biological agents	2
Lec9	First pre-medical aid	2
Lec10	Fire protection	2
Lec11	Threats and work protection at transport manual labour	2
Lec12	Heights work and closed-containers work as especially dangerous works.	2
Lec13	Sitting work geometry, computer work stand.	2
Lec14	Breaks at work, shift work. Stress at work.	2
Lec15	Work physiology. Work environment microclimate. Ventilation and air conditioning at accomodation.	2
		Total hours: 30

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_W02, 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
Management and Manufacturing Engineering

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	K1ZIP_W21	C1	Lec1, Lec2, Lec3, Lec9, Lec10, Lec11, Lec12, Lec14, Lec15	N1, N2, N3, N4
PEK_W02	K1ZIP_W21, K1ZIP_W24, K1ZIP_W25	C2	Lec4, Lec5, Lec13	N1, N2, N3, N4
PEK_W03	K1ZIP_W20, K1ZIP_W21	C3	Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3, N4

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): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031106.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			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

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		2
Lec7		2
Lec8		2
		Total hours: 15
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
Proj11		2
Proj12		2
Proj13		2
Proj14		2
Proj15		2
		Total hours: 30

TEACHING TOOLS USED

N1. problem exercises
N2. problem discussion
N3. self study - preparation for project class
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	
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	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Finite Element Method
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W05	C1, C2		N2, N4
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U02, K1ZIP_U03, K1ZIP_U05	C1, C2, C3		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Sterowanie numeryczne**
Name in English: **Numerical control**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031109.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
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		2
Lec6		2
Lec7		2
Lec8		2
		Total hours: 16
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		4
Lab3		4
Lab4		2
Lab5		2
Lab6		2
		Total hours: 16

TEACHING TOOLS USED

N1. informative lecture
N2. tutorials
N3. self study - preparation for laboratory class
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_W1	
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	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Numerical control
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W12	C1		N1, N2
PEK_U01	K1ZIP_U12	C1		N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**
Name in English: **Diploma seminar**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031112.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					15
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		1
Sem3		2
Sem4		11
		Total hours: 15

TEACHING TOOLS USED

N1. multimedia presentation
N2. tutorials
N3. problem discussion

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	
F2	PEK_K01, PEK_K02, PEK_K03	
P = 0,8*F1+0,2*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Diploma seminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_U33, K1ZIP_U34	C1, C2, C4		N1, N2
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K01, K1ZIP_K03, K1ZIP_K06	C3		N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Operacyjne sterowanie wytwarzaniem**
Name in English: **Operational control of manufacturing**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031201**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
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				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of the operation of the manufacturing enterprise.
2. Knowledge of technological processes in manufacturing.
3. Computer skills (Windows).

SUBJECT OBJECTIVES

C1. Get to know the essence of manufacturing operational control in various industries.
C2. Getting familiar with the methods and problems of scheduling of production orders
C3. Gathering scheduling skills using a dedicated IT tool.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Knowledge of the principles and methods of construction schedules for production orders.
PEK_W02 - Knowledge of the basic criteria for optimizing schedules.
PEK_W03 - Knowledge of scheduling strategies in companies from various industries.

II. Relating to skills:
PEK_U01 - Ability to prepare a schedule for production orders.
PEK_U02 - Ability to use IT tools for building schedules.
PEK_U03 - Ability to apply schedule optimization based on selected criteria.

