FACULTY OF MECHANICAL AND POWER ENGINEERING **SUBJECT CARD**	
Name in Polish	**Chemia**
Name in English	Chemistry
Main field of study (if applicable)	Mechanical Engineering and Machine Building Power Engineering
Level and form of studies:	1st level, full-time
Kind of subject	obligatory
Subject code	CHC 1101
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		30		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher–student contact (BK) classes	1,5		0.75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of chemistry on secondary school level
2. Knowledge of elementary mathematics

SUBJECT OBJECTIVES	
C1	Providing the students with definitions and symbols used in chemistry, with chemical theory and practice.
C2	Providing fundamental knowledge about structure of atom and molecule.
C3	Providing the students with structure of periodic table of the elements and properties of metallic and non-metallic elements.
C4	Acquiring fundamental knowledge about properties of water, acids, bases and salts, dissociation and hydrolysis.
C5	Providing the students with information about chemical equilibrium and kinetics.
C6	Providing the students with principles of basic chemical calculations.
C7	Acquiring the fundamental knowledge about electrochemistry and corrosion.
C8	Providing the students with fundamentals of organic chemistry, organic compound groups, including polymers.
C9	Practical training of quantitative analysis of inorganic and organic substances, as well as water.
C10	Practical training on identification of metal properties, electrochemical corrosion measurements, protection against corrosion.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01 – knows fundamental definitions and chemical laws,

PEK_W02 – knows the fundaments of atom and molecule structure, chemical bonds, has the knowledge about periodic table of the elements,

PEK_W03 – has the fundamental knowledge about solutions, their properties, composition, concentrations of compounds,

PEK_W04 – knows fundamental types of chemical reactions, knows fundamental definitions used in chemical kinetics and in chemical equilibrium,

PEK_W05 – knows properties of: oxides, hydroxides, acids and salts, knows the dissociation and hydrolysis processes,

PEK_W06 – can make fundamental chemical calculations,

PEK_W07 – knows the basics of electrochemistry and corrosion,

PEK_W08 – can determine main groups of organic compounds, their properties, knows the types of fuels, has fundamental knowledge about polymers.

Relating to skills:

PEK_U01 – knows basic chemical laboratory equipment, glass, measuring apparatus and reagents, can use them in practice,

PEK_U02 – knows basic techniques of quantitative analysis (volumetric and weight methods), can make simple analysis of solution composition,

PEK_U03 – can make chemical analysis of water, can identify its composition, pH, total hardness, can make water conditioning for energetic applications,

PEK_U04 – can make chemical analysis of organic substances, including selected fuels, can apply the laboratory techniques for distillation, extraction, can make measurements of fundamental parameters identifying organic substances,

PEK_U05 – can make measurement of electric potential of selected metals and determine on this basis electrochemical properties of these metals,

PEK_U06 – can make measurements determining chemical corrosion, electrochemical corrosion, atmospheric corrosion and soil corrosion, can determine influence of inhibitors on corrosion in aqueous systems.

PROGRAMME CONTENT

Form of classes – lecture		**Number of hours**
Lec 1	Physical and chemical phenomena, simple and complex substances, elements and chemical compounds, physical mixtures. Atom as the smallest part of chemical substance. Nuclide, atomic and mass number, nuclide symbol. Isotopes. Molecule as the smallest part of chemical compound. Mol as the quantity unit, Avogadro number. Molar mass. Chemical symbols and formulas. Molecule models.	2
Lec 2	Atom structure. Atom models of Rutherford and Bohr. Dual nature of light and matter. Nuclear chemistry.	2
Lec 3	Orbitals and quantum numbers. Orbital as a wave function describing state of electron in atom. Quantum numbers: *n, l, m, s*. Orbitals of *s, p* and *d* type. Electronic structures of atoms and ions.	2
Lec 4	Periodic table of the elements. Periodic cycles of atomic volume, atomic radius, ionization energy and electron affinity. The metallic, semi-metallic and non-metallic elements. Acidic, amphoteric and basic properties of chemical elements and their oxides. Prediction of selected properties of elements based on their location in periodic table.	2
Lec 5	Chemical bonds. Bond types: electrovalent, covalent, metallic and intermolecular.	2
Lec 6	Solutions and concentrations. Solution and mixture. Solvent, solute, mass and density of solution. Molar concentration, mass fraction, molar fraction. Conversion of concentrations.	2

Lec 7	Chemical reactions. Equation of chemical reaction. Classification of chemical reactions according to: reaction scheme, reagent types, energetic effects, phase composition of reagents, reaction reversibility, electrons exchange. Energetic effect of the reaction. Principles of stoichiometric calculations – law of conservation of mass, law of constant proportions.	2
Lec 8	Chemical kinetics. Kinetic equation and reaction order.	2
Lec 9	Chemical equilibrium. Reversible reactions, dynamic equilibrium concept. Law of mass action, equilibrium constant and its dependence on temperature. Dependence of equilibrium state location on concentration, temperature and pressure.	2
Lec 10	Oxides, hydroxides, acids and salts. Water. Water conditioning. Electrolyte, degree of dissociation, strong and weak electrolytes. Ionic reactions in solutions. Ionic solubility product of water, pH.	2
Lec 11	Hydrolysis, sparingly soluble salts. Hydrolysis reaction. Equilibrium in saturated solutions of the salts. Solubility product.	2
Lec 12	Chemical calculations. Calculation and conversion of concentrations, dilution of solutions. Equilibria in phase systems. Redox reactions. Stoichiometry. Dissociation. Calculation of pH.	2
Lec 13	Electrochemistry. Oxidation-reduction reactions. Electrochemical series of the metals. Battery cells and accumulators. Fuel cells.	2
Lec 14	Corrosion and protection against corrosion. Chemical and electrochemical corrosion.. Corrosion cells. Methods of protection against corrosion.	2
Lec 15	Selected problems from organic chemistry. Main groups of organic compounds. Fuels. Polymers.	2
	Total hours	**30**

Form of classes – laboratory		**Number of hours**
Lab 1	Organisation and basic informations. BHP rules in chemical laboratory. Basic equipment, apparatus, glass, reagents in chemical laboratory. Fundamental definitions and calculations needed for laboratory works.	2
Lab 2	Quantitative analysis – volumetric methods: titrimetric analysis, acid-base titration, redoxymetry, complexometry, titration/precipitation analysis.	2
Lab 3	Quantitative analysis – weight and precipitation methods, precipitate types, techniques of weight analysis, thermal methods.	2
Lab 4	Water analysis and the methods of their conditioning for energetic applications. Physical and chemical properties of water. Alkaline/acid reaction, pH, indicators. Water hardness. Water conditioning methods: mechanical and physicochemical ones.	2
Lab 5	Chemical analysis of organic substances, including fuels. Elemental analysis, distillation, extraction. Determination of melting, freezing and boiling temperatures.	2
Lab 6	Electrochemistry. Electrochemical series of the metals (normal, practical). Measurements of electrochemical potential of selected metals.	2
Lab 7	Metal corrosion. Chemical corrosion, electrochemical corrosion, atmospheric corrosion and in soil corrosion. Methods of protection against corrosion. Corrosion inhibitors in aqueous systems.	2
Lab 8	Credit.	1
	Total hours	**15**

TEACHING TOOLS USED	
N1	Lecture with multimedial presentation.
N2	Making experiments and chemical analyses.
N3	Office hours

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation F – forming (during semester), C – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C (lecture)	PEK_W01 – PEK_W08	Crediting with grade
C (laboratory)	PEK_U01 – PEK_U06	Crediting with grade

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] I. Barycka, K. Skudlarski, Podstawy Chemii, Wyd. PWr, Wrocław, 2001.
[2] M.J. Sienko, R.A. Plane, Chemia – podstawy i zastosowania, WNT, Warszawa, 2002.
[3] A. Bielański, Podstawy chemii nieorganicznej, PWN, Warszawa, 2003.
[4] L. Jones, P. Atkins, Chemia ogólna, PWN, Warszawa, 2004.
[5] H. Bala, Wstęp do chemii materiałów, WNT, Warszawa, 2003.

SECONDARY LITERATURE:

[1] J.E. Brady, J.R. Holum, Fundamentals of chemistry, Wiley & Sons, New York, 2002.
[2] G.C. Pimentel, J.A. Coonrod, Chemia dziś i jutro, PWr, Wrocław, 1993.
[3] P. Mastalerz, Elementarna chemia nieorganiczna, Wyd. Chem., Wrocław, 1997.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Chemia
AND EDUCATIONAL EFFECTS FOR MAIN FIELDS OF STUDY
Mechanical Engineering and Machine Building and **Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W04 (Mechanical Engineering and Machine Building) K1ENG_W04 (Power Engineering)	C1	Lec1	N1, N3
PEK_W02		C2, C3	Lec2 – Lec5	
PEK_W03		C4	Lec6	
PEK_W04		C5	Lec7 – Lec9	
PEK_W05		C4, C5	Lec10, Lec11	
PEK_W06		C6	Lec12	
PEK_W07		C7	Lec13, Lec14	
PEK_W08		C8	Lec15	
PEK_U01	K1MBM_U04 (Mechanical Engineering and Machine Building) K1ENG_U10 (Power Engineering)	C1	Lab1	N2, N3
PEK_U02		C9	Lab2, Lab3	
PEK_U03		C9	Lab4	
PEK_U04		C9	Lab5	
PEK_U05		C10	Lab6	
PEK_U06		C10	Lab7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Pakiety użytkowe**
Name in English	Application Packages /Utility Packages
Main field of study	**Mechanical Engineering and Machine Building (MBM)** **Power Engineering (ENG)**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**INN1003**
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		
For group of courses mark (X) final course					
Number of ECTS points			2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes			1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

3. Competence in mathematics and computer science, certified by positive grades in the high school certificate.
4. Familiarity with issues related to the information technologies.

SUBJECT OBJECTIVES

C1 – To acquaint students with the advanced capabilities of the integrated package Microsoft Office
C2 – Developing the ability of automated work by using the advanced tools of the package as well as by creating one's own tools with macros and algorithms in Visual Basic for Applications.
C3 – Developing the ability to select the right tools in Microsoft Office applications to solve problems that occur in the course of studies during various activities.
C4 – To acquaint students with the basics of programming in Visual Basic for Applications

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – Can effectively use the text editor, apply tools to automate all formatting procedures, including page numbering, tables of contents, etc.. Can record and use macros.
PEK_U02 – Can use the equation editor to create complex mathematical formulas
PEK_U03 – Can use the mail merge capability of the word processor
PEK_U04 – Knows and is able to apply the basic tools of the Excel spreadsheet.
PEK_U05 – Can perform calculations using formulas containing relative, absolute, and mixed addresses.
PEK_U06 – Can efficiently use the chart wizard to draw graphs with a number of special editorial requirements.
PEK_U07 – Can solve diverse tasks, as algebraic (systems of equations) or statistical (regression) using Excel functions.
PEK_U08 – Performs calculations using the Solver tool.
PEK_U09 – Uses simple numerical methods of solving equations in Excel
PEK_U10 – Can formulate a simple computer algorithm solving a problem. Can create suitable code in Visual Basic for Applications.
PEK_U11 – Uses standard functions of Excel and Visual Basic; can design his/her own function.

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
La1	Introduction to Word. Selected menu items. Application of less well-known, practical tools in tasks.	2
La2	Recording and executing macros in Word. Formatting large text using macros and advanced tools.	2
La3	Writing complex mathematical formulas using the equation editor. Practical use of mail merge.	2
La4	Introduction to Excel spreadsheet. Selected menu items: defining custom lists, filling in the data series, conditional formatting, and other tools. Relative, absolute, and mixed addresses.	2
La5	Overview of Boolean functions in Excel. Solving the quadratic equation and graphing a parabola with automatic selection of data series. Solve the system of equations using Cramer's method of nested logic functions.	2
La6	Calculation of the linear regression using two methods: self-writing formulas and using the built-in Excel functions. Illustration of the results on the graph. Comparison of the methods. Defining cells and blocks in Excel.	2
La7	Explanation of the Seek and Solver tools with application to the degree three polynomial and its graph. The practical use of these tools in different tasks.	2
La8	Solving arbitrary systems of linear equations using matrix functions in Excel, with the simultaneous use of Boolean functions. Engineering functions in Excel illustrated by converting numbers from decimal to binary or hex systems. Working with large data sets, e.g. the graphs of trigonometric functions.	2
La9	Mastering chart details: shifting data series on an auxiliary axis, trend lines and other aspects of charts, illustrated with graphs for a centrifugal pump and flows. Newton's method of finding zeroes of a function applied to the graph of a polynomial of degree three. Comparison to the results obtained in the Solver.	2
La10	Charts for curves with parameters and Cycloid. Developing a worksheet to calculate the equivalent resistance of series and parallel configuration for given values of current or voltage. Implementation of the possibility of such choices in Excel using bar controls.	2
La11	Introduction to Programming with Visual Basic for Applications. The concept of a variable, and basic types of variables. The assignment instruction, its properties and use. Basic input-output functions, and their use to load data and output results, in	2

	cooperation with Excel.	
La12	VBA conditional statement in three forms and its practical application in the tasks. Solving the quadratic equation and comparison with the results in Excel. Inserting a button in Excel and assigning to them custom macros, created in VBA.	2
La13	Repetition instructions in VBA: For ... Next loop, Do While ... Loop and Do Until ... Loop and their application to create arrays of the function values as well as the calculation of the function from its Maclaurin power series. Selected standard functions in VBA.	2
La14	Description of a procedure and a custom function in VBA. Ways to invoke custom procedures and functions. Iterative and recursive algorithms: explanation and application to the factorial function and the Euclidean algorithm.	2
La15	Final test	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Explanation and computer presentations N2. Practice in working with a computer machine N3. Monitoring independent work of students in a computer network. N4. Consultation and email correspondence with students.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01- PEK_U11	Verbal response.
F2	PEK_U01- PEK_U11	Checking the tasks solved by students in a computer network.
F3	PEK_U01- PEK_U11	Three computer tests.
C = 0,1 F1 + 0,2 F2 + 0,7 F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[6] Dec Zdzisław, „ABC ... Worda", wyd."Edition 2000", Kraków 2001
[7] Kuciński Krzysztof, „ABC ... Excela", wyd."Edition 2000", Kraków 2001
[8] Microsoft web page with a Visual Basic course (in Polish): www.vb4all.pl/teoria/
[9] Web page „VBA w Excelu - kurs dla początkujących": http://dzono4.w.interia.pl/

SECONDARY LITERATURE :

[1] Podlin Sharon, Programowanie w Excelu 2000 w 24 godziny, wyd. „Infoland", Warszawa 2001
[2] Zbigniew Smogur, Excel w zastosowaniach inżynieryjnych, Wyd. Helion 2008

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Application Packages /Utility Packages
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building (MBM); Power Engineering (ENG)

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_U01	K1ENG_U02	C1, C2, C3	La1+ La2	N1, N2, N3, N4
PEK_U02			La3	
PEK_U03			La3	
PEK_U04			La4	
PEK_U05			La5	
PEK_U06			La6+La8÷La10	
PEK_U07			La5÷La8	
PEK_U08			La7	
PEK_U09			La9	
PEK_U10		C4	La11÷La14	
PEK_U11			La5÷La14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Technologie informacyjne**
Name in English	Information Technologies
Main field of study	**Mechanical Engineering and Machine Building (MBM)** **Power Engineering (ENG)**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**INN 1004**
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				
For group of courses mark (X) final course					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes	0				
including number of ECTS points for direct teacher-student contact (BK) classes	1				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in mathematics and computer science, confirmed by positive grades on the certificate of completion of secondary school.

SUBJECT OBJECTIVES

C1. Providing basic knowledge in the following areas: data types and data coding, construction and operations of computer, operating systems and computer networks.
C2. Familiarize students with the integrated packages, in particular with the word processor MS Word and Excel spreadsheet, in the field of their advanced tools and capabilities.
C3. Formulation of tasks that can be solved with the help of integrated packages. Training in choosing and application of an adequate tool to solve such tasks.
C4. Presenting examples of computer algorithms for solving special problems by applying the Visual Basic for Applications programming language.
C5. Presenting modern trends in the computer science development.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – Recognizes types of data and different methods of data coding.
PEK_W02 – Can effectively choose the proper type of a file for saving specific data.
PEK_W03 – Is able to explain the principles of operation of the main computer components.
PEK_W04 – Can analyse and evaluate the basic computer parameters for suitability for specific purposes.
PEK_W05 – Can enumerate different tasks and capabilities of the computer operating systems; can distinguish working levels of the OS and different applications.
PEK_W06 – Has basic computer networks understanding.
PEK_W07 – Is aware of and is able to exploit diverse capabilities of the Internet in an effective and safe way.
PEK_W08 – Understands the main risks of networking and knows how to counteract them.
PEK_W09 – Has working knowledge of some advanced tools available in the text editor MS Word and the Excel spreadsheet.
PEK_W10 – Is able to choose proper tools supplied by MS Word and Excel enabling him/her solving diverse tasks faced during the university studies.
PEK_W11 – Is able to formulate an algorithmic solution of a specific problem.
PEK_W12 – Has general understanding about coding the algorithms by using the Visual Basic for Applications programming language.
PEK_W13 – Is aware of main trends in the development of computer hardware and software.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	A brief introduction to the history of computing. Information systems versus computer systems. Data and their types.	2
Lec 2	Positional notation, bits, bytes and data coding. Estimating errors.	2
Lec 3	Computer architecture. Computer functioning principles. Peripheral devices.	2
Lec 4	Central processing unit. Types of memory.	2
Lec 5	Operating systems. Tasks performed by OS. Sample operating systems.	2
Lec 6	Integrated packages: word processing with MS Word. Automation of the word processor. Macros. Selected tools. Serial (merge) mailing.	2
Lec 7	MS Excel spreadsheet: selected issues, tools. Solver. Different types of charts. Overview of the available functions. The calculations in Excel using algebraic and numerical methods.	2
Lec 8	Formulating algorithms for tasks. Flowcharts (block diagrams). Examples of iterative and recursive algorithms.	2
Lec 9	Programming languages. Translators, compilers and interpreters.	2
Lec 10	Elements of programming in Visual Basic. Variables, their types, declarations. Operators. Arithmetic and Boolean operators and expressions.	2
Lec 11	Visual Basic: numerous examples of conditional and loop instructions.	2
Lec 12	Visual Basic: standard and custom procedures and functions.	2
Lec 13	Computer networks: classification, protocols. TCP/IP protocol. IP address, DNS servers.	2
Lec 14	Security of computer systems. Passwords, digital signature, data protection. Viruses and anti-virus programs.	2
Lec 15	Final test	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Traditional lecture supported by computer and multimedia presentations. N2. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W13	Written assessment test

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [4] W. Sikorski, Wykłady z podstaw informatyki, Mikom 2002 [5] K. Wojtuszkiewicz, Jak działa komputer, Mikom 1999 [6] Microsoft web page with a Visual Basic course (in Polish): www.vb4all.pl/teoria/ [7] Web page „VBA w Excelu - kurs dla początkujących”: http://dzono4.w.interia.pl/ [8] Elementy informatyki (ed. M. Sysło), Wydawnictwo Naukowe PWN, Warszawa 1997 [9] Zbigniew Smogur, Excel w zastosowaniach inżynieryjnych, Helion 2008 SECONDARY LITERATURE: [1] Peter B. Galwin, Abraham Silberschatz, Podstawy systemów operacyjnych, Wydawnictwo Naukowo- Techniczne, Warszawa 2006 [2] Ch. S. Parker, D. Morley, „Understanding computers today and tomorrow” . [3] Niklaus Wirth, Algorytmy+struktury danych=programy. Klasyka informatyki. Wydawnictwo Naukowo-Techniczne, 2004 [4] David Harel, Rzecz o istocie informatyki: algorytmika. Klasyka informatyki. Wydawnictwo Naukowo-Techniczne, Warszawa, 2002

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Information Technologies

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building (MBM); Power Engineering (ENG)

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1ENG_W06	C1	Lec 1	N1, N3
PEK_W02			Lec 2	
PEK_W03			Lec3	
PEK_W04			Lec4	
PEK_W05			Lec5	
PEK_W06			Lec13	
PEK_W07			Lec13, Lec14	
PEK_W08			Lec14	
PEK_W09		C2, C3	Lec6÷ Lec7	
PEK_W10				
PEK_W11		C4	Lec8÷ Lec9	
PEK_W12			Lec10÷ Lec12	
PEK_W13		C5	Lec1÷ Lec14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in English:	ALGEBRA AND ANALYTIC GEOMETRY A
Name in Polish:	ALGEBRA Z GEOMETRIĄ ANALITYCZNĄ A
Main field of study :	Mechanical Engineering and Machine Building Power Engineering
Level and form of studies:	I level, full time
Kind of subject:	obligatory
Subject code:	MAP001140
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	Exam	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	2	2			
including number of ECTS points for practical (P) classes	0	2			
including number of ECTS points for direct teacher-student contact (BK) classes	1	1,5			

PREREQUISITIES

It is recommended to know the basic algebraic operations on rational and real numbers, and knowledge of basic geometric figures and shapes.

SUBJECT OBJECTIVES

C1. Understanding the basic properties of complex numbers.
C2. Learning basic algebraic properties of polynomials.
C3. Mastering the concept of a vector, a vector space and the base of a linear space.
C4. Learning how to calculate the distance between the points in the space R^n, how to determine the equations of lines and planes and understanding the concept of conic sections.
C5. Mastering the concepts of matrices, matrix operations, and learn the methods of solving systems of linear equations.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01 knows basic properties of complex numbers
PEK_W02 knows basic algebraic properties of polynomials
PEK_W03 knows basic concepts of theory of linear spaces and methods of description of lines, planes and conic sections
PEK_W04 knows basic methods of solving systems of linear equations

Relating to skills:

PEK_U01 can carry out calculations with complex numbers
PEK_U02 can add, multiply and divide polynomials
PEK_U03 can find the equations of planes and lines in three dimensional space
PEK_U04 can add and multiply matrices and calculate determinants
PEK_U05 can solve systems of linear equations

PROGRAM CONTENT		
Form of classes - lectures		**Hours**
W1	Natural, rational and real numbers. Mathematical induction. Newton's binomial formula.	2
W2	Complex numbers. Basic operations, modulus, complex conjugate.	2
W3	Polar form of complex number. Multiplication, division and exponentiation in polar form. Roots of complex numbers. The notion of algebraic field.	2
W4	Polynomials. Addition and multiplication of polynomials. Roots of polynomial. Polynomial remainder theorem. **Fundamental theorem of algebra**.	2
W5	The decomposition of a polynomial with real coefficients into product of linear and quadratic factors. Rational functions. Real simple rational factors. Decomposition of the functions into rational simple factors.	2
W6	Vectors in the space R^n. Addition and multiplication by scalars. Distance between points. Scalar product. Length of vector. **Cauchy–Schwarz inequality**. The angle between vectors.	2
W7	Analytic geometry of the plane. Straight line formulas (normal parametric and directional form). Distance of a point from a line. The angle between lines	2
W8	Analytic geometry of the space R^3. Equations for lines and planes. Distance between point and a plane. Intersection of planes.	2
W9	Linear combinations of vectors. Linearly independent vectors. The base of a space. Linear mappings. Matrix representation of linear mappings.	2
W10	Addition and multiplication of matrices and its correlation with operations on linear mappings. Example of matrices.	2
W11	Permutations and its sign..Definition of determinant and methods of calculation of determinant Algebraic complement of an element of a matrix. Laplace' formula for determinant. **Determinant and volume**.	2
W12	Inverse matrix. Systems od linear equations. **Cramer's formulas**. Examples. Homogeneous and non-homogeneous systems.	2
W13	Properties of linear mappings (kernel, image, rank). **Rouché – Capelli theorem**. Gaussian elimination.	2

W14	Eigenvalues and eigenvectors.	2
W15	Conic sections.	2
	Total hours	**30**

Form of classes – classes		**Hours**
Cw1	Real and complex numbers.	2
Cw2	Polynomials.	2
Cw3	Geometry of the plane.	2
Cw4	Geometry of the space R^3.	2
Cw5	Basis and linear mappings.	2
Cw6	Matrices and determinants.	2
Cw7	Systems of linear equations.	2
Cw8	Test	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Lecture - traditional method N2. Classes - traditional method N3. Student's self work with the assistance of mathematical packages

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F -forming; P - concluding)	**Educational effect number**	**Way of evaluating educational effect achievement**
F - Cw	PEK_U01-PEK_U05	Oral answers, quizzes, written tests and/or e-tests
F – W	PEK_W01-PEK_W04	Exam or e-exam
F=(2/3)*W+(1/3)*Cw		

LITERATURE

PRIMARY:

[1] A. Białynicki-Birula, Algebra Liniowa z Geometrią, PWN 1976.
[2] F. Leja, Geometria analityczna, PWN, Warszawa 1972.
[3] A. Mostowski, M. Stark, Elementy algebry wyższej, PWN, Warszawa 1963.
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SECONDARY:

[1] G. Farin, D. Hansford, Practical Linear Algebra: A Geometry Toolbox 2004, AK Peters, 2005.
[2] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2011.
[3] T. Jurlewicz, Z. Skoczylas, Algebra liniowa. Przykłady i zadania, Oficyna Wydawnicza GiS, Wrocław 2005.
[4] T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna.. Definicje, twierdzenia i wzory. Oficyna Wydawnicza GiS, Wrocław 2011.
[5] T. Jurlewicz, Z. Skoczylas, Algebra liniowa. Definicje, twierdzenia i wzory. Oficyna Wydawnicza GiS, Wrocław 2005.
[6] E. Kącki, D. Sadowska, L. Siewierski, Geometria analityczna w zadaniach, PWN, Warszawa 1993.
[7] W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, Cz. A, PWN, Warszawa 2003.