III. Relating to social competences:
PEK_K01 - Awareness of the role of the engineer in the planning of production and demand for accountability and involvement in one of the most important links of the production process in the company.
PEK_K02 - Awareness of the legal aspects and impacts of engineering.
PEK_K03 - Understands the need for lifelong learning in the field of business engineering and professional and social skills development.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Manufacturing operational control in various industrial sectors.	2
Lec2	Methods and techniques of manufacturing operational control.	2
Lec3	Scheduling of production orders on the example of selected information tool.	2
Lec4	Scheduling methods using a chosen IT tool	2
Lec5	An example of operational control of manufacturing in a chosem manufacturing company	2
Lec6	Scheduling algorithms and methods to optimize scheduling	2
Lec7	An example of operational control of manufacturing in a chosem manufacturing company	2
Lec8	Methods for production data acquisition	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Establishing a simple schedule.	2
Proj2	Shortening the time of production orders in the prepared schedule.	2
Proj3	Scheduling of assembling processes.	2
Proj4	Self construction of a schedule and the use of known methods of shortening the lead time.	2
Proj5	Construction and comparison of different versions of the schedule.	2
Proj6	Modifying the schedule as a result of failure or planned maintenance activities	2
Proj7	The use of optimization algorithms to schedule production orders	2
Proj8	Modification of the schedule as a result of the current time data obtained from production	1

	Total hours: 15

TEACHING TOOLS USED

N1. case study
N2. problem exercises
N3. traditional lecture with the use of transparencies and slides
N4. self study - preparation for project 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_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_U02, PEK_U03	Completion of project task.
F2	PEk_K01, PEK_K02, PEK_K03	Project defense
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Czesław Smutnicki, Algorytmy szeregowania, Akademicka Oficyna Wydawnicza EXIT, ISBN: 83-87674-39-7
2. Muhlemann A., Oakland J., Lockyer K.: Zarządzanie Produkcja i Usługi, Wydawnictwo Naukowe PWN, Warszawa 2001

SECONDARY LITERATURE

1. Brzeziński M.: Organizacja i sterowanie produkcją, Placet, Warszawa 2002
2. Durlik I.: Organizacja i zarządzanie produkcją, Warszawa 2002

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Operational control of manufacturing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_ZPW_W01	C1, C2	Lect1 - Lec8	N1, N3
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U15, K1ZIP_ZPW_U02	C3	Pr1 - Pr8	N2, N4
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K07	C1	Pr1 - Pr8	N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Bezpieczeństwo, normowanie i ergonomia w organizacji pracy**
Name in English: **Safety, standarization and ergonomics in work organization**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031202**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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

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	2
Lec3	Estimate of professional risk on work positions	2
Lec4	Ergonomics as interdisciplinary science	2
Lec5	Labor biomechanics - science about threats for employee health discovering, being result of executable wor	2
Lec6	Dangerous and harmful agents in work environment - mechanical agents and electric power	2
Lec7	Dangerous and harmful agents in work environment - noise, vibrations and lighting	2
Lec8	Dangerous and harmful agents in work environment - chemical and biological agents	2
Lec9	First pre-medical aid	2
Lec10	Fire protection	2
Lec11	Threats and work protection at transport manual labour	2
Lec12	Heights work and closed-containers work as especially dangerous works.	2
Lec13	Sitting work geometry, computer work stand.	2
Lec14	Breaks at work, shift work. Stress at work.	2
Lec15	Work physiology. Work environment microclimate. Ventilation and air conditioning at accomodation.	2
		Total hours: 30

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_W02, 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
Safety, standarization and ergonomics in work organization
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W21	C1	Lec1, Lec2, Lec3, Lec9, Lec10, Lec11, Lec12, Lec14, Lec15	N1, N2, N3, N4
PEK_W02	K1ZIP_W21, K1ZIP_W24, K1ZIP_W25	C2	Lec4, Lec5, Lec13	N1, N2, N3, N4
PEK_W03	K1ZIP_W20, K1ZIP_W21	C3	Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Praca przejściowa**
Name in English: **Intermediate project**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031206.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				45	
Number of hours of total student workload (CNPS)				120	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				4	
including number of ECTS points for practical (P) classes				4	
including number of ECTS points for direct teacher-student contact (BK) classes				2.8	

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 – Project	Number of hours

Proj1		2
Proj2		2
Proj3		4
Proj4		6
Proj5		4
Proj6		6
Proj7		6
Proj8		4
Proj9		5
Proj10		6
		Total hours: 45