SUBJECT SUPERVISORS
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ALGEBRA AND ANALYTIC GEOMETRY A MAP001140

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building
Power Engineering

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1ENG_W01 (Power Engineering) K1MBM_W01 **(**Mechanical Engineering and Machine Building)	C1	W1, W2, W3, W14	1,3
PEK_W02		C2	W4, W5	1,3
PEK_W03		C3, C4	W6, W7, W8, W9, W15	1,3
PEK_W04		C5	W10, W11, W12, W13	1,3
PEK_U01	K1ENG_U07 (Power Engineering) K1MBM_U01 (Mechanical Engineering and Machine Building)	C1	Cw1, Cw6, Cw7	1,2,3
PEK_U02		C2	Cw2	1,2,3
PEK_U03		C3, C4	Cw3, Cw4, Cw5	1,2,3
PEK U04		C5	Cw6, Cw7	1,2,3
PEK_U05		C5	Cw6, Cw7	1,2,3

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in English	Mathematical Analysis 1.1 A
Name in Polish	Analiza Matematyczna 1.1 A
Main field of study (if applicable)	Mechanical Engineering and Machine Building Power Engineering
Level and form of studies	I level, full-time
Kind of subject	obligatory
Subject code	MAP1142
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	exam	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	5	3			
including number of ECTS points for practical (P) classes	0	3			
including number of ECTS points for direct teacher-student contact (BK) classes	2,5	2,25			

PREREQUISITIES

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

SUBJECT OBJECTIVES

C1. Understanding the basic methods of analysis of the graph of functions of one variable.
C2. Understanding the concept of definite integral and its basic properties and methods of determination.
C3. Understanding the practical applications of mathematical methods for the analysis of functions of one variable.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:
PEK_W1. Knows the basic definitions and theorem from Mathematical Analysis of functions of one variable.
PEK_W2. Knows the notion of definite integral and its basic applications.

Relating to skills:
PEK_U1. Can examine graphs of simple functions.
PEK_U2. Can calculate integrals of simple functions.

Relating to social competences:
PEK_K1. Understand how calculus affects on the development of technical civilization

PROGRAM CONTENT		
	Form of classes - lectures	**Hours**
Wy1	Mathematical notations (logical connetives, quantifieries), elements of set theory, real numbers, subsets of real numbers (intervals, half-lines). Linear and quadratic functions.	2.0
Wy2	Basic properties of functions (injective and monotonic functions). Composition of functions. The inverse function. Power and exponential functions, and opposite to them. Properties of logarithms.	2.0
Wy3	Trygonometric functions and their inverses. Graphs of trigonometric and of its inverses.	2.0
Wy4	Sequences and limits. Basic formulas and theorems. Number e. Improper limits.	2.0
Wy5	The limit of a function in a point. Directional limits of function. Asymptotics of function.	2.0
Wy6	Continuity of a function in a point and on the interval. Basic properties of conituous functions. Approximate solutions of equations. Points of discontinuity.	2.0
Wy7	The definition of derivative. Basic formulas and theorems. Geometric and physics interpretations. Mean value theorem. De L'Hospital rule.	2.0
Wy8	Extreme values, monotonicity. Higher order derivatives. Convexity of function.	2.0
Wy9	Examination of the graph of a function.	2.0
Wy10	Taylor formula. Aproximation of function. Applications.	2.0
Wy11	Definite integral. Simple examples. Connection between interal and derivative (Fundamental Theorem of Calculus). Simple examples	2.0
Wy12	Indefinite integral: basic formulas. Areas of simple figures.	2.0
Wy13	The basic methods of calculus of integrals: integration by parts and by substitution.	2.0
Wy14	The basic methods of calculus of integrals: simple rational funnctions. Area and perimeter of a circle. The volume of rotary figures.	2.0
Wy15	Application of methods of mathematical analysis of one variable functions.	2.0
	Total hours	**30**
	Form of classes - classes	**Hours**
Cw1	Tautologies, de Morgan laws, union, intersection and complement of set	2.0
Cw2	Natural numbers, integers, rational and real numbers. Logarithm.	2.0
Cw3	Graphs of simple functions. Inverse function. Composition of functions.	2.0
Cw4	Trygonometric functions and trygonometric identities.	2.0
Cw5	Limit of sequences.	2.0
Cw6	The limit of a function in point.	2.0
Cw7	Continuous functions	2.0
Cw8	Points of discontinuity. Solutions of equations	2.0
Cw9	Derivatives. Tangent line to a graph of a function.	2.0
Cw10	Examination of graphs of functions - I	2.0
Cw11	Examination of graphs of functions - II	2.0
Cw12	Taylor formula. De L'Hospital rule	2.0
Cw13	Integration - I	2.0
Cw14	Integration - II	2.0
Cw15	Integration - applications	2.0
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture - traditional method
N2. Classes - traditional method
N3. Student's self work with the assistance of mathematical packages

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation (F-forming; P - concluding)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W1, PEK_U1, PEK_K1	kolokwium na cwiczeniach, odpowiedzi ustne

F2	PEK_W2, PEK_U2, PEK_K1	kolokwium na cwiczeniach, odpowiedzi ustne
F3	all	exam
P - sets the lecturer		

LITERATURE

PRIMARY

A1. F. Leja, Rachunek Różniczkowy i Całkowy, Wydawnictwo Naukowe PWN, 2012
A2. W. Krysicki, L. Włodarski, Analiza Matematyczna w Zadaniach, Cz. I, PWN, Warszawa 2006

SECONDARY

B1. K. Kuratowski, Rachunek Różniczkowy i Całkowy. Funkcje Jednej Zmiennej, Wydawnictwo Naukowe PWN, 2012
B2. G. M. Fichtenholz, Rachunek Różniczkowy i Całkowy, T. I-II, PWN, Warszawa 2007
B3. M. Gewert, Z. Skoczylas, Analiza Matematyczna 1. Przykłady i Zadania, Oficyna Wydawnicza GiS, Wrocław 2011

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Analiza Matematyczna 1.1 A MAP1142
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Power Engineering
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study	Subject objectives	Programme content	Teaching tool number
PEK_W1	K1ENG_W02 (Power Engineering) K1MBM_W02 (Mechanical Engineering and Machine Building	C1	Wy1 Wy2 Wy3 Wy4 Wy5 Wy6 Wy7 Wy8 Wy9 Wy10 Wy11 Wy12 Wy13 Wy14 Wy15 Cw1 Cw2 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9 Cw10 Cw11 Cw12 Cw15	N1, N2, N3
PEK_W2		C2 C3	Wy11 Wy12 Wy13 Wy14 Wy15 Cw13 Cw14 Cw15	N1, N2, N3
PEK_U1	K1ENG_U08 (Power Engineering) K1MBM_U02 (Mechanical Engineering and Machine Building	C1	Wy1 Wy2 Wy3 Wy4 Wy5 Wy6 Wy7 Wy8 Wy9 Wy10 Wy15 Cw1 Cw2 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9 Cw10 Cw11 Cw12 Cw15	N1, N2, N3
PEK_U2		C1 C2 C3	Wy11 Wy12 Wy13 Wy14 Wy15 Cw13 Cw14 Cw15	N1, N2, N3
PEK_K1	K1ENG_K01 K1MBM_K01	C1 C2	Wy9 Wy10 Wy11 Wy12 Wy13 Wy14 Wy15 Cw12 Cw13 Cw14 Cw15	N1, N2, N3

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in English	**Mathematical Analysis 2.2 A**
Name in Polish	**Analiza Matematyczna 2.2 A**
Main field of study (if applicable)	Mechanical Engineering and Machine Building Power Engineering
Level and form of studies	I level, full-time
Kind of subject	obligatory
Subject code	MAP1144
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	60			
Form of crediting	exam	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	5	3			
- including number of ECTS points for practical (P) classes	0	3			
- including number of ECTS points for direct teacher-student contact (BK) classes	2,5	2,25			

PREREQUISITIES

Knowledge of differential and integral calculus of function of one variable

SUBJECT OBJECTIVES

C1. Knowledge of basic properties of infinite series and power series.
C2. Understanding the basic concepts of differential calculus of several variables.
C3. Understanding the basic concepts of integral calculus of functions of several variables.
C4. Understanding the Laplace transform and Fourier transform.

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:
PEK_W1. Know the basic criteria of convergence of infinite series.
PEK_W2. Know the basic concepts of differential and integral calculus of functions of several variables.
PEK_W3. Know the basic concepts of differential and integral calculus of functions of several variables.
Relating to skills:
PEK_U1. Can find power series of a function, knows how to use power series for approximations of functions
PEK_U2. Can compute the partial derivatives, directional and gradient functions of several variables and interpret the wielkośći, able to solve problems for the optimization of functions of several variables
PEK_U3. Is able to calculate and interpret the integral multiple, able to solve engineering problems using double and triple integrals
PEK_U4. Can calculate integral transforms from simple functions
Relating to social competences:
PEK_K1. Understand the role played by Mathematical Analysis to analyze technical problems

PROGRAM CONTENT		
	Form of classes - lectures	**Hours**
Wy1	Improper integrals. Cauchy principal value.	4.0
Wy2	Infinite series. The basic criteria for convergence of series. Absolute and conditional convergence. Leibniz criterion.	4.0
Wy3	Power series. The radius and interval of convergence. Cauchy theorem - Hadamard. Taylor Series.	4.0
Wy4	Properties of the space R^n. Subsets of the space R^n. Functions of several variables.	2.0
Wy5	Partial derivatives of the first order. Definition. Geometric interpretation. Higher order partial derivatives. Schwarz theorem	3.0
Wy6	The plane tangent to the graph of a function of two variables. Directional derivatives. Gradient of a function.	2.0
Wy7	Local extremes of functions of two variables. Sufficient conditions for the existence of extreme. The smallest and the largest value of the function on the set. Examples of extremal problems in geometry and technology.	3.0
Wy8	Conditional extremes conditional function of two variables. Applications. Examples of optimization problems.	2.0
Wy9	Double integrals. The definition of the double integral. Geometric and physical interpretation. Calculation of double integrals normal regions.	4.0
Wy10	Properties of double integrals. Jacobian function. Change of variables in double integrals. Double integral in polar coordinates.	2.0
Wy11	Triple integrals. Reversal iterated integrals. Change of variables in cylindrical and spherical coordinates	2.0
Wy12	Applications of double and triple integrals in geometry and physics.	2.0
Wy13	Laplace transform.	4.0
Wy14	Inverse Laplace transform and its applications	3.0
Wy15	Introduction to the Fourier transform.	4.0
	Total hours	**45**
	Form of classes - classes	**Hours**
Cw1	Infinitie series	2.0
Cw2	Power series	2.0
Cw3	The functions of two variables.	2.0
Cw4	Partial derivatives.	2.0
Cw5	Gradient. Tangent planes.	2.0
Cw6	Extremes of functions of two variables.	2.0
Cw7	Conditional Extremes.	2.0
Cw8	The study of functions of several variables - I	2.0
Cw9	The study of functions of several variables - II	2.0
Cw10	Double integrals.	2.0
Cw11	Triple integrals.	2.0
Cw12	Integrals of functions of several variables.	2.0
Cw13	Applications of multiple integrals	2.0
Cw14	Laplace transform	2.0
Cw15	Integral transforms	2.0
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture - traditional method
N2. Classes - traditional method
N3. Student's self work with the assistance of mathematical packages

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation (F-forming; P - concluding)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W1, PEK_W2, PEK_U1, PEK_U2, PEK_K1	kolokwium na cwiczeniach, odpowiedzi ustne
F2	PEK_W2, PEK_U2, PEK_U3, PEK_K1	kolokwium na cwiczeniach, odpowiedzi ustne
F3	all	exam
P - sets the lecturer		

LITERATURE

PRIMARY

A1. F. Leja, Rachunek Różniczkowy i Całkowy, Wydawnictwo Naukowe PWN, 2012
A2. R. Leitner, Zarys Matematyki Wyższej dla Studiów Technicznych, Cz. 1-2 WNT, Warszawa, 2006.

SECONDARY

B1. W. Krysicki, L. Włodarski, Analiza Matematyczna w Zadaniach, Cz. II, PWN, Warszawa 2006
B2. G. M. Fichtenholz, Rachunek Różniczkowy i Całkowy, T. I-II, PWN, Warszawa 2007
B3. M. Gewert, Z. Skoczylas, Analiza Matematyczna 2. Przykłady i Zadania, Oficyna Wydawnicza GiS, Wrocław 2011

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Mathematica Analysis 2.2 A MAP1144

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W1	K1ENG_W02 (Power Engineering) K1MBM_W02 (Mechanical Engineering and Machine Building	C1	Wy1 Wy2 Wy3 Cw1 Cw2	N1, N2, N3
PEK_W2		C2 C3	Wy4 Wy5 Wy6 Wy7 Wy8 Wy9 Wy10 Wy11 Wy12 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9 Cw10 Cw11 Cw12 Cw13	N1, N2, N3
PEK_W3		C4	Wy13 Wy14 Wy15 Cw14	N1, N2, N3
PEK_U1	K1ENG_U08 (Power Engineering) K1MBM_U02 (Mechanical Engineering and Machine Building	C1	Wy1 Wy2 Wy3 Cw1 Cw2	N1, N2, N3
PEK_U2		C2	Wy5 Wy6 Wy7 Wy8 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9	N1, N2, N3
PEK_U3		C3	Wy9 Wy10 Wy11 Wy12 Cw10 Cw11 Cw12 Cw13	N1, N2, N3
PEK_U4		C4	Wy13 Wy14 Wy15 Cw14 Cw15	N1, N2, N3
PEK_K1	K1ENG_K01 K1MBM_K01	C1 C2 C3 C4	Wy1 Wy2 Wy3 Wy5 Wy6 Wy7 Wy8 Wy9 Wy10 Wy11 Wy12 Wy13 Wy14 Wy15 Cw1 Cw2 Cw3 Cw4 Cw5 Cw6 Cw7 Cw8 Cw9 Cw10 Cw11 Cw12 Cw13 Cw14 Cw15	N1, N2, N3

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Aerodynamika**
Name in English	Aerodynamics
Main field of study	Mechanical Engineering and Machine Building
Specialization	Engineering of Aviation
Level and form of studies	1st level, full-time
Kind of subject	optional-specialization
Subject code	MSN0020
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	30	30		
Form of crediting	Examination	crediting with grade	crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3	1	1		
including number of ECTS points for practical (P) classes	0	0	1		
including number of ECTS points for direct teacher-student contact (BK) classes	1,5	0,75	0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills of thermodynamics and fluid mechanics

SUBJECT OBJECTIVES

C1 – Acquaint with rights and phenomena associated flow around bodies.
C2 – Acquaint with mechanisms leading to the lift and drag force front.
C3 – Acquaint with characteristics of the aerodynamic airfoil in subsonic and supersonic flow.
C4 – Introduction to basic issues related to the stability of the aircraft.
C5 – Acquaint with the compounds of gas parameters before and after the shock wave.
C6 – Elaboration of ability pinpoint the the lift and drag force front.
C7 – Elaboration skills for calculating the basic parameters of the gas before and after the shock wave.
C8 – Elaboration basic skills The parameters in the measurement of gas flow through a constriction.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – recite types of flow around the body
PEK_W02 – explain the mechanism of formation the lift and drag force front
PEK_W03 – explain the aerodynamic characteristics of the aerofoil in subsonic and supersonic flow
PEK_W04 – explain phenomena occurring in gas flow through a constriction
PEK_W05 – recite types of stability of the aircraft.

relating to skills:

PEK_U01 – perform basic calculations of lift and drag force front
PEK_U02 – use the known formulas for calculating gas parameters before and after the shock wave
PEK_U03 – Measure the of basic parameters of the gas flow through the constriction and flow around the body

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Subject of aerodynamics. Physical properties of gases. Fundamentals of flow kinematics. Potential flow.	2
Lec2	Steady plane flow: complex potential, principle of flow superposition, examples.	2
Lec3	Flow around a circular cylinder without and with velocity circulation. D'Alembert's paradox, aerodynamic lift of a circular cylinder. Aerodynamic forces and moment.	2
Lec4	Aerodynamic lift: Kutta-Żukowski theorem, Czapłygin-Żukowski postulate.	2
Lec5	Importance layout velocity around profile, fundamentals problems, opposite problems. Influence nearness ground on aerofoil profile lift.	2
Lec6	Flows around a axis symmetrical body. Elementary flow.	2
Lec7	Bernoulli's equation, parameter critical gases. Wave phenomenon in one-dimensional compressible fluid flow. Propagation of disturbances in gases. Shock waves.	2
Lec8	Relationship parameter gases between different side perpendicular shock waves. Hugoniot's adiabatic.	2
Lec9	Supersonic flow around a convex and concave corner. Perpendicular and diagonal shock waves.	2
Lec10	Aerofoil profile, geometric and aerodynamic characteristics of aerofoil profile. Subsonic flow around an aerofoil profile: relation with uncompressible flow, effect of compressibility. Features of transonic and supersonic flow around an aerofoil profile.	2
Lec11	Finite span lifting aerofoil, geometric characteristics of airfoils, aerodynamic model of flow around an aerofoil.	2
Lec12	Two problem theory rational line. Glauerta's method.	2
Lec13	Experimental aerodynamic characteristics of aerofoil profile. Induced velocity and drag force.	2
Lec14	Skew aerofoils. Subsonic and supersonic flow around an aerofoil.	2
Lec15	Maximal lift coefficient, angle of stall. High-lift devices.	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Solving for the calculation of velocity potential and stream function for flow around a profile.	2
Cl 2	Solving for the calculation of lift and drag force.	2
Cl 3	Solving for the calculation of the parameters of the gas, calculate the speed based on the dynamic pressure in subsonic and supersonic flow.	2
Cl 4	Solving problems of changing parameters of gas after passing perpendicular shock wave.	2

Cl 5	Solving problems of changing parameters of gas after passing perpendicular shock wave.	2
Cl 6	Solving problems of changing parameters of gas after passing oblique shock wave.	2
Cl 7	Solving problems of changing parameters of gas after passing oblique shock wave.	2
Cl 8	crediting	1
	Total hours	**15**
Form of classes - laboratory		**Number of hours**
Lab1	Safety training, introduction to classes	2
Lab2	Measure the velocity profile in the pipe line	2
Lab3	Measure the frictional resistance of flow through the pipe	2
Lab4	Ancona chart calculations for serial flow	2
Lab5	Measurement of the pressure distribution along Venturi orifice	2
Lab6	Calculating the actual object on the basis of measurements made on a model of measuring overflow.	2
Lab7	Measurement of pressure distribution on the surface of the cylinder.	2
Lab8	Clearance of reports classifying laboratory	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Traditional lectures using multimedia presentation. Students work to preparing for exam. N2. Classes. discussion of the tasks. Students work to preparing for classes N3. Experimental measurements. Analysis of measurement systems. Verbal answers. short skill tests. Students work to preparing for classes. N4. Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W04	The written examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01÷PEK_U02	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U03	Laboratory report
F2	PEK_U01÷PEK_U03	Written and oral answers
C=((6*F1)/6)*0,6 + ((6*F2)/6*0,4		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [10] Hull D. G. Fundamentals of airplane flight mechanics, Springer 2007 [11] Houghton E. L., Carpenter P. W., Aerodynamics for engineering students, Butterworth Heinemann 2003. [12] Аржаников, Садекова - Аэродинамика Летательных Аппаратов 1983. [13] Ojha S. K. Flight performance fo aircraft, AIAA, Ohio 1995. SECONDARY LITERATURE: [5] Etkin B., Dynamics of atmospheric flight, John Wiley & Sons, New York, 1972. [6] Карман - Аэродинамика. Избранные темы в их Историческом. [7] Аржаников, Мальцев - Аеродинамика 1956.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Aerodynamika

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01 PEK_W02 PEK_W03 PEK_W04 PEK_W05	S1ILO_W03	C1÷C3, C5	Lec1÷Lec14	N1, N4
		C4	Lec15	
PEK_U01	S1ILO_U03	C6	Cl1÷Cl2	N2, N4
PEK_U02		C7	Cl3÷Cl7	
PEK_U03	S1ILO_U04	C8	Lab1÷Lab6	N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish:	**Awionika i sterowanie statkami latającymi**
Name in English:	Avionics and Aircraft Control Systems
Main field of study:	Mechanical Engineering and Machine Building
Specialization:	Engineering of Aviation
Level and form of studies:	1nd level, stationary
Kind of subject:	Obligatory / Specialization
Subject code:	MSN0051
Group of courses:	NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in university (ZZU)	15		15	30	
Number of hours of total student workload (CNPS)	30		30	60	
Form of crediting	crediting with grade		crediting with grade	crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	1		1	2	
Including number of ECTS points for practical (P) classes	0		1	2	
Including number of ECTS points for direct teacher-student contact (BK) classes	0,5		0,75	1,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of electrical engineering, electronics and mechanical engineering.

SUBJECT OBJECTIVES

C1 - Introduction to classification and general characteristics of the equipment and accessories of the aircraft avionics.
C2 - Presentation of the design solutions, design and function of the instrument pilot - navigation and operation control of aircraft engines.
C3 - Identify methods to determine the position of the aircraft used
air navigation services and the general characteristics of air navigation systems.
C4 - Presentation of the purpose, construction and operation of the selected on-board data and display the information on the aircraft.
C5 - Identify methods to stabilize the angular positions of the aircraft and the general characteristics of automatic control systems.
C6 - Discover the methods of registration, construction and operation of on-board flight data recording systems of the aircraft.
C7 - Improving the ability to perform complex calculations on a pilot project selected devices - navigation and propulsion control of the team's work.
C8 - Improving the ability to use modern engineering design support software.
C9 - Developing skills put into practice the theoretical knowledge acquired
during exercise laboratory .
C10 - Strengthening of security when conducting activities of control - measurement on aircraft

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge

Following the course, the student should be able to:

PEK_W01 - describe the general classification of aircraft avionics equipment,

PEK_W02 - replace the basic pilot devices - navigation and control aircraft engine instruments,

PEK_W03 - describe the construction and operation of on-board navigation systems, data and information visualization,

PEK_W04 - describe the principle of operation and replace the main components of automatic control and on-board flight data recording systems of the aircraft,

relating to skills

Following the course, the student should be able to:

PEK_U01 - perform basic calculations, and perform a preliminary design of the selected instrument pilot - navigation / engine control,

PEK_U02 - improve your skills in modern engineering design support software,

PEK_U03 - perform the validation work of the selected device pilot - navigation / operation control drive unit for the laboratory and in the aircraft,

PEK_U04 - perform control operations - some measuring instruments and observe safety rules an aircraft.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Rules for selection of aircraft avionics equipment.	2
Lec 2	Measurements of basic parameters of the pilot - navigation.	2
Lec 3	Terrestrial and satellite navigation systems	2
Lec 4	Aircraft communications and data transmission systems.	2
Lec 5	Aircraft information displays.	2
Lec 6	An aircraft as an object of automatic control. Aircraft automatic flight control.	2
Lec 7	Flight data recorders.	2
Lec 8	Completion of the course.	1
	Total hours	**15**
Form of classes - Laboratory		**Number of hours**
Lab 1	Introduction to laboratory classes. Teaching health and safety.	2
Lab 2	The test of resistance thermometers.	2
Lab 3	The test of thermoelectric thermometers.	2
Lab 4	Measurement integrity and accuracy of the barometric speed indicator.	2
Lab 5	Measurement integrity and accuracy of a barometric altimeter .	2
Lab 6	Measurement integrity and accuracy barometric vertical speed indicator.	2
Lab 7	The test of aircraft gauges.	2
Lab 8	Completion of the laboratory.	1
	Total hours	**15**
Form of classes - Project		**Number of hours**
Pr 1	A preliminary project of air pressure receiver - Prandtl tube .	4
Pr 2	A preliminary project of the barometric altimeter	4
Pr 3	A preliminary project of barometric and true airspeed .	4
Pr 4	A preliminary project of barometric Mach number indicator	4
Pr 5	A preliminary project of barometric vertical speed indicator.	4
Pr 6	A preliminary project of resistance thermometer.	4
Pr 7	A preliminary project of thermoelectric thermometer	4
Pr 8	A course.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture: – Traditional lecture using multimedia presentations; – Individual work – self – study and exam preparation. N2. Laboratory: – short written tests by the laboratory exercise; – Individual work - to prepare for the laboratory exercises. N3. Project: – guidelines for the implementation of projects; – presentation of completed projects; – discussion of the project made . N4. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation F – forming (during semester), C – summary (at semester end)	Number of training effect	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W04	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation F – forming (during semester), C – summary (at semester end)	Number of training effect	Way of evaluating educational effect achievement
F1	PEK_U03 PEK_U04	Rating for exercise laboratory No. 2
F2		Rating for exercise laboratory No. 3
F3		Rating for exercise laboratory No. 4
F4		Rating for exercise laboratory No. 5
F5		Rating for exercise laboratory No. 6
F6		Rating for exercise laboratory No. 7
P=(F1+F2+F3+F4+ F5+F6)/6		The prerequisite is that all ratings were forming positive ratings

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Oceny (F– forming (during semester), C– concluding (at semester end)	Number of training effect	Way of evaluating educational effect achievement
F1	PEK_U01 PEK_U02	Rating for Project No1
F2		Rating for Project No2
F3		Rating for Project No3
F4		Rating for Project No4
F5		Rating for Project No5
F6		Rating for Project No6
F7		Rating for Project No7
C=(F1+F2+F3+F4+F5+F6+F7)/7		Grades for completed projects

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[14] Bociek S., Gruszecki J.: Układy sterowania automatycznego samolotem. OWPRz, Rzeszów 1999.
[15] Kazana J., Lipski J.: Budowa i eksploatacja pokładowych przyrządów lotniczych. WKił, Warszawa 1983.
[16] Narkiewicz J.: Podstawy układów nawigacyjnych. WKiŁ, Warszawa 1999.
[17] Polak Z., Rypulak A.: Awionika, przyrządy i systemy pokładowe. WSOSP, Dęblin 2002.
[18] Stefanowicz A.: Pokładowe układy pomiarowe, Wydawnictwa PW, Warszawa 1984.
[19] Żugaj M.: Układy automatycznego sterowania lotem. OWPW, Warszawa 2011.

SECONDARY LITERATURE:

[8] Brasławski D.A., Łogunow S. Pelpor D. S. Lotnicze przyrządy pokładowe. Wydawnictwo Komunikacyjne Warszawa 1957.
[9] Grzegorczyk T., Witkowski R.: Lotnicze systemy pomiarowe – czujniki. WAT, Warszawa 2000.
[10] Tooley M., Wyatt D. : Aircraft Electrical and Electronic Systems. Elsevier 2009.
[11] Tooley M., Wyatt D.: Aircraft Communication and Navigation Systems. Elsevier 2007.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Awionika i sterowanie statkami latającymi
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1ILO_W07	C1	Wy1	N1, N4
PEK_W02		C2	Wy2	
PEK_W03		C3 ÷ C4	Wy3 ÷ Wy5	
PEK_W04		C5 ÷ C4	Wy6 ÷ Wy7	
PEK_U01	S1ILO_U07	C7 ÷ C8	Pr1 ÷ Pr7	N3, N4
PEK_U02				
PEK_U03	S1ILO_U08	C9 ÷ C10	Lab 2 – Lab 7	N2, N4
PEK_U04				

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Badanie maszyn**
Name in English	Research and testing of machines
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Power Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0060**
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	exam		crediting with grade		
For group of courses mark (X) final course					
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	1,50		1,50		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of metrology and experimental techniques, thermodynamics, fluid mechanics.

SUBJECT OBJECTIVES

C1. Provides knowledge related to the principles of energy balance for power engineering machines and devices.
C2. Provides knowledge about methods and possibilities of modernization of heating systems in terms of waste heat utilization and excessive loss reduction.
C3. Provide knowledge about methods of determining heat loss in devices, graphic illustration of energy balance and types of power engineering machines characteristics.
C4. Describes the problems associated with the experiment planning and results handling with particular reference to the determination of measurement uncertainties for indirect method.
C5. Develops the skills and practice in balance measurements caring out, results handling and measurement uncertainty evaluating.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Should have knowledge related to the principles of energy balance for power engineering machines and devices.

PEK_W02 Should have knowledge related to the heat loss analysis, the principles for excessive loss reduction, and the assessment of the potential for heating systems modernization in terms of waste heat utilization.

PEK_W03 Should have knowledge about the methods of determining efficiency and heat loss of power engineering machines and devices.

PEK_W04 Should be able to describe the method for graphic illustration of energy balance and explain the principle of presentation of performance characteristic of power engineering machines.

PEK_W05 Should have knowledge about methods for determining the uncertainty of the efficiency of power engineering machines and devices.

PEK_W06 Should have basic knowledge related to the techniques of experiment planning and results handling.

relating to skills:

PEK_U01 Should have the ability to carry out balance measurements of selected power engineering machines and devices.

PEK_U02 Should have the ability to set up a measuring step in balance studies.

PEK_U03 Should have the ability to determine the heat loss of selected power engineering machines and devices.

PEK_U04 Should have the ability to perform graphic illustration of energy balance of selected power engineering machines and devices.

PEK_U05 Should have the ability to perform main characteristics of power engineering devices on the basis of the energy balance.

PEK_U06 Should have the ability to carry out the assessment of the measurement uncertainty.

PROGRAMME CONTENT		
Form of classes – lecture		**Number of hours**
Lec 1, 2	The types of measurements, the principle of energy balance for power engineering machines and devices.	4
Lec 3	Assessment of the potential for power engineering machines and devices modernization.	2
Lec 4÷6	Examination of steam boilers.	6
Lec 7÷9	Examination of steam turbines and cooling towers.	6
Lec 10	Examination of centrifugal pumps.	2
Lec 11	Examination of the fans.	2
Lec 12, 13	Examination of piston air compressors.	4
Lec 14	Examination of combustion engines.	2
Lec 15	Exam.	2
	Total hours	**30**

Form of classes – laboratory		**Number of hours**
Lab 1	The scope and course completion conditions. Health and safety regulations.	2
Lab 2, 3	Testing of steam boilers.	4
Lab 4, 5	Testing of and steam turbines.	4
Lab 6	Testing of centrifugal pump.	2
Lab 7	Testing of the fan.	2
Lab 8	Testing of heating unit.	2
Lab 9, 10	Testing of heating system with 50 kW boiler (Vissman).	4
Lab 11	Testing of piston air compressor.	2

Lab 12	Energy balance of power unit.	2
Lab 13	Testing of combustion engine.	2
Lab 14	Testing of coal pulverizer.	2
Lab 15	Additional term of the laboratory. Colloquium.	2
	Total hours	**30**

TEACHING TOOLS USED
N1 Traditional lecture with use of the slides and the transparency. N2 Laboratory – small exams from laboratories preparation. N3 Laboratory – discussion of experimental procedures. N4 Laboratory – discussion of the reports related to the measurements carried out. N5 Student's own work – preparation for laboratories. N6 Consultations. N7 Student's own work – colloquium preparation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷ PEK_W06	Exam.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷ PEK_U06	Small written exams.
F2	PEK_U01÷ PEK_U06	Small oral exams.
F3	PEK_U01÷ PEK_U06	Grading of laboratory reports.
C = 0,4F1 +0,4F2+0,2F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Skrypt. Praca zbiorowa: Miernictwo energetyczne. Cz. II. Pomiary maszyn i urządzeń cieplnych. Wydawnictwo. Politechniki Wrocławskiej, 1974

[2] J. Stańda, J. Górecki, A. Andruszkiewicz: Badanie maszyn i urządzeń energetycznych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004

[3] Wyrażanie niepewności pomiaru. Przewodnik. Główny Urząd Miar 1995.

SECONDARY LITERATURE:

[1] Podręcznik. Praca zbiorowa: *Pomiary cieplne. Cz. II. Badania cieplne maszyn i urządzeń*. WNT, 1995

[2] J. Arendarski: *Niepewność pomiaru*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2003.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Badanie maszyn

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

AND SPECIALIZATION

Thermal Power Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01,	S1INC_W12	C1	Lec1, Lec 2	N1,N6,N7
PEK_W02	S1INC_W12	C2	Lec 3	
PEK_W03÷ PEK_W06	S1INC_W12	C1, C3÷C5	Lec 4÷Lec 14	N1,N6,N7
PEK_U01÷ PEK_U06	S1INC_U13	C1, C3÷C5	Lab 2÷Lab 14	N2÷N6

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**CAD I**
Name in English	CAD I
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN0091**
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		
For group of courses mark (X) final course					
Number of ECTS points			2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes			1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

5. Knowledge of issues related to creating of technical drawings.
6. Computer literacy in MS Windows.

SUBJECT OBJECTIVES

C1 - To acquaint students with the principles of working with computer aided design (AutoCAD software)
C2 – Developing the ability of creating 2D technical documentation

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – the ability to create and modify 2D models
PEK_U02 – the ability to prepare plot including necessary texts and dimensioning
PEK_U03 – the ability to transfer data between documents and collaboration with other users

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
La1	Basic terms and the principle of creating a model	2
La2	Accurate drawing	2
La3	Basic commands for entities creation, hatching	2
La4	Basic commands for entities creation part 2	2
La5	Entities modification and coping	2
La6	Entities modification and coping part 2	2
La7	Dimensioning in AutoCAD	2
La8	Additional elements: cross-sections, tolerances, welds, etc.	2
La9	Viewports and Layouts	2
La10	Preparing drawings for plotting	2
La11	Parametric design	2
La12	Blocks	2
La13	Templates and teamwork	2
La14	Advanced capabilities of AutoCAD	2
La15	Final test	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Introduction to classes using electronic presentation system N2. Individual work – preparation for classes, improvement for skills N3. Monitoring the progress of students/ revision activities N4. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01- PEK_U03	Revision during classes, short tests concerning classes-covered material
F2	PEK_U01- PEK_U03	Final test
C = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [10] W.Ferens, J.Wach – CAD AutoCAD 2D, Oficyna Wydawnicza Politechniki Wrocławskiej 2012 [11] Course guides (www.paliwa.pwr.wroc.pl) [12] AutoCad Textbooks and Handbooks (min. ver. 2010).

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

CAD I

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_U01	K1MBM_U07	C1, C2	La1-La6, La11	N1, N2, N3, N4
PEK_U02		C1, C2	La7-La10	N1, N2, N3, N4
PEK_U03		C1, C2	La12-La14	N1, N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**CAD II**
Name in English	CAD II
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN0100**
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		
For group of courses mark (X) final course					
Number of ECTS points			2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes			1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

7. Knowledge of issues related to creating of technical drawings.
8. Computer literacy in MS Windows.
9. Computer literacy in 2D AutoCAD.

SUBJECT OBJECTIVES

C1 - To acquaint students with the principles of creating 3D models and technical documentation using computer aided design (AutoCAD and Inventor software)
C2 – Developing the ability of creating 3D models and technical documentation based on them.

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – the ability to create and modify 3D models
PEK_U02 – the ability to prepare plot including necessary texts and dimensioning
PEK_U03 – the ability to creating assembly design
PEK_U04 – the basic ability to perform strength calculations

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
La1	Introduction to 3D design in AutoCAD	2
La2	3D Modeling – grids, surfaces	2
La3	Solid modeling	2
La4	3D elements edition	2
La5	Preparing a specification sheet for solids	2
La6	Preparing a specification sheet for solids part 2	2
La7	Automated creating a specification sheet	2
La8	Introduction to Inventor software	2
La9	Part Modeling	2
La10	Part editing	2
La11	Creating of complex parts	2
La12	Strength calculations using FEM analysis	2
La13	Assembly design	2
La14	Preparing a specification sheet	2
La15	Final test	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Introduction to classes using electronic presentation system N2. Individual work – preparation for classes, improvement for skills N3. Monitoring the progress of students/ revision activities N4. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01- PEK_U04	Revision during classes, short tests concerning classes-covered material
F2	PEK_U01- PEK_U04	Final test
C = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [13] Course guides (www.paliwa.pwr.wroc.pl) [14] AutoCad, Inventor Textbooks and Handbooks (min. ver. 2010).

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

CAD II

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_U01	K1MBM_U07	C1, C2	La1-La4 La8-La11	N1, N2, N3, N4
PEK_U02		C1, C2	La5-La7 La14	N1, N2, N3, N4
PEK_U03		C1, C2	La13	N1, N2, N3, N4
PEK_U04		C1, C2	La12	N1, N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**CATIA**
Name in English	CATIA
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional**
Subject code	**MSN0111**
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		
For group of courses mark (X) final course					
Number of ECTS points			3		
including number of ECTS points for practical (P) classes			3		
including number of ECTS points for direct teacher-student contact (BK) classes			2,25		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and ability in the scope of descriptive geometry, technical drawing, strength of materials, material science and basic of machine design.

SUBJECT OBJECTIVES

C1 –. Developing skills of application of advanced system of aid design - CATIA in scope of 3D parts creation.

C2 – Developing skills of application of advanced system of aid design - CATIA in scope of 3D assembly creation.

C3 - Developing skills of application of advanced system of aid design - CATIA in scope of preparing 2D technical documentation based on 3D model.

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – can create 3D model of basic machine elements into CATIA system environment,
PEK_U02 – based on 3D models, can create an assembly of machine components,
PEK_U03 - based on 3D models, can create a technical documentation of a part or a machine component.

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
Lab1	Introduction to CATIA system. Description of the CATIA environment. Product structure tree.	2
Lab2,3	Profiles creation – Sketcher module.	4
Lab4	Parts creation by profile extrusion.	2
Lab5	Parts creation by profile rotation.	2
Lab6,7	Parts transformations.	4
Lab8	Parts creation by profile extrusion along any path.	2
Lab9	Parts creation by extrusion through many profiles and paths.	2
Lab10	Parametric modelling.	2
Lab11	Usage an external source of data for parametric modelling.	2
Lab12	Creation of an assembly.	2
Lab13	Creation of technical documentation – part drawing.	2
Lab14	Creation of technical documentation – assembly drawing.	2
Lab15	Credit	2
	Total hours	

TEACHING TOOLS USED

N1. Lecture with multimedia.
N2. Introduction to laboratory.
N3. Individual work.
N4. Office hours

EVALUATION OF

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01 ÷ PEK_U03	Test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[20] Skarka Wojciech, Mazurek Andrzej: „CATIA. Podstawy modelowania i zapisu konstrukcji”, Helion 2004.

[21] Wełyczko A.:" CATIA V5. Przykłady efektywnego zastosowania systemu w projektowaniu mechanicznym", Helion 2004.

[22] Skarka W.: "CATIA V5. Podstawy budowy modeli autogenerujących", Helion 2009.

SECONDARY LITERATURE:

[23] …. Mazanek E. „Przykłady obliczeń z podstaw konstrukcji maszyn”, WNT 2005.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

CATIA

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_U01	K1MBM_U08	C1	Lab1 ÷Lab11	N1 N2 N3 N4
PEK_U02	K1MBM_U08	C2	Lab 12	N1 N2 N3 N4
PEK_U03	K1MBM_U08	C3	Lab 13,Lab14	N1 N2 N3 N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Cieplne maszyny przepływowe**
Name in English	Thermal turbomachinery
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0170**
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	30			
Form of crediting	crediting with grade	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Student has a basic knowledge in the field of mechanics, fluid mechanics, design fundamentals, material mechanics and material science.

SUBJECT OBJECTIVES

C1 – indicating role of turbo-machinery in fundamental power generation technologies, overview of design and components
C2 – presentation of one dimensional compressible flow analysis
C3 – becoming familiar with operation (and energy conversion) of turbo-machine stage (expanding and compressing)
C4 – introduction of turbo-machine stage kinematics and theory: axial, radial and diagonal
C5 – introducing relation between kinematics and characteristic stage indicators
C6 – presentation of stage design process and its limitations

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01- identification of fundamental types of machines, their components and meaning
PEK_W02- description of fundamental phenomena and criteria numbers used to describe compressive flows
PEK_W03 - explanation of energy conversion processes in flow channels (stationary and non-stationary) and operation rules of machine stage
PEK_W04 - description of turbo-machine stage kinematics (compressing and expanding)
PEK_W05 - describing relation between kinematics and energy conversion
PEK_W06 - characterization of basic stage design systems and design limitations

relating to skills:

PEK_U01 - identify basic machine elements, interpret control cross-sections and calculate losses
PEK_U02 - calculate rest parameters and critical parameters in confusor flow
PEK_U03 - presentation of single stage operation on enthalpy-entropy graph and interpret its efficiency
PEK_U04 - analyse stage kinematics and interpret forces acting on vanes
PEK_U05 - estimate losses and basic characteristic indicators
PEK_U06 – calculate basic geometrical parameters of turbo-machine stage

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec1	Classification turbo-machines and their evolution	2
Lec2	Operation rules of turbo-machine, machine components	2
Lec3	Laws describing flow phenomena – conservation equations	2
Lec4	Characteristic numbers describing compressive flow	2
Lec5	Flow around a profile, profile palisade, vane rim	2
Lec6	Equation of state of working medium, influence of compressibility	2
Lec7	De Saint Venant-Wantzel equation and critical parameters	2
Lec8	Kinematics of turbo-machinery stage, velocity triangle	2
Lec9	One-dimensional theory of expansion machine stage	2
Lec10	One-dimensional theory of compression machine stage	2
Lec11	Processes occurring in turbo-machine vane rims.	2
Lec12	Dimensionless indicators of turbo-machine stage.	2
Lec13	Construction systems and typical machine and their elements solutions	2
Lec14	Design and construction problems of turbo-machine late stages	2
Lec15	Material and aero-dynamical limitations of stage and whole machine	2
	Total hours	**30**
Form of classes - classes		**Number of hours**
Cl 1	Calculation of pressure distribution in flow installation with fan, diffuser role (discharge loss)	2
Cl 2	Calculation of rest and critical parameters, Mach number in flowing gas	2
Cl 3	Calculation of enthalpy drop (increment) in machine stage using enthalpy-entropy diagram	2
Cl 4	Calculation of aerodynamic force	2
Cl 5	Calculation of turbo-machine stage kinematics	2
Cl 6	Calculation of stage main dimensions	2
Cl 7	Calculation of basic losses, efficiency and stage	2
Cl 8	Final test	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Traditional lecture using multidimensional presentation, blackboard, chalk. Discussion over problem. N2. Tutorials, design calculations results discussion and solutions. N3. Individual work – design project preparation. N4. Individual consultancy

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01÷PEK_W09.	Average from partial tests.
F2	PEK_W01÷PEK_W09	Written test.
P=(2F1+F2)/3		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U06	Activity during classes
F2	PEK_U01÷PEK_U06	Short tests
F3	PEK_U01÷PEK_U06	Final test
P = (F1+F2+F3)/3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

1] Chmielniak T., Maszyny przepływowe, Politechnika Śląska, Gliwice 1997

[2] Gundlach R. W., Podstawy maszyn przepływowych i ich systemów energetycznych, WNT, Warszawa 2008

[3] Miller A., Teoria maszyn wirnikowych – zagadnienia wybrane, Politechnika Warszawska, Warszawa 1989

[4] Perycz St., Turbiny parowe i gazowe, Ossolineum, Wrocław 1992

[5] Postrzednik S., Termodynamika zjawisk przepływowych – jednowymiarowe przepływy odwracalne, Politechnika Śląska, Gliwice 2000

SECONDARY LITERATURE:

[1] Tuliszka E., Sprężarki, dmuchawy i wentylatory, WNT, Warszawa 1976

[2] Tuliszka E., Turbiny cieplne, zagadnienia termodynamiczne i przepływowe, WNT, Warszawa 1973

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Cieplne maszyny przeplywowe
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1INC_W06	C1	Lec1, Lec2	N1, N3, N4, N5
PEK_W02		C2	Lec3, Lec4	
PEK_W03		C3	Lec5 - Lec8	
PEK_W04		C4	Lec8 - Lec10	
PEK_W05		C5	Lec11, Lec12	
PEK_W06		C6	Lec 13 - Lec 15	
PEK_U01	S1INC_U07	C1	Cl1	N2, N3, N4, N5
PEK_U02		C2	Cl 2, Cl 3	
PEK_U03		C3	Cl 3- Cl 5	
PEK_U04		C4	Cl 5, Cl 6	
PEK_U05		C5	Cl 5- Cl 7	
PEK_U06		C6	Cl 6- Cl	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Czynnik ludzki w obsłudze statków powietrznych**
Name in English	Human factors in aircraft maintenance
Main field of study	Mechanical Engineering and Machine Building
Specialization	Engineering of Aviation
Level and form of studies	1st level, full-time
Kind of subject	optional-specialization
Subject code	MSN 0188
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
For group of courses mark (X) final course					
Number of ECTS points	1				2
including number of ECTS points for practical (P) classes	0				2
including number of ECTS points for direct teacher-student contact (BK) classes	0,5				1,5

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of: aircraft construction, production, repair and diagnostics of aircraft.