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. tutorials
N3. multimedia presentation
N4. 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_U1, PEK_U2, PEK_U3	
F2	PEK_K3, PEK_U3	
F3	PEK_U1, PEK_U2, PEK_U3, PEK_K1, PEK_K2	
P = 0,6*F1+01*F2+0,3*F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Intermediate project
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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_U1, PEK_U2, PEK_U3, PEK_K3	K1ZIP_K01, K1ZIP_K02, K1ZIP_K04, K1ZIP_K05, K1ZIP_U21, K1ZIP_U30, K1ZIP_U32	C1, C2, C3		N1, N2, N3, N4
PEK_K1, PEK_K2	K1ZIP_K01, K1ZIP_K02, K1ZIP_K03, K1ZIP_K04, K1ZIP_K05	C2		N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Programowanie obrabiarek CNC**
Name in English: **Programming of NC machine tools**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031211.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
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		2
Lec6		2
Lec7		2
Lec8		2
		Total hours: 16
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		4
Lab4		2
Lab5		4
Lab6		2
		Total hours: 16

TEACHING TOOLS USED

N1. informative lecture
N2. tutorials
N3.
N4. 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_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	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Programming of NC machine tools
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W12	C1, C2, C3		N1, N2
PEK_U01, PEK_U02, PEK_U03	K1ZIP_U12	C1, C2, C3		N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**
Name in English: **Diploma seminar**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031212.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)					15
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		1
Sem3		2
Sem4		11
		Total hours: 15

TEACHING TOOLS USED

N1. multimedia presentation
N2. tutorials
N3. problem discussion

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_K02, PEK_U03	
F2	PEK_K01, PEK_K02, PEK_K03	
P = 0,8*F1+0,2*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Diploma seminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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_K02, PEK_U03	K1ZIP_U33, K1ZIP_U34	C1, C2, C4		N1, N2
PEK_K01, PEK_K02, PEK_K03	K1ZIP_K01, K1ZIP_K03, K1ZIP_K06	C3		N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Organizacja i optymalizacja procesów produkcyjnych**
Name in English: **Organization and optimization of production processes**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **optional**
Subject code: **ZPM031214.**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
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

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 – Project		Number of hours
Proj1		2
Proj2		2
Proj3		4
Proj4		7
		Total hours: 15

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. laboratory experiment
N3. report preparation
N4. problem lecture
N5. 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_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	
F2	PEK_U01, PEK_U02, PEK_U03	
F3	PEK_U01, PEK_U02, PEK_U03	
P = F1 + F2 + F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Organization and optimization of production processes
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_ZPW_W01	C1, C2, C3		N4 - N5
PEK_U01, PEK_U02, PEK_U03	K1ZIP_ZPW_U01, K1ZIP_ZPW_U02	C1, C2, C3		N1 - N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Chemia**
Name in English: **Chemistry**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM032002**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				
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
C3. Providing opportunities for students to combine their knowledge of chemistry with other disciplines (ecology, physics, meterial scicnce)

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 with the optics and nanotechnology

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The structure of atom, matter, elements, compounds	4
Lec2	Periodic table of elements, structure, groups of elements, allotropy, concentration	4
Lec3	Chemical bonds, molecules	4
Lec4	The states of matter - Liquids, solids, gases	4
Lec5	Basic crystallography, unit cell, symmetry elements, crystallographic defect	4
Lec6	Solid state band theory.metals and alloys structure	2
Lec7	Selected topics of organic chemistry - fuels and polymers.	4
Lec8	Basic optics - the effects of electromagnetic waves on matter	2
Lec9	Qualifying class –test	2
		Total hours: 30

TEACHING TOOLS USED

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

PRIMARY AND SECONDARY LITERATURE

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

SECONDARY LITERATURE
selected web sites,

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Chemistry
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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	K1ZIP_W02	C1, C2, C3	Lec1 -Lec8	N1, N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Badania operacyjne**
Name in English: **Operations research**
Main field of study (if applicable): **Management and Manufacturing Engineering**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **ZPM032066**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			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

1. The knowledge from mathematics on the secondary school level confirmed with positive grade in the school certificate.
2. The knowledge of an spreadsheet e.g. Excel.