SUBJECT OBJECTIVES

C1 – Familiar with the basic concepts.
C2 – Presentation of the SHEL model and the introduction of Murphy's law in relation to the "human factor".
C3 – Presentation of the 12 major causes of maintenance errors.
C4 – Consideration of the possibility of human endurance and its limitations.
C5 – Presentation of the requirements for the "human factor" in the maintenance organization.
C6 – Manufacturing skills necessary to develop and present papers on a given topic.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

following the course, the student should be able to:

PEK_W01 – explain the need to consider the "human factor" in the maintenance of aircraft.
PEK_W02 – discuss the SHEL model.
PEK_W03 – explain human activity in the context of Murphy's laws.
PEK_W04 – explain the main human errors in the maintenance of aircraft.
PEK_W05 – characterize the nature of human error.
PEK_W06 – identify organizational factors that affect safety.
PEK_W07 – explain the impact of human capability and limitations of the body to its action.
PEK_W08 – clarify the role of the "human factor" in the organization PART145.

relating to skills:

following the course, the student should be able to:

PEK_U01 – analyse human activity, taking into account the "human factor".
PEK_U02 – use knowledge about the capabilities of the human body to create procedure of aircraft maintenance.
PEK_U03 – organize teamwork for technical personnel in accordance with procedures.
PEK_U04 – implement the principles of the "human factor" to the practice of maintaining aircraft subject to the requirements of teamwork.
PEK_U05 – prepare a maintenance documentation in accordance with the requirements of the "human factor".

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours
Lec1	Introduction and need to take account of the human factor.	2
Lec2	SHEL model.	2
Lec3	The human factor and Murphy's Law.	2
Lec4	Dirty dozen.	2
Lec5	Human error.	2
Lec6	Safety culture, organizational factors.	2
Lec7	Human performance.	2
Lec8	Requirements for the human factor in the maintenance organization.	1
	Total hours	**15**

Form of classes - seminar		Number of hours
Sem1	"Human factor" in the history of aviation.	4
Sem2	Factors affecting the human capacity.	4
Sem3	Procedures, information, tools and practices to aircraft maintenance.	4
Sem4	Restrictions on the human body.	4
Sem5	Communication.	2
Sem6	Teamwork.	4
Sem7	Requirements for the "human factor".	4
Sem8	"Human factor" in the Part 145 requirements.	4
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture: • traditional lecture using multimedia presentation, • individual work - self-study and preparation to pass the course. N2. Seminar: • individual work - preparing the presentation and outline on a specific topic, • presentation of a paper using a multimedia presentation, • listening to papers presented in class. N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W08	Written and oral test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- seminar

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03	Preparing and uttering lecture, presentation development.
F2	PEK_U01; PEK04; PEK_U05	Preparing and uttering lecture, presentation development.
C=(2·F1+2·F2)/4		Assessment condition is that all forming evaluation are positive.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Lewitowicz J.: Podstawy eksploatacji statków powietrznych. Tomy 1 – 6. ITWL, Warszawa 2003, 2006.
[2] Zagdański Z.: Stany awaryjne statków powietrznych. ITWL, Warszawa 2003.
[3] Przepisy Part 145.

SECONDARY LITERATURE:

[1] Dokumenty ICAO:
[2] Doc 9683 – Human Faktors Training Manual.
[3] Doc 9859 – Safety Management Manual.
[4] Circular 253 – Human factor Digest No. 12 – Human Factors In Aircraft Maintenance and Inspection.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Czynnik ludzki w obsłudze statków powietrznych
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Przedmiotowy efekt kształcenia	Odniesienie przedmiotowego efektu do efektów kształcenia zdefiniowanych dla kierunku studiów i specjalności	Cele przedmiotu	Treści programowe	Numer narzędzia dydaktycznego
PEK_W01	S1ILO_W16	C1	Lec1	N1; N3
PEK_W02		C2	Lec2	
PEK_W03		C2	Lec3	
PEK_W04		C3	Lec4	
PEK_W05		C3	Lec5	
PEK_W06		C3	Lec6	
PEK_W07		C4	Lec7	
PEK_W08		C5	Lec8	
PEK_U01	S1ILO_U19	C6	Sem1; Sem4; Sem7	N2; N3
PEK_U02		C6	Sem2	
PEK_U03		C6	Sem3; Sem5; Sem6	
PEK_U04		C6	Sem3; Sem4; Sem5, Sem6	
PEK_U05		C6	Sem7; Sem8	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish:	**Diagnostyka sprzętu lotniczego**
Name in English:	Diagnostics of aerial equipments
Main field of study:	Mechanical Engineering and Machine Building
Specialization:	Aircraft Engineering of Aviation
Level and form of studies:	1nd level, full-time
Kind of subject:	Obligatory / Specialization
Subject code:	MSN0190
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		
For group of courses mark (X) final course					
Number of ECTS points	2		2		
Including number of ECTS points for practical (P) classes	0		2		
Including number of ECTS points for direct teacher-student contact (BK) classes	1		1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of mechanics , materials science and automation.

SUBJECT OBJECTIVES

C1 - Introduction to basic concepts of technical diagnostics.
C2 - Presentation of the diagnostic parameters characterizing the status of devices and systems onboard the aircraft.
C3 - Characterization of selected models of diagnosis, prognosis and genesis state aircraft.
C4 - Improving diagnostic verification of selected models of aircraft and diagnose the state of the aircraft and propulsion systems of aircraft.
C5 - Familiarization with the methods of non-destructive testing of aircraft.
C6 - Improving the ability to use diagnostic equipment aircraft and put into practice the theoretical knowledge acquired in the performance of laboratory exercises ..
C7 - Implementing the principles of correct connection of the measuring systems, conduct and interpretation of laboratory results.
C8 - Strengthening of security when conducting control - measurement activities on board the aircraft.

SUBJECT EDUCATIONAL EFFECTS

KNOWLEDGE

Following the course, the student should be able to:

PEK_W01 - replace the basic concepts and gló1) century issues of technical diagnostics,
PEK_W02 - characterize the aircraft as a matter of diagnosing the state of devices and on-board systems,

PEK_W03 - characterize the models of diagnosis, and prognosis genezowania state aircraft
PEK_W04 - replace the method of verifying the status of diagnostic models of aircraft,
PEK_W05 - explain the methods of diagnosing the state of the aircraft and propulsion systems
PEK_W06 - describe methods of non-destructive testing of aircraft
PEK_W07 - list and describe the diagnostic equipment of aircraft.

SKILLS

Following the course, the student should be able to:

PEK_U01 - Diagnostic testing of selected equipment and on-board systems for the laboratory and in the aircraft ,
PEK_U02 - Observe safety rules when on board an aircraft

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Basic concepts and key issues of technical diagnostics.	2
Lec 2	An aircraft as a element of diagnosis..	4
Lec 3	Diagnostic models of aircraft.	2
Lec 4	Genesis state models of aircraft.	2
Lec 5	Predictive states models of aircraft.	2
Lec 6	Verification of diagnostic models of aircraft.	2
Lec 7	Diagnostics onboard systems the aircraft.	4
Lec 8	Diagnosis of air power units.	4
Lec 9	Non-destructive testing of aircraft.	4
Lec 10	Methods and diagnostic equipment of aircraft.	2
Lec 11	Completion of the course.	2
	Total hours	**30**
Form of classes - Laboratory		**Number of hours**
Lab 1	Introduction to laboratory classes. Teaching health and safety.	2
Lab 2	Analysis of the information obtained from diagnosis systems of the aircraft.	2
Lab 3	Visual testing - assessment of the technical condition of the aircraft.	2
Lab 4	Visual testing - the use of endoscopes.	2
Lab 5	Visual testing - using videoscope.	2
Lab 6	Non-destructive testing method of penetration.	2
Lab 7	Non-destructive testing by eddy currents.	2
Lab 8	Non-destructive testing method of magnetic.	2
Lab 9	Ultrasonic Non-Destructive Testing.	2
Lab 10	Assessment of technical condition of the aircraft approaches: radiological and radar.	2
Lab 11	Assessment of technical condition of the aircraft methods: infrared and vibroacoustical.	2
Lab 12	Objective control of aircraft operation.	2
Lab 13	Aircraft engine diagnostics - the analysis of control parameters.	2
Lab 14	Engine Test - analysis parameters.	2
Lab 15	Completion of the laboratory.	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture:
– Traditional lecture using multimedia presentations;
– Individual work – self – study and exam preparation.
N2. Laboratory:
– short written tests by the laboratory exercise ;
– Individual work - to prepare for the laboratory exercises .
N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation F – forming (during semester), C – summary (at semester end)	Number of training effect	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W07	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation F – forming (during semester), C – summary (at semester end)	Number of training effect	Way of evaluating educational effect achievement
F1÷F13	PEK_U01÷PEK_U02	Rating for exercise laboratory
$C=\frac{\sum_{n=1}^{n=13} F_n}{13}$		The prerequisite is that all ratings were forming positive ratings

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[24] Boliński B., Stelmaszczyk.: Eksploatacja silników turbinowych. WKiŁ, Warszawa 1981.
[25] Lewińska – Romicka A.: Badania nieniszczące. Podstawy defektoskopii. PWN, Warszawa 2001.
[26] Lindstedt P.: Praktyczna diagnostyk maszyn i jej teoretyczne podstawy. Wydawnictwo Naukowe ASKON, Warszawa 2002.
[27] Niziński S., Michalski R.: Diagnostyka obiektów technicznych. Wydawnictwo i Zakład Poligrafii Instytutu Technologii Eksploatacji, Radom 2002.

SECONDARY LITERATURE:

[12] Balicki W., Szczeciński S.: Diagnozowanie lotniczych silników turbinowych. BNIL. Ilot, Warszawa 2001.
[13] Lewitowicz J.: Podstawy eksploatacji statków powietrznych – Tom 4. Wyd. ITWL, Warszawa, 2006 r.
[14] Olejnik A.: Konstrukcja samolotów cz. II. WAT, Warszawa 1984..

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Diagnostyka sprzętu lotniczego
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	S1ILO_W12	C1	Lec 1	N1, N3
PEK_W02		C2	Lec 2	
PEK_W03		C3	Lec 3 ÷ Lec 5	
PEK_W04		C4	Lec 6	
PEK_W05			Lec 7 ÷ Lec 8	
PEK_W06		C5	Lec 9	
PEK_W07		C6	Lec 10	
PEK_U01	S1ILO_U15	C11 ÷ C13	Lab 2 ÷ Lab 14	N2, N3
PEK_U02				

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Ekologia**
Name in English	Ecology
Main field of study	Mechanical Engineering and Machine Building
Level and form of studies	1st level, fullt-time
Kind of subject	obligatory
Subject code	MSN0210
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				
For group of courses mark (X) final course					
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	1,5				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of the issues related to the combustion theory and fuel morphology, pollutant formation from the processes of natural fuels combustion.
2. Basic knowledge in the field of chemistry.

SUBJECT OBJECTIVES

The main objectives of the course are to:

C1 – Acquaint students with the biogeochemical cycles of the elements in the ecosystem on the basis of carbon, nitrogen and sulfur, as well as with the metals migration in the trophic chain.
C2 – Acquaint students with the flow of energy through an ecosystem and provide examples in the macro and micro scale.
C3 – Acquaint students with the influence of combustion technologies on the ecosystem (effect of impurities).
C4 – Discuss the problems associated with different types of anthropogenic pollution, scale and mechanism of their effects on the environment (e.g. bioaccumulation, the migration of metals in the food chain).
C5 – Acquaint students with directions of research on the greenhouse effect and controversial role of carbon dioxide.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK W01 – Should have a knowledge of the basic ecosystem processes.

PEK_W02 – Should have a knowledge of the mechanisms and impacts of pollutants on the ecosystem.

PEK_W03 – Should have a basic knowledge of the phenomena caused by human activities (e.g. water and soil acidification, smog) and legal requirements for environmental protection.

relating to social competences:

PEK_K01 – Should have a competence to carry out publishing activities for environmental protection and energy conservation.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	The concept of the ecosystem. Energy and matter cycles in an ecosystem.	2
Lec2	The cycles of carbon, nitrogen and sulfur.	2
Lec3	Types of pollution. Air, soil and water pollution.	2
Lec4	Environmental contamination by metals.	2
Lec5	Biological effects of pollution.	2
Lec6	The influence of combustion processes on the environment, part 1 (NO_x, SO_2, CO).	2
Lec7	The influence of combustion processes on the environment, part 2 (PAHs, dust).	2
Lec8	Transport of air pollutants.	2
Lec9	Wet and dry deposition.	2
Lec10	Black smog.	2
Lec11	Photochemical (white) smog.	2
Lec12	Greenhouse effect.	2
Lec13	Effects of climate change. Combat climate change.	2
Lec14	The ozone layer.	2
Lec15	Discussion about the impact of the power industry on environment.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Problematic-informative lecture, multimedia presentation.
N2. Student's own work – literature review.
N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01 - PEK_W03 PEK_K01	Colloquium.

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] Ekologia, Aulay Mackenzie, Andy S. Ball, Sonia R. Viedee PWN 2009, [2] Umiński T., Ekologia.Środowisko. Przyroda. Klimat, WSiP, Warszawa 1996, [3] Juda-Rezler K., Oddziaływanie zanieczyszczeń powietrza na środowisko, wyd. Politechnika Warszawska, Warszawa 2000, [4] Ekologia, Charles J. Krebs, WN 2011, [5] Ochrona Środowiska Przyrodniczego, Bożena Dobrzańska, Grzegorz Dobrzański, Dariusz Kiełczowski, PWN 2010. [6] J. Kucowski, D. Laudyn, M. Przekwas, Energetyka a ochrona środowiska, WNT Warszawa 1998. SECONDARY LITERATURE: [1] Śliwińska E., Środowisko Fizyczne człowieka, wyd. Politechnika Wrocławska, Wrocław 2003 [2] Pawlaczyk-Szpilowa M., Biologia i Ekologia, wyd. Politechnika Wrocławska, Wrocław 2003 [3] Czasopisma naukowe

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W17	C1, C2, C4	Lec 1,2,3 Lec 8-10	N1÷N3
PEK_W02		C3, C4	Lec 3 Lec 5-7 Lec 12-14	
PEK_W03		C3, C4	Lec 9-12, Lec 15	
PEK_K01	K1MBM_K02	C1-C5	Lec 1-15	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Geometria wykreślna**
Name in English	Descriptive Geometry
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**all**
Level and form of studies	**1st level, part-time**
Kind of subject	**Obligatory**
Subject code	**MSN0230**
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			
For group of courses mark (X) final course					
Number of ECTS points	3	2			
including number of ECTS points for practical (P) classes	0	2			
including number of ECTS points for direct teacher-student contact (BK) classes	1,50	1,50			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Lack of prerequisites

SUBJECT OBJECTIVES

C1 – Students acquaintance with Monge'a method of projection
C2 - Students acquaintance with recording of basics geometrical elements: points, lines, planes in three-dimensional projection
C3 - Students acquaintance with recording of correlating basics geometrical elements and transformation of their reciprocal positions
C4 - Students acquaintance with recording of polyhedrons and rotational solids; design methods of interpenetration
C5 – gaining ability of the presentation in the graphical form the plane and spatial objects,

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – one knows notions: axonometric drawing, axonometric types differentiates,
PEK_W02 – one knows rules of Orthogonal projection, parallel and middle projection,
PEK_W03 – one understands notions: point in the space, line in the space,
PEK_W04 – one knows notions: vertical, horizontal and lateral trace
PEK_W05 – one has knowledge about recording of relation between point and line, two lines, two planes,
PEK_W06 – one knows rules of Puncture point of the straight line with plane, and determination of visibility,
PEK_W07 – one has the knowledge about solids rotation rules in three dimensional projection,
PEK_W08 – knows notions: auxiliary projections, projection change
PEK_W09 – knows polyhedrons recording and point of the straight line with polyhedron
PEK_W10 – one knows rules of penetrate edge recording, mesh making,
PEK_W11 – knows recording of rotational solids and mesh designing,
PEK_W12– one has the knowledge of curves drawing: ellipse, involutes, screw line

relating to skills:

PEK_U01 – can record the model in Orthogonal projection,
PEK_U02 – can draw and notice the line in three-dimensional projections,
PEK_U03 – can draw cutting edge projection by line, show the visible part of line
PEK_U04 – can determine the puncture point of the line projection with plane, show the visible part of line,
PEK_U05 – can transform the position of solids to determine their real dimensions,
PEK_U06 – can transform the position of solids to determine their real dimensions using sectioning method,
PEK_U07 – can record polyhedron projections and rotational solids,
PEK_U08 – can record mesh of the solids,
PEK_U09 – can record the solid penetrates by plane,
PEK_U10 – can make recording penetration of two solids,
PEK_U11 – can determine penetration line of two rotational solids,
PEK_U12 – can draw curves: ellipse, involutes, screw line

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Basis of the graphical record. Axonometric drawing	1
Lec2	Parallel and middle projections. Orthogonal projection – introduction	1
Lec3	Arbitrary position of the point in the space Straight line in the space, traces of the straight line	2
Lec4	Point position with respect to the straight line Mutual position of the lines.	2
Lec5	Plane, trace of the plane. Straight line and plane belonging each other. Straight line parallel or perpendicular to the plane.	2
Lec6	Mutual position of the two planes - crossing, perpendicular, parallel	2
Lec7	Puncture point of the straight line with plane, determination of visibility.	2
Lec8	Rotation, cross-sections and raising the revolved section	2
Lec9	The change of the projection plane: single, repeated once	2
Lec10	Polyhedrons, cuts, puncture of polyhedron with straight line	2
Lec11	Interpenetration of the polyhedrons - mesh	2
Lec12	Rotational solids, cuts, puncture points, visibility	2
Lec13	Interpenetration of the solids, development of the surface	2

Lec14	Plotting the curves met in engineering projects: ellipse, involutes, screw line, spiral	2
Lec15	Colloquium	2
	Total hours	**15**

Form of classes - class		**Number of hours**
Cl.1	Projections of the points, projections and division of the sector, determination of the real value of the sector, plotting plane figures	2
Cl.2	Plane, point and straight line on the plane, determination of the traces of plane.	2
Cl.3	Interpenetration of the planes, straight line puncture with the plane	2
Cl.4	Straight line orthogonal to the plane, straight line parallel to plane, the planes: parallel, perpendicular, plotting the solids.	2
Cl.5	The methods of rotations, change of the projections planes, revolved sections and the raising the revolved section.	2
Cl.6	Polyhedrons, interpenetration, developments, visibilities mesh.	2
Cl.7	Rotational solids, interpenetration, developments, visibilities mesh..	2
Cl.8	Crediting of made drawings	1
	Total hours	**15**

TEACHING TOOLS USED

N1. traditional lecture with/or slides and cartoons, with aid of e-learning: web sides
http://fluid.itcmp.pwr.wroc.pl/~eichler/geometria-info.html
http://www.itcimp.pwr.wroc.pl/~rysunek_techniczny/
N2. classes: solution of prepared tasks.
N3. classes: short 10 min test.
N4. own work: making the tasks according with the standards
N5. office hours

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- classes

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-U12	Tests
F2		Checking of prepared drawing
P=0,4F1+0,6F2		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
P	PEK_W01÷W12	Colloquium

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[15] Bartel K.: Geometria wykreślna
[16] Lewandowski Zb.: Geometria wykreślna. PWN, Warszawa 1984
[17] Romaszkiewicz-Białas T.: Trzynaście wykładów z geometrii wykreślnej. Wyd. PWr
[18] Ciekot J., Suseł M.: Grafika inżynierska. Wyd. PWr

SECONDARY LITERATURE:

http: //fluid.itcmp.pwr.wroc.pl /~eichler/ geometria,html

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study	Subject objectives	Programme content	Teaching tool number
PEK_W01-W03	K1MBM_W07	C1	Lec1, Lec 2, Lec 3	N1, N3, N4, N5
PEK_W04-W06		C1,C2	Lec 4, Lec 5	N1, N3, N5
PEK_W07		C1,C2	Lec 6	N1, N4, N5
PEK_W08-W10		C3	Lec 7, Lec 8, Lec 9	N1, N3, N5
PEK_W11		C4	Lec 10, Lec 11	N1, N3, N4, N5
PEK_W12		C4,C5	Lec 12, Lec 13 Lec 14	N1, N4, N5
PEK_U01-U03	K1MBM_U07	C1-5	Cl.1, Cl.2	N1, N2, N5
PEK_U04-U08			Cl.3, Cl.4, Cl.5	N1, N2, N3, N5
PEK_U09-U12			Cl.6, Cl.7, Cl.8	N1, N2, N3, N4, N5

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Grafika 3D**
Name in English	3D Graphic
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional**
Subject code	**MSN 0236**
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		
For group of courses mark (X) final course					
Number of ECTS points			**3**		
including number of ECTS points for practical (P) classes			3		
including number of ECTS points for direct teacher-student contact (BK) classes			2,25		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Basics of descriptive geometry and technical drawing.

SUBJECT OBJECTIVES

C1 – Developing skills of computer visualization of devices designed.
C2 - Developing skills of communicative presentation of selected cross-sections and 3D animations

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 has knowledge related to the methods of geometrical description of spatial figures

relating to skills:

PEK_U01 knows how to draw the plane figures and shapes, can create 3D drawing of any component of the machine using 3D software

relating to social competences:

PEK_K01 is aware of the social role of communication media use, shall endeavor to convey their engineering ideas in universally understandable way

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
Lab1	Software basics	2
Lab2	Shapes interaction	4
Lab3	Advanced shapes creation	4
Lab4	Visual effects creation	6
Lab5	Sequential generation	4
Lab6	Randomized generation	2
Lab7	Isosurfaces	4
Lab8	Cross-sections, animations	4
	Total hours	**30**

TEACHING TOOLS USED
N1. An introduction to the various issues pursued in the classroom with the use of electronic presentation system N2. Checking the source files and drawings made by students N3. Individual students work, preparation for classes and skills N4. Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	C1	Checking the source files and drawings made by students
F2	C2	Checking the source files and drawings made by students
P=(F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] http://fluid.itcmp.pwr.wroc.pl/~kasper/grafika3d [2] www.povray.org SECONDARY LITERATURE: [3] www.povray.org

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

3D Graphic

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1MBM_W07	C1	Lab1 ÷ Lab8	N1, N2, N3, N4
PEK_U01	K1MBM_U07	C2	Lab1÷ Lab8	N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Inżynieria i aparatura procesowa**
Name in English	**Process Engineering and Apparatus**
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0262**
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			
For group of courses mark (X) final course					
Number of ECTS points	3	2			
including number of ECTS points for practical (P) classes	0	2			
including number of ECTS points for direct teacher-student contact (BK) classes	1.5	1.5			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competences in: the fundamentals of thermodynamics, the fundamentals of fluid mechanics, heat exchange and the fundamentals of machine design.

SUBJECT OBJECTIVES

C1 – To instruct the students in the dynamic and thermal diffusion process engineering unit operations.
C2 – To instruct the students in the design and operation of the apparatus used for process engineering unit operations.
C3 – The students are to acquire skills in doing basic calculations relating to process engineering unit operations and process apparatus.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

The student has:
PEK_W01 – knowledge concerning the description and measurement of the properties of granular materials;
PEK_W02 – knowledge concerning the settling of solid particles in fluids, the flow of a fluid through a fixed bed and a fluidized bed;
PEK_W03 – basic knowledge concerning the description of dynamic process engineering unit operations and the types of apparatus used for implementing them;
PEK_W04 – basic knowledge concerning the diffusion motion of mass, and mass transfer and overall mass transfer;
PEK_W05 – basic knowledge concerning the description of thermal diffusion process engineering unit operations and the types of apparatus used for implementing them.

relating to skills:

The student can:
PEK_U01 – determine the quantities characterizing granular materials;
PEK_U02 – do basic calculations relating to dynamic and thermal diffusion process engineering unit operations;
PEK_U03 – do basic calculations relating to process apparatus;
PEK_U04 – perform numerical computations aimed at simulating selected unit operations and the influence of their parameters on the dimensions of the apparatus.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Organizational matters. General information relating to process engineering and apparatus. Characterization of granular materials: methods of determining the diameter and shape of particles and the parameters of a set of particles.	2
Lec2	The settling of solid particles in fluids. Sedimentation. Types of sedimentation tanks. The flow of a fluid through a fixed bed and a fluidized bed.	2
Lec3	Filtration: equations used to describe filtration, constant-pressure filtration, constant-rate filtration, the determination of specific filtration resistance.	2
Lec4	Types of filters: band, drum, plate, rotary, candle, filter press. Centrifugation: filtering and sedimentation centrifuges, the rate of the volumetric flow of a filtrate under the action of the centrifugal force in a filtering centrifuge, sedimentation centrifuge output, centrifuge designs.	2
Lec5	The separation of suspensions in hydrocyclones: the principle of operation of the hydrocyclone, the limit particle diameter, the rate of flow through the hydrocyclone, types of hydrocyclones. The separation of solid particles in cyclones: parameters affecting fractional separation efficiency, cyclone designs.	2
Lect6	Mixing: agitator and mixer tank designs, the circulation of a liquid in the mixer, the pumping capacity of agitators, suspension formation conditions, agitation power.	2
Lect7	The liquid phase/gaseous phase equilibrium. The equilibrium in ideal and real solutions (mixtures). Diffusion: the mechanism of diffusion, the diffusion coefficient, special cases of diffusion.	2
Lect8	Mass transport via mass transfer: the mass transfer coefficient, mass transfer models, the determination of mass transfer coefficients. Mass transfer: mass transfer constituent processes, the mass transfer driving force and the overall mass transfer coefficient.	2
Lect9	Distillation: simple differential distillation and equilibrium distillation, installation	2

	schemes, the composition diagram. Rectification: the principle of operation of the rectifying column, the mass and heat balance, operating lines and the feedstock line, the determination of the rectifying column height.	
Lect10	Absorption and desorption: an absorption-desorption system scheme, the absorption-desorption process balance, the calculation of the number of theoretical plates, exemplary applications of absorption-desorption processes.	2
Lect11	Column apparatus: the column plate design and the kinds of column packing used in column apparatuses, the hydrodynamics of plate columns and packed columns, plate column efficiency, mass transport in packed columns.	2
Lect12	Crystallization: the essence of mass crystallization, ways of producing supersaturation, kinds of nucleation, the mass, energy and population balance, kinetic process parameters, methods of mathematical modelling, types of crystallizers.	2
Lect13	Extraction: single-stage liquid-liquid extraction, multistage cross-flow extraction and continuous countercurrent extraction, extraction column designs, liquid-solid extraction, apparatus for the extraction of solids.	2
Lect14	Adsorption: the essence of adsorption, the properties of adsorbents, the height of the bed in an adsorber, adsorption apparatus, adsorbent regeneration, the use of adsorption in industry.	2
Lect15	Drying: the relative and absolute moisture content in a damp material and the relative and absolute humidity of the drying air, drying equilibrium isotherms, the mass and heat balance of a dryer, types of dryers	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Solving problems relating to the characterization of granular materials: particle size distribution, the parameters characterizing a set of particles.	2
Cl 2	Solving problems relating to the settling of solid particles in a fluid and to the flow of a fluid through a fluidized bed: the settling of particles in laminar, turbulent and transition flows, the critical velocity of fluidization, the critical point pressure drop.	2
Cl 3	Solving problems relating to filtration: the specific resistance of deposit, filter medium resistance, filtration time, filter surface. Solving problems relating to centrifuging: the pressure produced by the centrifugal force, the volumetric rate of flow of filtrate in a filtering centrifuge, the sedimentation time in a sedimentation centrifuge, the capacity of a sedimentation centrifuge.	2
Cl 4	Solving problems relating to hydrocyclones and cyclones: the output of a hydrocyclone, a pressure drop in a hydrocyclone, the limit particle size, the dimensions of a hydrocyclone, the resistances of a gas flow through a cyclone, the limit size of particles separated in a cyclone, fractional dust collection efficiency, the dimensions of a cyclone.	2
Cl 5	Solving problems relating to the mixing operation: the minimal rate of agitator revolutions, agitation power, specific power input, the pumping capacity of agitators, the dimensions of a mixer.	2
Cl 6	Solving problems relating to the liquid phase/vapour phase equilibrium: the composition of the vapour phase remaining in equilibrium with a liquid mixture, phase equilibrium diagrams.	2
C1 7	Solving problems relating to distillation: the mass and composition of the distillate and of the exhausted liquid, obtained from simple differential distillation, energy consumption, the composition of the distillate and the exhausted liquid obtained from equilibrium distillation.	2
Cl 8	Solving problems relating to rectification: the mass and heat balance of a rectifying column, the minimal and real reflux ratio, the number of theoretical plates.	2
Cl 9	Solving problems relating to absorption: the minimal and real reflux ratio and the flow of an absorptive liquid, the composition of the purified gas and that of the absorptive liquid, the theoretical efficiency of absorption, the number of theoretical	2

	plates.	
Cl 10	Solving problems relating to column apparatus: the height of the liquid and froth on the plate and the pressure drop on the plate in a plate column, the height of the column packing layer.	2
Cl 11	Solving problems relating to crystallization: the mass and heat balance of a crystallizer, population density in the MSMPR crystallizer and its use in determining the rate of nucleation and crystal growth, design equations for a continuous operation crystallizer.	2
Cl 12	Solving problems relating to extraction: the mass balance of single- and multi-stage cross-flow extraction and continuous countercurrent extraction, the course of extraction in the Gibbs diagram, the number of theoretical extraction plates.	2
C1 13	Solving problems relating to adsorption: static and dynamic adsorptive activity, adsorption time, adsorbent bed height.	2
Cl 14	Solving problems relating to drying: the mass and heat balance of a dryer, air demand for drying, the amount of heat energy consumed.	2
Cl 15	Solving problems relating to selected unit processes – a test	2
	Total hours	**30**

TEACHING TOOLS USED
N1. The traditional lecture with the use of PowerPoint presentations. N2. Calculation exercises: a discussion of problem solutions. N3. Tutorials.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W05	Written examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01÷PEK_U04	Oral answers
F2	PEK_W01÷PEK_U04	Test
C=0.25F1+0.75F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[19] R. Koch, A. Noworyta, Procesy mechaniczne w inżynierii chemicznej, WNT, Warszawa, 1995.
[20] R. Koch, A. Kozioł, Dyfuzyjno-cieplny rozdział substancji, WNT, Warszawa, 1994.
[21] Zadania rachunkowe z inżynierii chemicznej, Praca zbiorowa pod redakcją R. Zarzyckiego, PWN, Warszawa, 1980.
[22] K. F. Pawłow, P. G. Romankow, A. A. Noskow, Przykłady i zadania z zakresu aparatury i inżynierii chemicznej, WNT, Warszawa, 1988.
[23] Z. Kawala, A. Kołek, M. Pająk, Zbiór zadań z podstawowych procesów inżynierii chemicznej, cz. I, Przenoszenie pędu, Redakcja Wydawnictw Politechniki Wrocławskiej, Wrocław, 1973.
[24] Z. Kawala, M. Pająk, J. Szust, Zbiór zadań z podstawowych procesów inżynierii chemicznej, cz. III, Przenoszenie masy, Wydawnictwo Politechniki Wrocławskiej, Wrocław, 1988.

SECONDARY LITERATURE:

[29] J.M. Coulson, J.F. Richardson, Coulson &Richardson's chemical engineering. Volume 1, Fluid flow, heat transfer and mass transfer, [Dokument elektroniczny]/ J. M. Coulson and J. F. Richardson, with J.R. Backhurst and J. H. Harker, Knowel, 2009.
[30] J. F. Richardson, J. H. Harker, J. R. Backhurst, Chemical engineering. Volume 2, Particle technology and separation processes, [Dokument elektroniczny]/ J. F. Richardson with J.H. Harker and J.R. Backhurst, Knowel, 2007.
[31] R. K. Sinnott, Coulson &Richardson's chemical engineering. Volume 6, Chemical engineering design, [Dokument elektroniczny]/ R. K. Sinnott, Knowel, 2005.
[32] M. Serwiński, Zasady inżynierii chemicznej i procesowej, WNT, Warszawa, 1982.
[33] Procesy dyfuzyjne i termodynamiczne. Część 1, praca zbiorowa pod redakcją Z. Ziołkowskiego, Wydawnictwo

Politechniki Wrocławskiej, Wrocław, 1977.
[34] Procesy dyfuzyjne i termodynamiczne. Część II, praca zbiorowa pod redakcją Z. Ziołkowskiego, Wydawnictwo Politechniki Wrocławskiej, Wrocław,1978.
[35] J. Warych, Aparatura chemiczna i procesowa, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 1996.
[36] J. Pikoń, Aparatura chemiczna, PWN, Warszawa, 1978.
[37] T. Hobler, Dyfuzyjny ruch masy i absorbery, WNT, Warszawa, 1962.
[38] F. Stręk, Mieszanie i mieszalniki, WNT, Warszawa, 1981.
[39] S. Leszczyński, Filtracja w przemyśle, WNT, Warszawa, 1972.
[40] Z. Rojkowski, J. Synowiec, Krystalizacja i krystalizatory, WNT, Warszawa, 1991.
[41] Przykłady i zadania z procesów mechanicznych w inżynierii chemicznej, praca zbiorowa pod redakcją Cz. Bryszewskiego i H. Firewicza, Wydawnictwo Politechniki Wrocławskiej, Wrocław, 1980.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Inżynieria i aparaura procesowa
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1INC_W08	C1	Lec1	N1, N3
PEK_W02		C1, C2	Lec2	
PEK_W03		C1, C2	Lec2÷Lec6	
PEK_ W04		C1	Lec7, Lec8	
PEK_ W05		C1, C2	Lec9÷Lec15	
PEK_U01	S1INC_U09	C3	C11	N2, N3
PEK_ U02		C3	C12÷ C114	
PEK_ U03		C3	C12÷ C15, C17÷ C114	
PEK_ U04		C3	C13, C15, C19, C111	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Konstruowanie samolotów**
Name in English	Constructing of airplanes
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Engineering of Aviation**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0321**
Group of courses	**No**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in university (ZZU)	15	15		30	
Number of hours of total student workload (CNPS)	60	30		60	
Form of crediting	exam	crediting with grade		crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	2	1		2	
including number of ECTS points for practical (P) classes	0	1		2	
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75		1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Strength of Materials, Aerodynamics, Flight mechanics, Designing of aeroplanes

SUBJECT OBJECTIVES

C1 – Present requirements for aircraft
C2 – Provide load main airframe assemblies
C3 – Familiar with the design of structural elements and major airframe assemblies
C4 – Explain the procedure to the airframe strength calculations
C5 – Specify the types of connections airframe components
C6 – Consult the methodology of determining the loads airframe
C7 – Perform the procedures strength calculations of structural and airframe components
C8 – Present a methodology for the construction of airframe components

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Describe requirements for aircraft
PEK_W02 Explain the actual load acting on the plane
PEK_W03 Describe the the construction of airframe components
PEK_W04 Describe strength calculation procedure
PEK_W05 Choose the type of connection between the components airframe

relating to skills:

PEK_U01 Calculate the actual load acting on the aircraft and its components
PEK_U02 Reduce actual load to load substitute
PEK_U03 Calculate the stresses in structural elements and major airframe assemblies
PEK_U04 Design a wing spar
PEK_U05 Determine the load of an aircraft wing
PEK_U06 Design of aircraft wing
PEK_U07 Determine the load and design landing gear

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Requirements for aircraft	2
Lec2	Strength calculations airframe	2
Lec3	Airframe Structures	2
Lec4	Wing loading	2
Lec5	Construction of the wings and tail	2
Lec6	Loads and construction of hull	2
Lec7	Loads and construction of landing gear	2
Lec8	Connections componenets of airframe	1
	Total hours	**15**
Form of classes - class		**Number of hours**
Cl 1	Calculating the componenets of airframe	2
Cl 2	Determining the actual aircraft load	2
Cl 3	Determining the loads of replacement aircraft	2
Cl 4	Calculating the loads of wing and tail plane	2
Cl 5	Calculation of thin-walled structures	2
Cl 6	Calculation of structures made of various materials	2
Cl 7	Landing gear load calculation	2
Cl 8	Completion of the course	1
	Total hours	**15**
Form of classes - project		
Proj1	Introduction to the design procedure	2
Proj2	The project of wing spar	4
Proj3	Loads of an aircraft wing	8
Proj4	The design of an aircraft wing	10
Proj5	Loads and design of landing gear	4
Proj6	Completion of the project	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture with multimedia
N2. Classes – class :

– instruction in the implementation of the computational exercises
– discussion of the results solved tasks

N3. Classes – project:
– teaching for the algorithms of design
– presentation by students of current developments in the project
– discussion of the solutions applied in the project

N4. Office hours

N5. Individual work:
– development of the various stages of the project
– preparation for the presentation of the results of the project
– preparation for classes - class
– individual study
– prepare students to exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W05	Exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 ÷ U03	Rating for the tasks solved during classes
F2	PEK_U01 ÷ U03	Final test
C = (F1+2 F2)/3		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U04	Rating for project No. 1
F2	PEK_U05	Rating for project No. 2
F3	PEK_U06	Rating for project No. 3
F4	PEK_U07, PEK_U07,	Rating for project No. 4
C = (F1+2 F2+2 F3+F4)/6		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] Cichosz E. Konstrukcja i praca płatowca. Wojskowa Akademia Techniczna, Warszawa 1968 [2] Cichosz E.: Obciążenia zewnętrzne samolotu. Wojskowa Akademia Techniczna, Warszawa 1968 [3] Danilecki S.: Konstruowanie samolotów. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004 r [2] Raymer D.P.: Aircraft Design. A conceptual approach. Virginia Polytechnic Institute and State University, Blacksburg, Virginia 2006 [4] Roskam J.: Aeroplan design. Part I ÷ VII. Lawrence, Kansas, USA 2005 [5] Szulżenko M.N., Mostowoj A.S.: Konstrukcja samolotów. Wydawnictwo Komunikacji i Łączności SECONDARY LITERATURE: [1] Cymerkiwicz R.: Budowa samolotów. Wydawnictwa komunikacji i Łączności. Warszawa 1982 [2] Blockley R.: Encyclopedia aerospace engineering. Volume 7 Vehicle design. Chichester : Wiley, 2010 [3] Dobrzański L. i inni: Leksykon materiałoznawstwa. Verlag Dashofer, Warszawa 2007

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Constructing of airplanes
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION Engineering of Aviation

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1ILO_W10	C 1	Wy 1	N1, N4, N5
PEK_W02		C 2	Wy 4, 6, 7	
PEK_W03		C 3	Wy 3, 5, 6	
PEK_W04		C4	Wy 2	
PEK_W05		C5	Wy 8	
PEK_U01	S1ILO_U12	C7	Ćw 2, 3, 7	N2, N4, N5
PEK_U02		C7	Ćw 3, 4	
PEK_U03		C8	Ćw 1, 5, 6	
PEK_U04	S1ILO_U13	C8, C9	Pr 1, 2	N3, N4, N5
PEK_U05		C7	Pr 3	
PEK_U06		C8, C9	Pr 4	
PEK_U07		C8, C9	Pr 5	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish:	**Lotnicze maszyny i urządzenia elektryczne**
Name in English:	Aviation machines and electric devices
Main field of study:	Mechanical Engineering and Machine Building
Specialization:	Engineering of Aviation
Level and form of studies:	1nd level, full-time
Kind of subject:	Obligatory / Specialization
Subject code:	MSN0360
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				
For group of courses mark (X) final course					
Number of ECTS points	2				
Including number of ECTS points for practical (P) classes	0				
Including number of ECTS points for direct teacher-student contact (BK) classes	1				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of electrical engineering and automation.

SUBJECT OBJECTIVES

C1 - Introduction to classification and general characteristics of electrical systems and aircraft.
C2 - Presentation of the design solutions, the overall design and function of essential and emergency sources of electrical power the aircraft and equipment co.
C3 - Presentation of the impact of lighting and light-signaling devices on flight safety of the aircraft.
C4 - Get to know the purpose, construction and operation of electrical systems selected airframe and systems for controlling the starting and driving the team's work.

SUBJECT EDUCATIONAL EFFECTS

KNOWLEDGE

Following the course, the student should be able to:

PEK_W01 - describe the general classification of devices and electrical systems of the aircraft,
PEK_W02 - list the main components of a DC power system and AC, characterized by the mutual interactions between the components of the systems,
PEK_W03 - explain the principles of parallel-board DC power sources and AC, and define the basic parameters that characterize their work,
PEK_W04 - identify and characterize emergency power supply systems,
PEK_W05 - explain the purpose, design and operation of internal and external lighting and light-signaling aircraft

PEK_W06 - describe the design and operation of electrical systems selected airframe and indicate their impact on the safety of an aircraft,
PEK_W07 - explain the variations of the electrical installation work and commissioning work for controlling the drive unit of the aircraft.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Working conditions and requirements for aircraft electrical devices.	2
Lec 2	Electric power distribution system	2
Lec 3	DC power system.	2
Lec 4	Aircraft DC power supply current.	2
Lec 5	Compatibility with DC sources of electricity current.	2
Lec 6	AC power system.	2
Lec 7	Aircraft AC power supply current.	2
Lec 8	Compatibility with AC sources of electricity current.	2
Lec 9	Parallel on-board power sources AC and DC.	2
Lec 10	Emergency AC / DC power supply systems.	2
Lec 11	Systems of aircraft lighting.	2
Lec 12	Systems of aircraft light signaling.	2
Lec 13	Electric aircraft systems.	2
Lec 14	Electrical installation of aircraft engines.	2
Lec 15	Completion of the course.	
	Total hours	**30**

TEACHING TOOLS USED

N1. Traditional lecture using multimedia presentations;
N2. Individual work – self – study and exam preparation.
N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation F – forming (during semester), C – summary (at semester end)	Number of training effect	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W07	Final test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[42] Adamowicz M., Juszczyński Z.: Elektryczne instalacje pokładowe. Wydawnictwo Politechniki Warszawskiej, Warszawa 1986.
[43] Będkowski L.: Lotnicze urządzenia elektryczne I-III. WAT, Warszawa 1984.
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[46] Ilustrowany Leksykon Lotniczy. Osprzęt i radioelektronika. WKŁ, Warszawa 1990.

SECONDARY LITERATURE:

[15] Moir I., Seabridge A.: Aircraft Systems: Mechanical, electrical, and avionics subsystems integration. Wiley 2008.
[16] Polak Z., Rypulak A.: Awionika, przyrządy i systemy pokładowe. WSOSP, Dęblin 2002.
Tooley M., Wyatt D.: Aircraft Electrical and Electronic Systems. Elsevier 2009.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Lotnicze maszyny i urządzenia elektryczne
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1ILO_W04	C1	Lec 1 ÷ Lec 2	N1, N2, N3
PEK_W02		C2, C3	Lec 3 ÷ Lec 8	
PEK_W03			Lec 9	
PEK_W04			Lec 10	
PEK_W05		C3	Lec 11 ÷ Lec 12	
PEK_W06		C4	Lec 13	
PEK_W07			Lec 14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Maszynoznawstwo**
Name in English	Theory of machines
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN0371**
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				
For group of courses mark (X) final course					
Number of ECTS points	**2**				
including number of ECTS points for practical (P) classes	0				
including number of ECTS points for direct teacher-student contact (BK) classes	1				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of physics and mathematics at the secondary school level

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SUBJECT OBJECTIVES

C1 – providing knowledge about systematics and construction of machines and equipment used in power engineering
C2 – providing knowledge about trends in the development of modern machinery and power equipment
C3 – providing knowledge about concepts related to energy machinery and equipment

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – knowledge about types of machines and equipment used in power engineering
PEK_W02 – knowledge about concepts related to power engineering machinery and equipment
PEK_W03 – knowledge about history of the power engineering development
PEK_W04 – knowledge about energy resources, consumption and storage capacity
PEK_W05 – knowledge about basics of energy management
PEK_W06 – knowledge about formulas useful for the calculation of the efficiency of machinery and power equipment
PEK_W07 – knowledge about connections between machines and equipment forming specific energy conversion chain

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Organizational issues. Historical outline of power engineering development	2
Lec2	Selected aspects of thermal power engineering. Energy and its units. Basics of energy management	2
Lec3	Energy resources and consumption. Energy conversion and storage	2
Lec4	Fuels and fuel system components	2
Lec5	Power plants	2
Lec6	Steam boilers	2
Lec7	Steam machines	2
Lec8	Steam and water turbines. Gas turbines and gas-steam systems	2
Lec9	Compressors and fans	2
Lec10	Hydraulic machinery and equipment	2
Lec11	Internal combustion engines	2
Lec12	Refrigeration machinery and heat pumps	2
Lec13	Nuclear power machinery and equipment	2
Lec14	Machinery dedicated to alternative energy sources	2
Lec15	Final test	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Multimedia presentation N2. Consultation hours

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation F – forming (during semester), C – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01 – PEK_W07	Final test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[25] Z. Gnutek, W. Kordylewski: Maszynoznawstwo energetyczne, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003 (in Polish)

SECONDARY LITERATURE:

[47] D. Laudyn, F. Strzelczyk, M. Pawlik: Elektrownie, WNT, Warszawa, 2006 (in Polish)
[48] S. Kruczek: Kotły – konstrukcje i obliczenia, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2001 (in Polish)
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[55] W. Warczak: Sprężarki ziębnicze, WNT, Warszawa, 1987 (in Polish)
[56] S. Łazarkiewicz, A. Troskolański: Pompy wirowe, WNT, Warszawa, 1968 (in Polish)
[57] B. Soresen, Renewable energy, Academic Press, San Diego, 2000

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Maszynoznawstwo

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W13	C1, C2	Lec1, Lec2	N1, N2
PEK_W02		C3	Lec3, Lec4	
PEK_W03		C1	Lec5, Lec6	
PEK_W04		C1	Lec7, Lec8	
PEK_W05		C1	Lec9, Lec10	
PEK_W06		C1	Lec11, Lec12	
PEK_W07		C1	Lec12, Lec14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Maszyny wyporowe**
Name in English	Volumetric machines
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0392**
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)	60	30		30	
Form of crediting	crediting with grade	crediting with grade		crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	**2**	1		1	
including number of ECTS points for practical (P) classes	0	1		1	
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75		0,75	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of theory of machines, physics, thermodynamics, heat transfer, fluid mechanics, mechanics and materials strength

SUBJECT OBJECTIVES

C1 – providing knowledge about types and construction of volumetric machines
C2 – providing knowledge about energy and substance treatment processes occurring in volumetric machines
C3 – developing skills of calculating thermodynamic and flow processes, and heat transfer occurring in volumetric machines
C4 – developing skills of designing of the volumetric machines

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – knowledge about volumetric machines types
PEK_W02 – knowledge about types and purposes of volumetric machines subassemblies
PEK_W03 – knowledge about thermodynamic processes occurring in volumetric machines
PEK_W04 – knowledge about flow processes occurring in volumetric machines
PEK_W05 - knowledge about heat transfer in volumetric machines
PEK_W06 – knowledge about purposes of different volumetric machines design

relating to skills:

PEK_U01 – skills to calculate thermodynamic processes in volumetric machines
PEK_U02 – skills to calculate flow processes in volumetric machines
PEK_U03 – skills to calculate heat transfer in volumetric machines
PEK_U04 – ability to conduct project calculations of volumetric machines and its subassemblies
PEK_U05 – ability to select machine subassemblies from manufacturers' catalogs for the selected design conditions
PEK_U06 – ability to evaluate thermodynamic properties of working medium from computer software
PEK_U07 – ability to create technical documentation of volumetric machine and subassemblies

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Organizational issues. Historical outline of volumetric machines. Basic concepts for the description of volumetric machines.	2
Lec2	Types, properties and usage of the volumetric machines.	2
Lec3	The terms and definitions used in the theory of volumetric machines, the characteristics of the working chambers.	2
Lec4	Fundamentals of mechanical analysis of volumetric machines	2
Lec5	Working mediums and substances processed in volumetric machines.	2
Lec6	Thermodynamic processes in the working chamber.	2
Lec7	Compression and expansion with taking into account the irreversibility of the process	2
Lec8	Selected problems of heat transfer in volumetric machines	2
Lec9	Designing of piston and membrane machines	2
Lec10	Designing of rotary single and multi-vane machines	2
Lec11	Designing of scroll machines	2
Lec12	Designing of screw machines	2
Lec13	Designing of Roots and Wankel machines	2
Lec14	Designing of gear machines	2
Lec15	Final test	2
	Total hours	**30**