SUBJECT OBJECTIVES

C1. Acquiring the basic knowledge from linear and network programming area with its application.
C2. Ability to formulate optimization models in the decision taking process from the management field, e.g.: transport services market, distribution of limited resources, project planning, optimization of design, technology and systems.
C3. Acquiring the skills of solving of linear optimization problems using computer programs.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - A course participant has the basic knowledge on the supporting methods of taking optimum decisions.
PEK_W02 - A participant knows the algorithms of linear programming and knows how a sensitivity analysis of the optimum solution should be done.
PEK_W03 - A participant has the basic knowledge on the modelling and solving of optimization problems from network programming field.

II. Relating to skills:

PEK_U01 - A course participant knows how to formulate linear optimization models from engineering and management field.
PEK_U02 - A course participant can use algorithms of linear and network programming to a support decision making process.
PEK_U03 - A course participant knows how to use computer programs when solving mathematical optimization problems.

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to Operations Research (OR): basic definitions, examples of optimization problems, OR in a decision making process, OR history, classification of OR methods and algorithms. Linear programming: linear model, feasible and optimum decisions.	2
Lec2	The graphical method of linear model solving. Interpretation of its results. Sensitivity analysis of the optimum solution.	2
Lec3	Dualism in linear programming: primal and dual model formulation, dual problem solving, results interpretation in the relation to the primal model.	2
Lec4	The Simplex method.	2
Lec5	The network programming: the Critical Path Method (CPM).	2
Lec6	Project planning and optimization: the CPM-COST method.	2
Lec7	Network methods supporting management of non-deterministic projects: the PERT method.	1
Lec8	Final test.	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Organizational issues. Formulating of linear decision models for chosen examples of engineering and management application: identification of decision variables, problem constraints and an objective function.	2
Proj2	Application of the graphical method to linear optimization. Sensitivity analysis of the optimum solution.	2
Proj3	Application of the dual approach to linear programing cases: formulation of primal and dual form of a linear model, dual model solution, results interpretation.	2

Proj4	Linear programming models with a greater number of variables – the simplex method with slack and artificial variables.	2
Proj5	An example of the Critical Path Method application: identification of operations in the project, their sequence, activities graph construction, identification of project duration, critical activities and slack times.	2
Proj6	Application of the CPM-COST method. Minimization of the project cost at a given duration time. Minimization of project duration for an assumed budget limit.	2
Proj7	The PERT method. Estimation of project completion probability at a given time. Estimation of project duration for a given probability level.	1
Proj8	The final test.	2
		Total hours: 15

TEACHING TOOLS USED

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Ignasiak E. (red.): Badania operacyjne. Warszawa 2001, PWE
[2] Kukuła K. (red.): Badania operacyjne w przykładach i zadaniach. Warszawa 2002, PWN
[3] Trzaskalik T.: Wprowadzenie do badań operacyjnych z komputerem. Warszawa 2008, PWE

SECONDARY LITERATURE

[1] Operations research an introduction /Hamdy A. Taha. Boston [etc.] : Pearson, cop. 2011
[2] Introduction to operations research /Frederick S. Hillier, Gerald J. Lieberman. New York: McGraw-Hill, cop. 2005.
[3] Operations research /Michał Kulej ; Wrocław University of Technology. Wrocław : Wrocław University of Technology ; Łódź : PRINTPAP, 2011

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Operations research
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management and Manufacturing Engineering

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, PEK_U	K1ZIP_U19, K1ZIP_W13	C1, C2	Le1-Le7, Proj1 - Proj7	N1-N4

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