Form of classes - class		Number of hours
Cl1	Organizational issues. Thermodynamic analysis of volumetric compressors and engines work – repeat	2
Cl2	Calculations of reactions and the forces in volumetric machines	2
Cl3	The calculation of heat transfer coefficients in the volumetric machines	2
Cl4	Modeling of working medium thermodynamic properties in the working chambers	2
Cl5	Theoretical determination of the power and performance of volumetric machines	2
Cl6	Volumetric machines thermal calculations	2
Cl7	The calculation of volumetric machines efficiency. Exergy analysis of volumetric machines	2

Cl8	Final test	1
	Total hours	**15**

Form of classes - project		**Number of hours**
Proj1	Organizational issues. Determination of initial assumptions and machine construction structure	2
Proj2	Initial determination of geometric parameters for the selected type of machine	2
Proj3	Thermodynamic calculations	2
Proj4	Mechanical calculations. Determination of forces and moments.	2
Proj5	Strength analysis, bearings and foundation	2
Proj6	The design of the working chamber, seal, capacity control, heat transfer. Selection of external systems equipment - tanks, filters, measurement and control.	2
Proj7	Determination of the theoretical characteristics. Work out of technical documentation	2
Proj8	Final consultation and project defense	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Multimedia presentation N2. Classes N3. Consultation hours N4. Project defense

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT - lecture

Evaluation F – forming (during semester), C – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01 – PEK_W06	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT - classes

Evaluation F – forming (during semester), C – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01 – PEK_U03	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation F – forming (during semester), C – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U04 – PEK_U07	project evaluation

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[26] Z. Gnutek: Gazowe objętościowe maszyny energetyczne - podstawy, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2004 (in Polish)
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[28] W. Warczak: Sprężarki ziębnicze, WNT, Warszawa, 1987 (in Polish)
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[30] E. Judin: Pompy zębate: główne parametry i ich obliczanie, PWT, 1958 (in Polish)
[31] Gerc E. W.: Napędy pneumatyczne. Teoria i obliczenia, WNT, Warszawa, 1973 (in Polish)
[32] Cantek L, Białas M.: Sprężarki chłodnicze, Wyd. Politechniki Gdańskiej, 2003 (in Polish)
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[34] Szargut J.: Termodynamika techniczna, Wyd. Politechniki Śląskiej, 2011 (in Polish)
[35] Szargut J.: Zadania z termodynamiki technicznej. Wyd. Politechniki Śląskiej, 2011 (in Polish)
[36] Kostowski E.: Zbiór zadań z przepływu ciepła. Wyd. Politechniki Śląskiej, 2011 (in Polish)
[37] Kurmaz L.: Podstawy konstrukcji maszyn: projektowanie, PWN, 1999 (in Polish)

SECONDARY LITERATURE:

[58] Praca zbiorowa. Poradnik inżyniera. Mechanika t. 1, 2, 3, WNT, Warszawa 1969 (in Polish)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Maszyny wyporowe
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1INC_W07	C1	Lec1, Lec2	N1, N3
PEK_W02		C1	Lec3, Lec4	
PEK_W03		C2	Lec5, Lec6	
PEK_W04		C2	Lec7	
PEK_W05		C2	Lec8	
PEK_W06		C4	Lec9÷Lec14	
PEK_U01	S1INC_U02	C3	Cl1, Cl2	N2, N3
PEK_U02		C3	Cl3, Cl4, Cl5	
PEK_U03		C3	Cl6, Cl7	
PEK_U04	S1INC_U08	C4	Proj1, Proj2	N3, N4
PEK_U05		C4	Proj3, Proj4	
PEK_U06		C4	Proj5, Proj6	
PEK_U07		C4	Proj7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Materiałoznawstwo**
Name in English	Materials Science
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 0400**
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		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes	0		1		
including number of ECTS points for direct teacher-student contact (BK) classes	0,5		0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Having the knowledge about the types of engineering materials - their structure, properties and applications - obtained during the course of Fundamentals of Materials.
2. Having the knowledge of mechanical properties parameters of materials and their methods of measurement.
3. Having a detailed knowledge of the structures and properties of the steel and cast iron.
4. Student is able to use technical information.

SUBJECT OBJECTIVES

C1 – Providing of knowledge regarding the heat treatment and thermo-chemical treatment and their influence on the properties of iron alloys.
C2 – Overview of the structure, properties and application of different types of steel alloys, copper alloys, light alloys and other engineering materials.
C3 - Providing to students the knowledge regarding the ability to analyze the microscopic and macroscopic materials.
C4 - Providing to students the knowledge regarding ability to work in a team in order to effectively solve problems and on proper behavior in the student community and in the society.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - student knows the basic iron alloys heat treatment and its influence on the structure and properties of these alloys.

PEK_W02 - student has mastered detailed knowledge of steel grades and basic knowledge on non-ferrous alloys and their properties and applications.

PEK_W03 - student has mastered knowledge of polymers, composites and ceramic materials in the field of their basic structure, basic properties and applications.…

relating to skills:

PEK_U01 - student is able to link appropriate variant of the heat treatment with the structure of the material and its properties.

PEK_U02 - student is able to link the chemical composition of the alloy steels, alloys of copper and aluminum with their structure and properties.

PEK_U03 - student can critically compare the different groups of materials with regard to their manufacturing technology and their properties.

PEK_U04 - student is able to carry out macroscopic and microscopic tests of materials.

relating to social competences:

PEK_K01 - student is capable to team cooperation, which is aimed at optimally solving the problems entrusted to the group.

PEK_K02 - the student is able to evaluate the arguments, is able also rational them interpretive, and justify own point of view using the knowledge of materials science.

PEK_K03 - student is respecting of customs and rules of the academic environment.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Podstawy obróbki cieplnej stopów żelaza – cel, klasyfikacja. Przemiany fazowe podczas nagrzewania.	
Lec2	Phase transformations during cooling of steel – diffusional transformation, diffusionless transformation, diffusional - diffusionless transformation.	2
Lec3	Technology of heat treatment. Surface treatment.	2
Lec4	Alloy steels – types, effect of alloying elements on the phase transformations during heating and cooling of steel.	2
Lec5	Classification, denotations, properties and application of alloy steels.	2
Lec6	Copper alloys and light metal alloys.	2
Lec7	Polymers and composite materials.	2
Lec8	Ceramic materials.	1
	Total hours	**15**
Form of classes - laboratory		**Number of hours**
Lab1	Introduction. Aim and methods of investigating of materials. Construction and handling of metallographic microscope.	2
Lab2	Macroscopic examination of materials – analyze of fracture and defects of technological origin.	2
Lab3	Macroscopic and microscopic examination of composite materials with polymer matrix.	2
Lab4	Microscopic examination of metals in unetched and etched states.	2
Lab5	Analyze of phase equilibrium diagrams of binary systems.	2
Lab6	Analyze of equilibrium diagram and microstructures of iron - cementite binary system.	2
Lab7	Microstructure examination of alloy steels.	2
Lab8	Summary and pass the laboratory.	2
	Total hours	**15**

TEACHING TOOLS USED
N1. traditional lecture and slide show N2. own work – preparation to laboratory N3. laboratory experiment N4. preparation the report N5. own work - self-study and credition preparation N6. consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01 ÷ PEK_W03 PEK_K02÷PEK_K03	written and oral credition

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 ÷ PEK_U07 PEK_K01÷ PEK_K03	a test before each laboratory exercise
F2		oral answers
F3		written report of the exercise
C = 0,3F1+0,4F2+0,3F3		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [59] Blicharski M., Wstęp do inżynierii materiałowej, WNT, Warszawa [60] Haimann R., Metaloznawstwo cz. I, OW PWr. Wrocław 2000 [61] Haimann R., Metaloznawstwo, Wydawnictwo PWr. Wrocław 1980 [62] Praca zbiorowa pod red. W. Dudzińskiego i K. Widanki, Ćwiczenia laboratoryjne z materiałoznawstwa, OW PWr., Wrocław 2005 SECONDARY LITERATURE: [17] Dobrzański L.A., Materiały inżynierskie, WNT, Warszawa [18] Ashby M.F., Jones D.R.H., Materiały inżynierskie t. 1 i 2, WNT, Warszawa 1996

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

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01 – PEK_W03	K1MBM_W06	C1 – C2	Wy1 – Wy8	N1, N5, N6
PEK_U01 – PEK_U04	K1MBM_U06	C3	La1 – La8	N2, N3, N4, N6
PEK_K01	K1MBM_K03	C4		
PEK_K02, PEK_K03	K1MBM_K06			

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Mechanika 1**
Name in English	Mechanics 1
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 0430**
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			
For group of courses mark (X) final course					
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	0,5	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of mathematics and physics.

SUBJECT OBJECTIVES

C1. To instruct students with the basic knowledge of Theoretical Mechanics – statics.
C2. Learning how to use the proper techniques and methods of computation in Theoretical Mechanics – statics

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – knows the basic definitions and the laws of the Theoretical Mechanics – statics
PEK_W02 – has a basic knowledge of the equilibrium of the particle and the rigid-body

relating to skills:

PEK_U01 – is able to apply the laws of statics to solve problems of the Theoretical Mechanics – statics
PEK_U02 – can use the known methods for solving systems of coplanar forces

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Introduction, principles and fundamental notions, vectors	2
Lec2	System of concurrent forces	1
Lec3	System of coplanar forces	2
Lec4	Beams and frames – statically determined	2
Lec5	Plane trusses – statically determined	3
Lec6	Laws of friction	2
Lec7	Centers of gravity	2
Lec8	Final test	1
	Total hours	**15**
Form of classes - class		**Number of hours**
Cl 1	Vectors	2
Cl 2	Solving system of concurrent forces – grafical and analitical methods	2
Cl 3	Solving system of coplanar forces – grafical and analitical methods	2
Cl 4	Solving beams and bars – statically determined	2
Cl 5	Solving trusses – statically determined	3
Cl 6	Friction, center of gravity	2
Cl 7	Final test	2
	Total hours	**15**

TEACHING TOOLS USED
N1. Lecture – traditional form, multimedia presentations N2. Class – solving problems, discussion N3. Class – short written proficiency checks N4. Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01, PEK_W02	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation	Educational effect number	Way of evaluating educational effect

(F– forming (during semester), C– concluding (at semester end)		achievement
F1	PEK_U01, PEK_U02	Short written proficiency checks
F2	PEK_U01, PEK_U02	Final test
C = max{F1,F2}		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] Siuta Władysław, *Mechanika techniczna*, Wydawnictwa Szkolne i Pedagogiczne, Warszawa 1985. [2] Zawadzki Jerzy, Siuta Władysław, *Mechanika ogólna*, PWN 1970, Warszawa 1985 . [3] Misiak Jan, *Mechanika ogólna*, WNT, Warszawa 1998 . [4] Nizgodziński M, Niezgodziński T., *Mechanika ogólna*, PWN, Warszawa 1998. SECONDARY LITERATURE : Huber M. T. *Mechanika ogólna i techniczna*. PAN Warszawa 1956.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechanics 2
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1MBM_W05	C1	Lec1-Lec8	N1, N4
PEK_W02	K1MBM_W05	C1	Lec1-Lec8	N1, N4
PEK_U01	K1MBM_U05	C2	Cl 1-Cl 7	N2, N3, N4
PEK_U02	K1MBM_U05	C2	Cl 1- Cl 7	N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Mechanika 2**
Name in English	Mechanics 2
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 0450**
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	30			
Form of crediting	examination	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	3	1			
including number of ECTS points for practical (P) classes		1			
including number of ECTS points for direct teacher-student contact (BK) classes	1,5	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge and skills in the field of mathematics and physics.
2. Knowledge of Theoretical Mechanics – statics.

SUBJECT OBJECTIVES

C1. To instruct students with the basic knowledge of Theoretical Mechanics – kinematics and dynaminc.
C2. Learning how to use the proper techniques and methods of computation in Theoretical Mechanics (kinematics and dynamics)

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – knows the basic definitions and the laws of kinematics and dynamics
PEK_W02 – has a basic knowledge of movement of the particle and the rigid-body – kinematics.
PEK_W03 – has a basic knowledge of non-equilibrium state of forces acting of the particle and the rigid-body – dynamics.

relating to skills:

PEK_U01 – is able to apply the laws of kinematics to solve problems of the particle and rigid body
PEK_U02 – is able to apply the laws of dynamics to solve problems of the particle and rigid body

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Bending moments, shear and normal forces	3
Lec2	Kinematics of the particle	2
Lec3	Motion of the rigid body	2
Lec4	Motion of the particle	2
Lec5	Plane motion of the rigid body	2
Lec6	Spherical motion	1
Lec7	Dynamics of the free and constrained particle	4
Lec8	Laws of conservation	3
Lec9	Work, power and energy	3
Lec10	Vibration of the particle	2
Lec11	Moment of inertia	4
Lec12	Impact theory	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Bending moments, shear and normal forces	2
Cl 2	Kinematics of the particle	2
Cl 3	Kinematics of the rigid-body	2
Cl 4	Dynamics of the particle	2
Cl 5	Laws of conservations, work, power and energy	4
Cl 6	Moment of inertia	2
Cl 7	Final test	1
	Total hours	15

TEACHING TOOLS USED
N1. Lecture – traditional form, multimedia presentations N2. Class – solving problems, discussion N3. Class – short written proficiency checks N4. Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02	Short written proficiency checks
F2	PEK_U01, PEK_U02	Final test
C = max{F1,F2}		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE
[38] MISIAK J., Mechanika techniczna t.I i II, WNT Warszawa (2003) [39] MISIAK J., Zbiór zadań z mechaniki ogólnej t.I, II i III, WNT Warszawa (2003) [40] MISIAK J., Mechanika ogólna t. I statyka i kinematyka, WNT, Warszawa (1998) [41] MISIAK J., Mechanika ogólna t, II dynamika, WNT, Warszawa (1998)
SECONDARY LITERATURE
[63] NIEZGODZIŃSKI M., NIEZGODZIŃSKI T., Mechanika ogólna, PWN (1998) NIEZGODZIŃSKI M., NIEZGODZIŃSKI T., Zbiór zadań z mechaniki ogólnej, PWN, Warszawa (1998)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechanika 2
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W05	C1	Lec1-Lec12	N1, N4
PEK_W02	K1MBM_W05	C1	Lec1-Lec12	N1, N4
PEK_W03	K1MBM_W05	C1	Lec 1-Lec12	N1, N4
PEK_U01	K1MBM_U05	C2	Cl 1-Cl 7	N2, N3, N4
PEK_U02	K1MBM_U05	C2	Cl 1-Cl 7	N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Mechanika płynów - laboratorium**
Name in English	Fluid Mechanics - Laboratory
Main field of study	Mechanical Engineering and Machine Building
Specialization	Thermal Engineering
Level and form of studies	1st level, full-time
Kind of subject	Optional/specialization
Subject code	MSN0500
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		
For group of courses mark (X) final course					
Number of ECTS points			2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes			1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills of fluid mechanics

SUBJECT OBJECTIVES

C1 – Performing experimental designation of the nature of flow (laminar, turbulent) and flow through a constriction and flow around

C2 – Performing experimental designation of the velocity profile in the pipe, flow stream, hydraulic loss factor, changes in line pressure in the constriction and serial hydraulic system. Measuring characteristics overflow and Venturi channel.

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – Experimental determination perform the velocity profile in the pipe,
PEK_U02 – perform measurements of flow stream, hydraulic loss factor, changes in line pressure in the constriction and serial hydraulic system.
PEK_U03 – make characteristic a overflow measuring and Venturi channel
PEK_U04 – Performing experimental designation of the nature of flow, flow through a constriction and flow around

PROGRAMME CONTENT		
Form of classes - laboratory		**Number of hours**
Lab1	Safety training, introduction to classes	2
Lab2	Equilibrium relative	2
Lab3	The velocity profile in the pipe line	2
Lab4	Orifice flow coefficient	2
Lab5	Measure the frictional resistance of flow through the pipe	2
Lab6	Calculating the actual object on the basis of measurements made on a model of measuring overflow.	2
Lab7	Ancona chart calculations for serial flow	2
Lab8	Measurement of the pressure distribution along Venturi orifice	2
Lab9	Cavitation in a constriction the tube	2
Lab10	Overflow measuring characteristics	2
Lab11	Venturi channel characteristics	2
Lab12	Measurement of pressure distribution on the surface of the cylinder.	2
Lab13	The critical Reynolds number	2
Lab14	Written test of chart Ancona	2
Lab15	Clearance of reports classifying laboratory	2
	Total hours	**30**

TEACHING TOOLS USED

N1. – Laboratory classes,
– Discussion of the results of measurements,
– Experimental measurements,
– Verbal answers,
– Short skill tests,
– Students work to preparing for laboratory.
N2. Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U04	Verbal answers, short skill tests.
F2	PEK_U01÷PEK_U04	Laboratory report
C = ((14*F1)/14)*0,4 + ((12*F2)/12*0,6		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [64] Jeżowiecka-Kabsch K., Szewczyk H., Mechanika Płynów, Wydawnictwo Politechniki Wrocławskiej, Wrocław 2001. [65] Szewczyk H. (red.), Mechanika Płynów. Ćwiczenia laboratoryjne, Wydawnictwo Politechniki Wrocławskiej, Wrocław 1989. SECONDARY LITERATURE: [19] Bechtold (red.) Mechanika Płynów. Zbiór zadań, Wydawnictwo Politechniki Wrocławskiej, Wrocław 1993.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Mechanika płynów - laboratorium

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_U01 PEK_U02 PEK_U03 PEK_U04	K1MBM_U10	C1, C2	Lab 02÷14	N1, N2

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy konstrukcji maszyn I (PKM I)**
Name in English	Basics of machine design I
Main field of study	Mechanical Engineering and Machine Building
Level and form of studies	1st level, full-time
Kind of subject	obligatory
Subject code	MSN0680
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	
For group of courses mark (X) final course					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes	0			2	
including number of ECTS points for direct teacher-student contact (BK) classes	1			1,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and ability in the scope of technical drawing, mechanics, strength of materials and material science.

SUBJECT OBJECTIVES

C1 – Familiarize students with methodology of design machine elements.
C2 – Familiarize students with rules of design, calculations and operating such elements as: joints, clutches, breaks, shafts and bearings .
C3 – Developing skills of stress analysis into machine elements under different load cases.
C4 – Developing skills of unaided design of selected machine elements.
C5 - Developing skills of cooperation during task realization process.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - knows rules of machine elements design.
PEK_W02 – has knowledge of machine elements joints – design and operating.
PEK_W03 – has knowledge of structure and operating such machine elements as coupling, clutches, breaks, shafts and bearings.

relating to skills:

PEK_U01 – knows how to perform the stress analysis of selected machine elements under different load cases.
PEK_U02 – can design selected machine elements, doing necessary calculations and technical drawings.
PEK_U03 – knows how to select proper material taking into account type of machine elements, their function and loads.
PEK_U04 – can find necessary technical information in different types of knowledge unaided.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1,2	Methodology of design – rules of design, criteria in design process.	4
Lec3	Permanent fastening – welded joints, durability of such joints at static and dynamic load	2
Lec4,5	Temporary fastening-bolted, knuckled and tightened joints	4
Lec6,7	Couplings and clutches: basic types, mechanical characteristics of couplings and clutches, selection of materials for frictional elements.	4
Lec8	Types of brakes: calculation of friction heat, friction materials	2
Lec9	Axles and shaft-the basics concepts. Division and types of construction materials used in axles and shaft.	2
Lec10	Axles and shaft- strength and fatigue calculations, the critical speed of the shaft.	2
Lec11	Rules of axles and shaft design.	2
Lec12	Shaft bearing: rolling bearings	2
Lec13	Assessment of bearings load and operating life-time	2
Lec14	The rules of bearing supports design with different bearing types.	2
Lec15	Credit	2
	Total hours	**30**

Form of classes - project		Number of hours
Proj1	Organizational issues. Topics distribution.	2
Proj2,3	Elaboration of the concept of the technical solution and the optimal choice for a given circumstance.	4
Proj4,6	Design of selected device with forced methodology of connecting parts.	6
Proj7,10	Design of selected type of clutch or brake.	8
Proj10,14	Design of machine shaft with the bearing supports.	8
Proj15	Credit, defend of outstanding projects.	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture with multimedia.
N2. Introduction to the project.
N3. Individual work.
N4. Office hours.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U04	quiz
F2	PEK_U01÷PEK_U04	oral report
F3	PEK_U01÷PEK_U04	defend project
C=0.2F1+0.2F2+0.6F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[42] Dietrech M. i inni: "Podstawy Konstrukcji Maszyn" - Tom 1 i 2, WNT, Warszawa 2006.
[43] Mazanek E. „Przykłady obliczeń z podstaw konstrukcji maszyn”, WNT 2005
[44] Skoć A., Spałek J. "Podstawy Konstrukcji Maszyn" - Tom 1 i 2, WNT, Warszawa 2008.
[45] Szewczyk K.: „Połączenia gwintowe”, PWN, Warszawa 1991.
[46] Osiński Z.: „Sprzęgła i hamulce”, PWN Warszawa 1996.
[47] Dąbrowski Z., Maksymiuk M.: „Wały i osie”, PWN, Warszawa 1984.

SECONDARY LITERATURE:

[66] Korewa W., Zygmunt K.: "Podstawy Konstrukcji Maszyn" - Tom 1 i 2, WNT, Warszawa 1965.
[67] Chicińska B. (red): "Poradnik Mechanika", Rea 2008.
SKF: "Katalog łożysk tocznych", 2008.

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

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1MBM_W14	C1 C2 C3	Lec 1,2	N1 N4
PEK_W02		C1 C2 C3	Lec 3÷5	
PEK_W03		C1 C2 C3	Lec 6÷14	
PEK_U01	K1MBM_U13	C3 C4	Proj 2÷14	N2 N3 N4
PEK_U02		C3 C4	Proj 2÷14	
PEK_U03		C3 C4	Proj 2÷14	
PEK_U04		C3 C4	Proj 2÷14	
PEK_U05		C3 C4	Proj 2÷14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy konstrukcji maszyn II (PKM II)**
Name in English	Basics of machine design II
Main field of study	Mechanical Engineering and Machine Building
Level and form of studies	1st level, full-time
Kind of subject	obligatory
Subject code	MSN0690
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	
For group of courses mark (X) final course					
Number of ECTS points	3			2	
including number of ECTS points for practical (P) classes	0			2	
including number of ECTS points for direct teacher-student contact (BK) classes	1,5			1,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence confirmed by positive note of *Podstawy konstrukcji maszyn I*

SUBJECT OBJECTIVES

C1 – Familiarize students with structure, functioning and the rules of design as well as calculating of slide bearings.
C2 - Familiarize students with basic of sealing technology.
C3 – Familiarize students with structure, operating and the rules of the mechanical gears design.
C4 – Developing skills of stress analysis into machine elements under different load cases.
C5 - Developing skills of unaided design of selected parts of machines and devices.
C6 - Developing skills of cooperation during task realization process.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – has basic knowledge of tribology.
PEK_W02 – has knowledge of structure and operating such machine elements as slide bearings.
PEK_W03 – has basic knowledge of sealing technology.
PEK_W04 – has basic knowledge of design and operating such machine elements as mechanical gears.

relating to skills:

PEK_U01 – knows how to perform the stress analysis of selected machine elements under different load cases.
PEK_U02 – can design selected machine elements, doing necessary calculations and technical drawings.
PEK_U03 – Knows how to select proper material taking into account type of machine elements, their function and loads.
PEK_U04 – can find necessary technical information in different types of knowledge unaided.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec1,2	Elements of tribology - boundary friction, mixed friction, hydrostatic and hydrodynamic lubrication, stiffness of lubricating layer, number of Herse'y and Somerfield.	4
Lec3	Slide bearings – design of thrust and journal slide bearings. Sliding materials	2
Lec4	Seals – need of sealing, static and dynamic seals, mechanism of sealing, seals used in hydraulic cylinders.	2
Lec5	Transformation of torque and rotational speed: division of mechanical gears, gear index, types and description of gears.	2
Lec6	Belt transmissions – types and basic parameters, design and rules of operating, kinematics of wrapping conector, the rules of design.	2
Lec7	Frictional transmissions with variable ratio - types and basic parameters, design and rules of operating, kinematics of gears, the rules of design..	2
Lec8	Gears with straight teeth - types and basic parameters, design and rules of operating, kinematics of gears, the rules of design..	2
Lec9	Gears with straight teeth – methodology of gears manufacturing, correction of gearing, forces in gearing.	2
Lec10	Gears with straight teeth -the rules of calculating durability, the rules of reduction gear design.	2
Lec11	Helical gears - types, design and operation, forces in gearing.	2
Lec12	Helical gears – the rules of designing.	2
Lec13	Worm gears- types and basic parameters, design and rules of operating, kinematics of gears, the rules of design..	2
Lec14	Planetary gear – structure and rules of operating, examples of constructions	2
Lec15	Synthesis of lectures, searching of generalizations.	2
	Total hours	**30**

Form of classes - project		**Number of hours**
Proj1	Organizational issues. Topics distribution.	2
Proj2-4	Design of the hydraulic cylinder for given parameters and functionality.	6
Proj5-14	Design the selected power transition system.	20
Proj15	Credit, defend of outstanding projects.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture with multimedia. N2. Introduction to the project. N3. Individual work N4. Office hours

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W04	Exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U04	quiz
F2	PEK_U01÷PEK_U04	oral report
F3	PEK_U01÷PEK_U04	defend project
C=0.2F1+0.2F2+0.6F3		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [48] Dietrech M. i inni: "Podstawy Konstrukcji Maszyn" - Tom 3 i 4, WNT, Warszawa 2006. [49] Mazanek E. „Przykłady obliczeń z podstaw konstrukcji maszyn”, WNT 2005. [50] Bartoszewicz J.: „Przekładnie cierne” PWN Warszawa 1984. [51] Dudziak M., „Przekładnie cięgnowe” PWN Warszawa 1997. [52] Dziama A.: „ Przekładnie zębate”, PWN Warszawa 1996. [53] Dąbrowski Z., Maksymiuk M.: „Wały i osie”, PWN, Warszawa 1984. SECONDARY LITERATURE: [68] Korewa W., Zygmunt K.: "Podstawy Konstrukcji Maszyn" - Tom 3 i 4, WNT, Warszawa 1965. [69] Chicińska B. (red): "Poradnik Mechanika", Rea 2008. [70] SKF: "Katalog łożysk tocznych", 2008.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

PKM II

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W14	C1	Lec 1, Lec2	N1 N4
PEK_W02		C2	Lec3	
PEK_W03		C3 C4	Lec4	
PEK_W04		C2 C3	Lec5÷Lec15	
PEK_U01	K1MBM_U13	C4 C5	Proj2÷Proj14	N2 N3 N4
PEK_U02		C4 C5	Proj2÷Proj14	
PEK_U03		C4 C5	Proj2÷Proj14	
PEK_U04		C4 C5	Proj2÷Proj14	
PEK_U05		C4 C5	Proj2÷Proj14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy eksploatacji statków powietrznych**
Name in English	Bases of aircraft operation
Main field of study	Mechanical Engineering and Machine Building
Specialization	Engineering of Aviation
Level and form of studies	1st, full-time
Kind of subject	optional-specialization
Subject code	MSN 0732
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)	60		30		30
Form of crediting	crediting with grade		crediting with grade		crediting with grade
For group of courses mark (X) final course					
Number of ECTS points	2		1		1
including number of ECTS points for practical (P) classes	0		1		1
including number of ECTS points for direct teacher-student contact (BK) classes	1		0,75		0,75

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of piston aircraft engines, aircraft equipment, turbine aircraft engines and aircraft equipment diagnostics.

SUBJECT OBJECTIVES

C1 – Familiar with the basic concepts and rules related to the maintenance of aircraft.
C2 – Familiarization with the aviation systems, their hierarchy and relationships between their components.
C3 – Clarification of issues related to air traffic.
C4 – Presentation of the aircraft records.
C5 – Familiar with the aircraft maintenance systems.
C6 – Familiar with the problems of exploitation vulnerability.
C7 – Familiar with issues related to continuing of airworthiness.
C8 – Presentation of the flight safety system.
C9 – Practice of skills related to implementation of tasks independently and as a team.
C10 - Development of skills in self preparation and presentation of papers on a given topic.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

following the course, the student should be able to:
PEK_W01 – choose the correct term to describe the maintenance of aircraft.
PEK_W02 – characterize aviation systems.
PEK_W03 – discuss air traffic and its elements.
PEK_W04 – describe the airport, its facilities and equipment.
PEK_W05 – describe the technical documentation of the aircraft.
PEK_W06 – characterize systems of aircraft maintenance.
PEK_W07 – define the elements of exploitation vulnerability.
PEK_W08 – interpret the provisions relating to the operation of aircraft.
PEK_W09 – characterize the system of continuing of airworthiness.
PEK_W10 – explain the maintenance program.
PEK_W11 – explain the role of the management of the continuing airworthiness.
PEK_W12 – describe the implementation of the airworthiness review.
PEK_W13 – characterize means of technical support.
PEK_W14 – provide maintenance standards.
PEK_W15 – discuss flight safety system.

relating to skills:

following the course, the student should be able to:
PEK_U01 – safely operate the selected units and air equipment.
PEK_U02 – perform certain maintenance tasks on aircraft.
PEK_U03 – evaluate the technical condition of the aircraft selected parts.
PEK_U04 – develop aircraft maintenance program.
PEK_U05 – prepare technical description as a report.
PEK_U06 – prepare the work station for the realization of maintenance task.

SUBJECT EDUCATIONAL EFFECTS		
Form of classes - lecture		Number of hours
Lec1	Basic concepts.	2
Lec2	Aviation systems.	2
Lec3	Air traffic.	2
Lec4	The airport and its facilities.	2
Lec5	Documentation of the aircraft.	2
Lec6	Aircraft maintenance systems.	2
Lec7	Susceptibility of maintenance.	2
Lec8	The regulations for the maintenance of aircraft.	2
Lec9	Continuing Airworthiness.	2
Lec10	The maintenance program.	2
Lec11	Management organization of continuing airworthiness.	2
Lec12	Airworthiness review.	2
Lec13	Maintenance authentication.	2
Lec14	Support standards.	2
Lec15	Flight safety system.	2
	Total hours	**30**

Form of classes - laboratory		Number of hours
Lab1	Safety in the laboratory.	1
Lab2	Adjusting the engine control system of the aircraft.	2
Lab3	Examination of the aircraft powerplant.	2
Lab4	Leveling the aircraft.	2

Lab5	Examining the degree of damage to the main helicopter rotor.	2
Lab6	Evaluation of the use of gear and airframe structural failure test.	4
Lab7	Evaluation of aircraft installation filling.	2
	Total hours	**15**

Form of classes - seminar		Number of hours
Sem1	Safety during maintenance of aircraft.	2
Sem2	Service of the components of the aircraft.	2
Sem3	Maintenance of the aircraft powerplant.	2
Sem4	Maintenance of the aircraft executive installation.	3
Sem5	Service of aircraft rescue equipment.	2
Sem6	Maintenance of the aircraft landing gear.	2
Sem7	Maintenance of the aircraft electrical installation.	2
	Total hours	**15**

TEACHING TOOLS USED

N1. Lecture:
- traditional lecture using multimedia presentation,
- individual work - self-study and preparation to pass the course.

N2. Seminar:
- individual work - preparing the presentation and outline on a specific topic,
- presentation of a paper using a multimedia presentation,
- listening to papers presented in class.

N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W15	Written and oral test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F2	PEK_U01; PEK_U02; PEK_U03; PEK_U06	Short written tests, laboratory exercises and reports.
F3	PEK_U01; PEK_U02; PEK_U03; PEK_U06	Short written tests, laboratory exercises and reports.
F4	PEK_U01; PEK_U02; PEK_U03; PEK_U06	Short written tests, laboratory exercises and reports.
F5	PEK_U01;PEK_U02; PEK_U03; PEK_U06	Short written tests, laboratory exercises and reports.
F6	PEK_U01; PEK_U02; PEK_U03; PEK_U06	Short written tests, laboratory exercises and reports.
F7	PEK_U01 ;PEK_U02; PEK_U03; PEK_U06	Short written tests, laboratory exercises and reports.
C=(F2+F3+F4+F5+F6+F7)/6		Assessment condition is that all forming evaluations are positive.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- seminar

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01; PEK_U04; PEK_U05	Preparing and uttering lecture, presentation development.
F2	PEK_U01; PEK_U04; PEK_U05	Preparing and uttering lecture, presentation development.
C=(F1+F2)/2	Assessment condition – all evaluations are positive.	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Danilecki S.: Eksploatowanie samolotu. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.
[2] Lewitowicz J.: Podstawy eksploatacji statków powietrznych. Tom 1. Wydawnictwo Instytutu Technicznego Wojsk Lotniczych, Warszawa 2001.
[3] Lewitowicz J. i Kustroń K.: Podstawy eksploatacji statków powietrznych. Tom 2. Wydawnictwo Instytutu Technicznego Wojsk Lotniczych, Warszawa 2003.
[4] Lewitowicz J.: Podstawy eksploatacji statków powietrznych. Tom 3. Wydawnictwo Instytutu Technicznego Wojsk Lotniczych, Warszawa 2006.

SECONDARY LITERATURE:

[1] Karty technologiczne i instrukcje obsługi statków powietrznych.
[2] Instrukcje budowy statków powietrznych.

OPIEKUN PRZEDMIOTU (IMIĘ, NAZWISKO, ADRES E-MAIL)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
odstawy eksploatacji statków powietrznych
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Przedmiotowy efekt kształcenia	**Odniesienie przedmiotowego efektu do efektów kształcenia zdefiniowanych dla kierunku studiów i specjalności**	**Cele przedmiotu**	**Treści programowe**	**Numer narzędzia dydaktycznego**
PEK_W01	S1ILO_W15	C1	Lec1	N1; N4
PEK_W02		C2	Lec2	
PEK_W03		C3	Lec3	
PEK_W04		C3	Lec4	
PEK_W05		C4	Lec5	
PEK_W06		C5	Lec6	
PEK_W07		C6	Lec7	
PEK_W08		C7	Lec8	
PEK_W09		C7	Lec9	
PEK_W10		C7	Lec10	
PEK_W11		C7	Lec11	
PEK_W12		C7	Lec12	
PEK_W13		C7	Lec13	
PEK_W14		C7	Lec14	
PEK_W15		C8	Lec15	
PEK_U01	S1ILO_U17	C9	Lab1	N2; N3; N4
PEK_U02	S1ILO_U18	C9	Sem1÷ Sem7	N2; N4
PEK_U03	S1ILO_U17	C9	Lab6; Lab7	N2; N4
PEK_U04	S1ILO_U18	C10	Sem1÷Sem7	N3; N4
PEK_U05	S1ILO_U17	C10	Lab1÷ Lab7	N2; N4
PEK_U06	S1ILO_U17	C9	Lab1÷ Lab7	N2; N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy elektroniki**
Name in English	Fundamentals of Electronics
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 0740**
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		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes	0		1		
including number of ECTS points for direct teacher-student contact (BK) classes	0,5		0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competences related to mathematics and physics – acknowledged by positive grades scored during 1st level studies. Additional competences related to electronics and control theory.

SUBJECT OBJECTIVES

C1 –Introduction of fundamental knowledge (also in the practical aspect) related to the contruction and theory of operation of modern electronic devices, their applications in modern technical equipment, especially in instrumentation systems and control devices. Acqusition of a sound technical knowledge related to the following elements and functional blocks of electronic circuits:

C1.1. Passive RLC components

C1.2. Active semiconductor devices – diodes, BJTs, triacs, SCRs, optocouplers, integrated circuits.

C1.3 Basic applications of electronic components – Power supply circuits, rectifiers, filters.

C1.4 Low-level amplifiers, parameters, operational circuits, properties.

C1.5 Power electronic circuits, phase-controlled rectifiers and group power controllers.

C2. Training of ability of understanding, interpretation and numerical analysis of basic electronic circuits , especially:

C2.1. Electronic circuit structure design

C2.2. Selection of parameters of compoments that are to be used in an electronic circuit

C2.3. Setting up the operational parameters of active components used in an electronic circuit

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 The student is able to define the parameters of a electronic circuit.
PEK_W02 The student knows the physical background related to both passive and active electronic components
PEK_W03 The student has the basic skills related to metrology and has gained some experience in using measurement instruments.
PEK_W04 The student is able to define the basic time-domain and amplitude-domain parameters of an electric signal.
PEK_W05 The student has the basic knowledge about the construction and operation of a basic active electronic circuits.
PEK_W06 The student has the basic knowledge about technical solutions used in high power electronic circuits.
PEK_W07 The student has the basic knowledge regarding reliability issues in electronic systems.

relating to skills:

PEK_U01 The student can point out, define and compute the basic parameters of an electronic circuit.
PEK_U02 The student is able to build a simple DC-voltage powered electronic circuit.
PEK_U03 –The student is able to measure the operational parameters of a DC power supply.
PEK_U04 –The student is able to measure the operational parameters of a low-level amplifier.
PEK_U05 –The student is able to design and build a simple DC voltage power supply.
PEK_U06 –The student is able to analyse the operation of a simple power electronic circuit incorporating SCRs and triacs.
PEK_U07 –The student is able to analyse the structure and mode of operation of simple digital electronic circuit composed from the logical gates.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec1	Introduction, fundamental definitions, Ohm's law and Kirchhoff's circuit laws. Passive RLC components and their parameters..	2
Lec2	Semiconductor diode – internal structure, properties and parameters.	2
Lec3	Bipolar junction transistor (BJT)- internal structure, properties and parameters, basic single-stage BJT amplifier topologies.	2
Lec4	Field-Effect Transistor - internal structure, properties and parameters.	2
Lec5	Basic rectifier circuits, mains interference filters, DC power supplies – basic topologies and parameters.	2
Lec6	Small-signal amplifiers – parameters, applications, DC biasing of a single-stage amplifier. Operational amplifiers.	2
Lec7	Thyristors, triacs, optocouplers. Power electronic circuits – an introduction.	2
Lec8	Final assessment	1
	Total Hours	**15**
Form of classes - laboratory		**Number of hours**
La1	Introduction, Basic parameters, fundamental electrical measurement safety rules, applications of electrical measurement instruments.	2
La2	DC Power Supplies and DC Voltage regulators – measurement of working parameters.	2
La3	Semiconductor diodes and bipolar junction transistor – measurement of basic properties.	2
La4	Small-signal amplifiers – properties, measurement of the working characteristics.	2
La5	Power electronic circuits – Basic applications of thyristors and triacs	2
La6	Power electronic circuits – Basic applications of power transistors	2
La7	Digital circuits – logical gates	2
La8	Additional meeting, final assessment of student's work.	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Informative lecture, multimedia presentation, problem lecture N2. Laboratory : report as a proof of self-preparation, own work – preparation before exercises N3. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W07	Written final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U07,	Oral explanation/short tests
F2	PEK_U01÷PEK_U07,	Laboratory reports
P=(F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[1] Horowitz P., Hill W. : Sztuka elektroniki: Wyd. WKiŁ, 2008

[2] Schenk Ch., Tietze U. : Układy półprzewodnikowe, Wyd. WNT 2009.

[3] Filipkowski A.: Układy elektroniczne analogowe i cyfrowe. Wyd. WNT, 2006

[4] Rusek M., Pasierbiński J.: Elementy i Układy Elektroniczne w pytaniach i odpowiedziach, wyd. WNT,1997.

SECONDARY LITERATURE:

[1] Seely S.: Układy elektroniczne, Wyd. WNT, 1972

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Podstawy elektroniki

EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Mechanika i budowa maszyn**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W12	C1.1, C1.2, C1.3	Wy 1-8, La2-6	N1, N3
PEK_W02	K1MBM_W12	C1.1-C1.5	Wy1-8, La2-7	N1, N3
PEK_W03	K1MBM_W12	C1.3-C1.5	Wy1-8, La1-6	N1, N3
PEK_W04	K1MBM_W12	C1.3-C1.5	Wy1,5-8, La2-6	N1, N3
PEK_W05	K1MBM_W12	C1.4,C1.5	Wy3,6-8, La4-8	N1, N3
PEK_W06	K1MBM_W12	C1.5	Wy7, La5-6	N1, N3
PEK_W07	K1MBM_W12	C2.1, C2.2	Wy1-6	N1, N3
PEK_U01	K1MBM_W12	C2.1, C.2.2, C2.3	Wy5-8,La1-6	N2, N3
PEK_U02	K1MBM_U12	C2.1-C2.3	La2	N2, N3
PEK_U03	K1MBM_U12	C1.3,C2.1, C.2.2	Wy2,Wy5,La2	N2, N3
PEK_U04	K1MBM_U12	C1.4, C2.3	La4	N2, N3
PEK_U05	K1MBM_U12	C1.3, C2.1, C.2.2	La2	N2, N3
PEK_U06	K1MBM_U12	C1.5, C2.1, C.2.2	Wy7,La5,La6	N2, N3
PEK_U07	K1MBM_U12	C2.1	La8	N2, N3

FACULTY OF MECHANICAL, THERMAL AND ELECTRICAL POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy elektrotechniki**
Name in English	Fundamentals of Electrical Engineering
Main field of study	Mechanical Engineering and Machine Building
Level and form of studies	1st level, full-time
Kind of subject	Obligatory
Subject code	MSN0750
Group of courses	No

	Lecture	Recitations	Laboratory	Project	Seminar
Number of hours of organized classes in university (ZZU)	30	15	15		
Number of hours of total student workload (CNPS)	60	30	30		
Form of crediting	crediting with grade	crediting with grade	crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2	1	1		
including number of ECTS points for practical (P) classes	0	1	1		
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75	0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Thorough knowledge of physics (electricity and magnetism) and mathematics (mathematical analysis)

SUBJECT OBJECTIVES

C1 – Familiarity with terms, fundamental definitions and units.
C2 – Acquaintance with the theories of electric field, magnetic field, and DC and AC electric circuits
C3 – Familiarity with fundamental, simple measurement methods and devices as employed in DC circuits and single-phase and three-phase AC circuits.
C4 – Development and practical application of the abilities to properly connect the elements of single-phase and three phase electrical circuit systems to measurement of electrical quantities.
C5 – Familiarity with the measurement of non-electric quantities with electrical methods
C6 – Acquaintance with electrical signals and their selected different forms and electric switches along with their basic use in practice.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge

A student should demonstrate remarkable ability:

PEK_W01 to define and formulate basic concepts of electrical engineering and to appropriately use the quantities, their units along with multiples and subdivisions;
PEK_W02 to recognise and describe the phenomena and their mechanisms in electric and magnetic fields, and in the DC and AC electrical circuits;
PEK_W03 to try or to be able to show where and how the phenomena studied were applied in practice or a student himself can apply them to practical situations;
PEK_W04 to know what measurement methods can be used to measure an electrical quantity or electrical quantities, and how and when they should be applied correctly from the view point of metrology.

relating to skills

A student should demonstrate remarkable ability:

PEK_U01 to analyse and interpret the phenomena studied and the governing mechanisms, and to perform analytically mathematical calculations of simple electric and magnetic fields as well as of the DC and AC electrical circuits;

PEK_U02 to apply the formulae and equations known to the solution of problems and to the calculation of values of different electrical quantities;

PEK_U03 to formulate problems and to be able to solve them;

PEK_U04 to select and apply a proper method for measuring the electrical quantities according to a given situation;

PEK_U05 to set up a measuring system relevant to the method selected, to operate measuring instruments, and to properly interpret the measurement data obtained.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Fundamental definitions and units.	1
Lec2	Electric and electrostatic fields (definitions) – charge and its distributions; Coulomb's law; electric field strength; voltage and potential; Gauss' law; electrostatic induction; different kinds of charging; electric capacitance (capacitor) and field energy.	4
Lec3	Direct (DC) current – electric current and its density; linear electric circuits and methods of their solution; Ohm's and Kirchhoff's laws; energy; power; heat; a flow field of the DC current; resistance; resistors in series and parallel.	3
Lec4	Magnetism and electromagnetism – magnetic field; magnetic induction; Ampere's law; an electric field of the DC current; Biot-Savart's law; flow law; magnetic circuits and its calculation; Lorentz's force and equation; Faraday's law of electromagnetic induction; self-induction and mutual induction; inductance coil.	4
Lec5	Classification of the electric circuit elements – physical constants; circuit element; element parameters; elements of concentrated parameters; stationary, multiterminal, symmetric, linear and nonlinear, active and passive circuit elements; element passivity condition; active elements – sources and their features; generator – Faraday's law; electromotive forces, batteries and other sources of voltage and current; controlled source; ideal passive elements: resistor, capacitor, coil; electric motor – Ampére's law.	2
Lec6	Electric signals – signals' classification; quantities characterizing the periodic signals; some special non-periodic signals.	1
Lec7	Sinusoidal, alternating (AC) voltage – alternating voltage generation; sinusoidal voltage and current as rotating vectors; average and root mean square values of voltage and current; AC current power; elements L and C in AC current circuits; R, L and C in series – voltage resonance; electric circuits analysis with the complex number method – symbolic method; AC current power using the symbolic method; power factor.	4
Lec8	Complex frequency concept – complex frequency and exponential function features; circuit elements in the domain of a function of complex frequency; Laplace's transform; Ohm's law in the form of the Laplace transform; transfer function.	3
Lec9	Electric filters – general notions; low-pass and high-pass filters; RC filters; band-pass and band-elimination filters. Transformer.	1
Lec10	Electric measurements – measuring instruments: magnetoelectric, electromagnetic, electrodynamic, and induction meters; resistance measurement: technical and bridge methods; recording instruments; oscilloscope; measurements of non-electric quantities with electric methods.	3
Lec11	Three-phase circuits – three-phase voltage generation; three-phase systems (star and delta connections); active (true), passive and apparent power; measurement of the electric power and energy of three-phase current.	3
Lec12	Electric switches – switching devices and fuses/cut-outs; connectors; changeover switches; disconnecting switches (disconnectors); switch disconnectors; circuit breakers.	1
	Total hours	**30**
Form of classes – recitation (tutorial)		**Number of hours**
Re1	Electric and electrostatic fields – calculation of *Coulomb* force, electric field strength, voltage and potential for point charges and their simple, uniform distributions, and capacitance.	4
Re2	DC electric circuits – network analysis and calculation of circuit parameters based on *Ohm's*	4

	and *Kirchhoff's* Laws.	
Re3	Electromagnetism – calculation of forces, electromotive forces and other quantities related to electromagnetic fields	3
Re4	Sinusoidal AC circuits – AC network analysis and calculation of circuit parameters based on *Ohm's* and *Kirchhoff's* laws using time-dependent and complex number methods	4
	Total hours	**15**
Form of classes – Laboratory		**Number of hours**
Lab1	*Ohm's* and *Kirchhoff's* laws — their experimental verification	5
Lab2	Measurements of resistance, isolation resistance, and resistivity	2
Lab3	Examination of electromagnetic feedback — transformer	2
Lab4	Power measurement	2
Lab5	Resonance of voltages and currents	2
Lab6	Conversion of the electric energy into heat	2
	Total hours	**15**

TEACHING TOOLS USED
N1. Traditional lecture with richly illustrated multimedia presentation (in PowerPoint). N2. Recitation – mathematical training in solving simple physics problems. N3. Recitation – one or two written tests within a semester. N4. Office hours. N5. Own work – preparation for recitations. N6. Own work – individual self-studies and preparation for final tests.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT – lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W06.	Written test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT – recitation

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01÷PEK_U03	Written test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT – laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W04 i PEK_U03–U05	Oral test of students' knowledge before they start doing each lab experiment
F2		Written reports from the experiments performed
C		Final grade

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[2] Elektrotechnika teoretyczna, T. Cholewicki, WNT, Warszawa 1967.
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[13] Podstawy teorii pola elektromagnetycznego, Z. Piątek, P. Jabłoński, WNT, Warszawa 2010.

SUPPLEMENTARY READING:

[1] Poradnik inżyniera elektryka, WNT, Warszawa 1974.
[2] Teoretyczne podstawy elektrotechniki, A. Łuczycki, Wyd. PWr, Wrocław 1980.
[3] Elektrotechnika i elektronika, F. Przezdziecki, PWN, Warszawa 1982.
[4] Elektryczność i magnetyzm, A.H. Piekara, PWN, Warszawa 1970.
[5] Elektryczność i magnetyzm, Kurs fizyki, Tom III, B. Jaworski, A. Dietłaf, L. Miłkowska, PWN, Warszawa 1971.
[6] Feynmana wykłady z fizyki, Tom II, Część 1, R.P. Feynman, R.B. Leighton, M. Sands, PWN, Warszawa 1974.
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[8] Elektrotechnika, praca zb. pod red. P. Zielińskiego, Wyd. PWr, Wrocław 1990.
[9] Podstawy fizyki dla kandydatów na wyższe uczelnie, M. Herman, A. Kalestyński, L. Widomski, PWN, Warszawa 1991.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Podstawy elektrotechniki

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W12	C1	Lec1	N1, N7
PEK_W02		C2	Lec2–4; Lec7	N1, N5, N7
PEK_W03		C3	Lec2; Lec5; Lec10–11	N1, N5, N7
PEK_W04		C3–5	Lec3; Lec10–11	N1, N5–7
PEK_U01–U03	K1MBM_U12	C2	Re1–4	N2–7
PEK_U04–U05		C4–5	Lab1–6	N3–5

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy materiałoznawstwa**
Name in English	Fundamentals of Materials Science
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 0770**
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	Examination				
For group of courses mark (X) final course					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes	0				
including number of ECTS points for direct teacher-student contact (BK) classes	1,5				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Having the knowledge of physics and chemistry at the high school level.

SUBJECT OBJECTIVES

C1 – Overview of classification and properties of the main groups of engineering materials.
C2 – Providing knowledge about the basis of crystallography, structure and properties of crystalline materials.
C3 - Overview of structural changes occurring in the manufacture of materials.
C4 - Providing knowledge on the structure of metal alloys and their properties.
C5 - Overview of the structures and properties of the iron-carbon alloys.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - student knows the basic types of materials, their structure and properties.
PEK_W02 - student has mastered knowledge of the changes occurring in crystalline materials influencing their structure and properties.
PEK_W03 - student has mastered detailed knowledge of iron-carbon alloys, their types, structure and properties.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Introduction. Types of materials. Representative examples, properties and applications for each category of materials. Atomic structure of materials. Atomic bonding.	2
Lec2	Atomic arrangement in perfect solid materials. Lattice unit cell. Characterization of crystal systems and lattice unit cells.	2
Lec3	Determination of directions and planes in the unit cell. Anisotropy of crystalline materials.	2
Lec4	The actual structure of crystalline materials - imperfections in the atomic arrangement and their effect on the behavior of materials.	2
Lec5	Phase transformations. Fundamental principles of solidification. Allotropic transformation. Magnetic transformation.	2
Lec6	Plastic deformation of metals. Significance of dislocations in the plastic deformation. Recrystallization and its practical application.	2
Lec7	Structure and kinds of alloys - solutions, intermetallic phases, mixtures.	2
Lec8	Equilibrium phase diagram. Basic transformations occurring in binary systems.	2
Lec9	Analyze of binary phase diagrams. Alloys solidification in nonequilibrium conditions.	2
Lec10	Iron-carbon alloys – steels and cast irons. Phases and structure constituents of iron-carbon binary system. The Fe- C and Fe- Fe_3C equilibrium diagrams.	2
Lec11	Analyze of the Fe- Fe_3C equilibrium diagram.	2
Lec12	Mechanical testing of materials: tensile test , hardness test, impact test, fatigue test, creep test.	2
Lec13	Unalloyed steels and cast steels. Effect of carbon and tramp elements on steels properties. Grading and determination of steels.	2
Lec14	The iron-graphite equilibrium diagram. Types of cast iron. Graphitizing.	2
Lec15	Modification of grey cast iron. Grading and determination of steels. Forms of graphite, type of cast iron matrix and their effect on properties. Classification and determination of cast iron.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. traditional lecture and slide show N2. own work - self-study and exam preparation N3. consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W03	written and oral examination

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [71] Blicharski M., Wstęp do inżynierii materiałowej, WNT, Warszawa, [72] Haimann R., Metaloznawstwo cz. I, OW PWr. Wrocław 2000, [73] Haimann R., Metaloznawstwo, Wydawnictwo PWr. Wrocław 1980, [74] Ziółkowski B., Materiały do wykładów, www.immt.pwr.wroc.pl/~ziolek SECONDARY LITERATURE: [20] Dobrzański L.A., Materiały inżynierskie, WNT, Warszawa,…. [21] Ashby M.F., Jones D.R.H., Materiały inżynierskie t. 1 i 2, WNT, Warszawa 1996

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01 – PEK_W03	K1MBM_W06	C1 – C5	Wy1 – Wy15	N1 – N3

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy mechaniki płynów**
Name in English	Basis of Fluid Mechanics
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st, level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN0780**
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			
For group of courses mark (X) final course					
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	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1 .Skills in mathematics and physics.

SUBJECT OBJECTIVES

C1 Transfer basic knowledge of ideal fluid mechanics, covering the following topics.
- C1.1. Macroscopic properties of fluids.
- C1.2. Fluid statics.
- C1.3. Ideal fluid dynamics.

C2 Education ability to perform hydraulic calculations for ideal fluid, covering the following topics.
- C2.1. Macroscopic properties of fluids.
- C2.2. Applications of the basic equations describing ideal fluid motion.
- C2.3. Solving ideal fluid measurement systems.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge: have a basic knowledge of modeling ideal fluid

PEK_W01 - knows the basic definitions of the properties of fluids.
PEK_W02 - knows the laws of fluid statics.
PEK_W03 - can describe the motion of ideal fluid

relating to skills:

PEK_U01 - can calculate the macroscopic properties of liquids
PEK_U02 - can apply the laws of the static fluid for solving problems
PEK_U03 - can calculate quantities associated with the movement of ideal fluid

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Subject matter and methods of fluid mechanics, historical background.	2
Lec2	The forces acting on the fluid element. The state of tension.	2
Lec3	The equations of fluid balance, law of connected vessels, liquid manometers.	2
Lec4	Classification and methods for describing fluid motion. Basic concepts and equations of kinematics.	2
Lec5	Local motion of a fluid. Potential and vortex flow.	2
Lec6	The basic equations of fluid mechanics: the principle of conservation of mass, momentum and energy.	2
Lec7	Equations of ideal fluid motion and their integration. Cauchy integral and Bernoulli for compressible and incompressible fluid	2
Lec8	Applications of Bernoulli's equation and continuity equation. The measurement of the local and average velocity.	2
Lec9	Applications of Bernoulli's equation and continuity equation. Measurement of flow. Outflow through the holes. Cavitation.	2
Lec10	Navier - Stokes equation - basic equation of the fluid mechanics.	2
Lec11	The similarity of dynamic flow.	2
Lec12	Laminar flow. The integration of the Navier - Stokes equations for plane and axisymmetric flow.	2
Lec13	The basic theory of the boundary layer, equations of Prandtl.	2
Lec14	Turbulent flow - the essence of the flow, Reynolds equation, turbulent stress.	2
Lec15	Final test.	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Solving problems related to the macroscopic properties of the fluid.	2
Cl 2	Application of the law of connected vessels and the balance volume to solving problems of liquid manometers.	2
Cl 3	Solving problems of thrust on the flat walls.	2
Cl 4	Solving problems of thrust on the curved walls.	2
Cl 5	Using of the Bernoulli equation to solving problems with flow of ideal fluid.	2
Cl 6	Solving problems with Pitot and Prandtl tube.	2
Cl 7	Final test.	3
	Total hours	**15**

TEACHING TOOLS USED

N1. Traditional lectures using multimedia presentation containing the basic knowledge and examples of its application.
N2. Classes - discussion of the tasks.
N3. Classes - short skill tests.
N4. Tutorials - final test.

N5. Consultation. N6. Students work to preparing for classes. N7. Students work to preparing for exam.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U03	Short test on the each lecture.
F2		Final test
C=max{F1, F2}, F1 – points for short testes		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Podstawy mechaniki płynów

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1MBM_W09	C1.1.	Lec1, Lec10-Lec14	N1, N5, N7
PEK_W02		C1.2, C1.4	Lec2, Lec3	
PEK_W03		C1.3	Lec4-Lec9	
PEK_U01	K1MBM_U09	C2.1	Cl 1, Cl 2	N2,N3,N4,N5,N6
PEK_U02		C2.3	Cl 4	
PEK_U03		C2.2	Cl 3, Cl 5, Cl 6	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy termodynamiki**
Name in English	Basics of Thermodynamics
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN0810**
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			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

The basic knowledge and skills in physics and mathematics.

SUBJECT OBJECTIVES

C1 – to pass on the basic knowledge regarding phenomena and processes in classical thermodynamics
C2 – to pass the knowledge as to basic thermodynamic rules and laws
C3 – to pass the knowledge and to acquire skills in respect of calculating the ideal and real substances properties as well as energy balance for different systems
C4 – to illustrate the characteristic processes graphically that occur in thermodynamics and develop calculation skills as regards work and heat
C5 – transfer the basic knowledge and develop the calculation skills in respect with the heat cycles efficiencies
C6 – transfer the knowledge as to the fuel burning processes stoichiometry
C7 – transfer the knowledge regarding the gas flow in channels

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 know the basic laws and terms regarding classical thermodynamics
PEK_W02 know the ideal and real gas equations of state
PEK_W03 be acquainted with the thermodynamics laws
PEK_W04 be acquainted with the characteristic processes
PEK_W05 acquire knowledge as to calculation of the heat cycles efficiencies
PEK_W06 have the basic knowledge as to moisture air processes
PEK_W07 know the balance rules in respect with the burning processes
PEK_W08 can explain gas flow processes in nozzles and diffusers

relating to skills:

PEK_U01 can make energy balance for different systems
PEK_U02 determine the properties of ideal gases and for mixture of ideal gases
PEK_U03 have skills in determining work and heat for characteristic processes
PEK_U04 have skills in calculation the heat cycle efficiencies

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Introduction and basic concepts in Thermodynamics.	2
Lec2	Thermodynamic systems. Properties of a system. State and equilibrium. Processes. The ideal gas equation of state. Gas mixture analysis.	2
Lec3	Energy. Mechanisms of energy transfer: work, heat, and mass flow.	2
Lec4	The First Law of Thermodynamics.	2
Lec5	Characteristic processes analysis for ideal gases.	2
Lec6	The Second Law of Thermodynamics. Entropy.	2
Lec7	Temperature-entropy diagram analysis. Cycles. Irreversible processes	2
Lec8	Exergy. Maximum useful work. Exergy destruction. Exergy balance equations.	2
Lec9	Real gases analysis. Equation of states of the real gases.	2
Lec10	Thermodynamic properties of steam and other vapors. Property diagrams.	2
Lec11	Gas-vapor mixtures. Psychrometric chart. Gas-vapor processes analysis.	2
Lec12	Fuels and combustion. Parameters used in combustion analysis.	2
Lec13	Energy balance to reacting systems. Enthalpy of combustion. Heating values of fuels.	2
Lec14	Compressible gas flow analysis.	2
Lec15	Semestral colloquium.	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl1	Organizational affairs. Properties of the system.	1
Cl2	Energy balance equations.	2
Cl3	The ideal gas equation of state. Gas mixture analysis.	2
Cl4	Characteristic processes analysis for ideal gases.	2
Cl5	The First Law of Thermodynamics.	2
Cl6	Entropy. The Second Law of Thermodynamics. Cycles.	2
Cl7	Cycles.	2
Cl8	Computational test.	2
	Total hours	**15**

TEACHING TOOLS USED

N1. Traditional lecture.
N2. Computational classes.
N3. Consultations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W08	semestral colloquium

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_U04	Computational test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[57] Kalinowski E.: Termodynamika. Politechnika Wrocławska, Wrocław 1994
[58] Szargut J., Termodynamika Techniczna, WPŚl., Gliwice 2005
[59] Wiśniewski S., Termodynamika Techniczna wyd. II i dalsze, WNT, Warszawa 1987 i dalej

SECONDARY LITERATURE:

[22] Wark W., Richards D., Thermodynamics, McGraw-Hill, Sixth Edition, Boston 1999.

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

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1MBM_W09	C1, C2	Lec1	N1, N3
PEK_W02		C3	Lec2, Lec9, Lec10	
PEK_W03		C2	Lec3, Lec4, Lec6-Lec8	
PEK_W04		C4	Lec5	
PEK_W05		C5	Lec7, Lec8	
PEK_W06		C3	Lec11	
PEK_W07		C6	Lec12	
PEK_W08		C7	Lec13, Lec14	
PEK_U01	K1MBM_U09	C3	Cl1, Cl2, Cl5	N2, N3
PEK_U02		C3	Cl3	
PEK_U03		C4	Cl4	
PEK_U04		C5	Cl6, Cl7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy metrologii i techniki eksperymentu**
Name in English	Basics of metrology and experiment techniques
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 0815**
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)	60	30	30		
Form of crediting	crediting with grade	crediting with grade	crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	2	1	1		
including number of ECTS points for practical (P) classes		1	1		
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75	0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of mathematics and physics.

SUBJECT OBJECTIVES

C1. Familiarizes students with the basic measurement techniques and provides knowledge related to the properties of measuring instruments.
C2. Discusses the methods for disclosure and elimination of measurement errors.
C3. Discusses the problems related to the methods for determination of measurement uncertainty and for improvement of measurement accuracy as well as experimental results registration.
C4. Provides knowledge about the principles of examination and calibration of the instruments and measuring devices.
C5. Describes the problems associated with the experiment planning and results handling.
C6. Develops the ability to carry out a simple experiment.
C7. Develops the skills and practice to plot a measurement graph.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Should have knowledge related to the basic measurement techniques. Should be familiar with measurement equations and terms of physical quantity, unit of measure, measurement standard and calibration.
PEK_W02 Should be familiar with terms related to the devices properties including measuring accuracy, indication range and measuring scale, sensitivity and instrument error.
PEK_W03 Should be able to discuss the methods for measurement errors disclosure and correction factor determination.

PEK_W04 Should be familiar with techniques of registration of measurement results and units.
PEK_W05 Should be familiar with methods for determination of measurement uncertainty.
PEK_W06 Should be familiar with methods for improvement of measurement accuracy.
PEK_W07 Should understand the necessity of measurement results interpretation and analysis.
PEK_W08 Should know and understand the necessity of using correlation and regression functions to plot measurement graphs.
PEK_W09 Should have knowledge related to the principles of examination and calibration of measuring devices.
PEK_W10 Should have knowledge related to the techniques of experiment planning and results handling.

relating to skills:

PEK_U01 Should be able to discuss and discern measurement methods.
PEK_U02 Should be able to set up a measuring step in experiment.
PEK_U03 Should be able to carry out a simple experiment.
PEK_U04 Should be able to register and correctly interpret a measurement result.
PEK_U05 Should be able to calculate a measurement uncertainty for direct and indirect method.
PEK_U06 Should be able to plot a measurement graph on the basis of the results obtained during experiment.
PEK_U07 Should be able to assess the possibility to improve an experiment accuracy.
PEK_U08 Should be able to disclosure measurement error and calculate correction factor.
PEK_U09 Should be able to apply correlation and regression analysis to plot measurement graphs.
PEK_U10 Should be able to calibrate and test measuring devices and draw correction curve.

PROGRAMME CONTENT		
Form of classes – lecture		**Number of hours**
Lec 1, 2	The scope and course completion conditions. Measurement – definition and basic equation. Measurement quantities and units – classification, examples and application.	4
Lec 3	Measurement standards – classification and examples.	2
Lec 4, 5	Techniques, devices and measuring tools – classifications and examples. Characteristic parameters of measuring devices.	4
Lec 6	Measurement errors (accidental, systematic, excessive) – definitions, disclosure and elimination of measurement errors.	2
Lec 7	The rules for measurement results presentation. Accuracy and rules of approximate numbers rounding. Examples.	2
Lec 8÷12	Measurement uncertainties – standard, total standard, complete. Calculation methods (direct and indirect measurements), examples. Gaussian and Student's distributions. Improvement of the measurement accuracy.	10
Lec 13	Correlation and regression methods – basis.	2
Lec 14	Experiment planning and results handling.	2
Lec 15	Colloquium.	2
	Total hours	**30**

Form of classes – class		**Number of hours**
Cl 1	Organizational issues. Calculation and problem-solving exercises concerning the adaptation of quantitative formulas to the results.	2
Cl 2	Calculation and problem-solving exercises related to the systematic errors on the	2

	example of elementary measurements of temperature, pressure and stream flow.	
Cl 3	Calculation and problem-solving exercises related to the sensitivity of the measuring device, type B measurement uncertainty and results registration.	2
Cl 4	Calculation and problem-solving exercises associated with errors disclosure and type A measurement uncertainty (Gaussian and Student's distributions).	2
Cl 5	Calculation and problem-solving exercises related to the expanded uncertainty and accuracy improvement for direct and indirect measurements.	2
Cl 6	Calculation and problem-solving exercises related to the correlation and regression methods.	2
Cl 7	Calculation and problem-solving exercises related to the techniques and basis of experiment planning.	2
Cl 8	Additional Classes. Colloquium.	1
	Total hours	**15**

Form of classes – laboratory		**Number of hours**
Lab 1	Introduction. Organizational issues. Health and safety regulations.	1
Lab 2	Gaussian distribution, type A standard uncertainty.	2
Lab 3	Errors in direct measurements.	2
Lab 4	Basic measurement technique on the example of density determination. Errors in indirect technique.	2
Lab 5	Testing and calibration of instruments and measuring devices.	2
Lab 6	Correlation and regression analysis.	2
Lab 7	System for water volumetric flow measurement by means of oriface.	2
Lab 8	Additional term of the laboratory. Colloquium.	2
	Total hours	**15**

TEACHING TOOLS USED
N1 Traditional lecture with use of the slides and the transparency. N2 Calculation exercises – small 10 min. exams. N3 Calculation exercises – results discussion. N4 Laboratory – small exams from laboratories preparation. N5 Laboratory – discussion of experimental procedures. N6 Laboratory – discussion of the reports related to the measurements carried out. N7 Student's own work – preparation for classes and laboratories. N8 Consultations. N9 Student's own work – colloquium preparation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01 ÷PEK_W10	Colloquium.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01÷ PEK_U10	Colloquium

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷ PEK_U10	Small written exams.
F2	PEK_U01÷ PEK_U10	Small oral exams.
F3	PEK_U01÷ PEK_U10	Grading of laboratory reports.
C = 0,4F1 +0,4F2+0,2F3		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE:
[1] D. Turzeniecka : *Ocena niepewności wyniku pomiarów*. Wydawnictwo Politechniki Poznańskiej, Poznań 1997. [2] *Wyrażanie niepewności pomiaru*. Przewodnik. Główny Urząd Miar 1995. [3] John R. Taylor: *Wstęp do analizy błędu pomiarowego*. PWN 1999. [4] J. Arendarski: *Niepewność pomiaru*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2003. [5] J. Piotrowski, K. Kostyrko: *Wzorcowanie aparatury pomiarowej*, PWN, Warszawa 2000.
SECONDARY LITERATURE:
[1] J. Piotrowski: *Podstawy miernictwa*, WNT, Warszawa 2002 [2] L. Augustyniak : *Teoria pomiarów w przykładach*, Gdynia 1999 [3] *Mała encyklopedia metrologii*, WNT, Warszawa 1989 [4] A.Chwaleba, M. Poniński, A. Siedlecki: *Metrologia elektryczna*, WNT, Warszawa 2000
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Podstawy metrologii i techniki eksperymentu

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W10	C1,C4	Lec 1÷ Lec 3	N1,N8,N9
PEK_W02	K1MBM_W10	C1	Lec 4, Lec 5	N1,N8,N9
PEK_W03	K1MBM_W10	C2	Lec 6	N1,N8,N9
PEK_W04	K1MBM_W10	C3	Lec 7	N1,N8,N9
PEK_W05	K1MBM_W10	C3	Lec 8÷ Lec 12	N1,N8,N9
PEK_W06	K1MBM_W10	C3	Lec 8÷ Lec 12	N1,N8,N9
PEK_W07	K1MBM_W10	C5,C7	Lec 8÷ Lec 12	N1,N8,N9
PEK_W08	K1MBM_W10	C7	Lec 13	N1,N8,N9
PEK_W09	K1MBM_W10	C4	Lec 14	N1,N8,N9
PEK_W10	K1MBM_W10	C5	Lec 14	N1,N8,N9
PEK_U01	K1MBM_U10	C1	Lab 3,Lab 4	N4÷N8
PEK_U02	K1MBM_U10	C6	Lab 7, Cl 7	N2÷N7
PEK_U03	K1MBM_U10	C5,C6	Lab 2÷Lab 7	N4÷N7
PEK_U04	K1MBM_U10	C3	Lab 2÷Lab 4, Lab 7, Cl 1	N2÷N7
PEK_U05	K1MBM_U10	C3	Lab 2÷Lab 4, Lab 7, Cl 3÷ Cl 5	N2÷N7
PEK_U06	K1MBM_U10	C7	Lab 5÷Lab 7	N4÷N7
PEK_U07	K1MBM_U10	C3	Lab 7, Cl 5	N2÷N7
PEK_U08	K1MBM_U10	C2	Cl 2, Cl 4	N2,N3, N7
PEK_U09	K1MBM_U10	C7	Lab 6, Cl 6	N2÷N7
PEK_U10	K1MBM_U10	C4	Lab 5	N4÷N7

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Podstawy wytrzymałości materiałów**
Name in English	Fundamentals of Materials Strength
Main field of study	Mechanical Engineering and Machine Building
Level and form of studies	1st level, full-time
Kind of subject	obligatory
Subject code	MSN 0820
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			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Basic knowledge, skills and competences relating to mathematical analysis, algebra with analytic geometry, and mechanics – statics.

SUBJECT OBJECTIVES

C1. Solving technical problems on the basis of the laws of mechanics,
C2. Making strength analyses of structural components for complex load cases,
C3. Acquiring and strengthening social competences covering emotional intelligence consisting in the ability to collaborate in a student team in order to effectively solve problems. Responsibility, honesty and reliability, the observance of the customs prevailing in the academic community and in society

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge

The student:

PEK_W01 – can define the behaviour of a deformable body in complex load cases and use the laws derived for deformable body mechanics;

PEK_W02 – has systematized and theoretically underpinned knowledge concerning the strength of materials, including knowledge essential for strength dimensioning in simple load cases.

relating to skills

The student can:

PEK_U01 – carry out an analysis of the state of stress and strain, and strength dimensioning of bar elements in the elastic range;

PEK_U02 – assess the safety of the behaviour of a structure for simple load cases.

relating to social competences:

PEK_K01 – shows openness to searching for information and subjecting it to critical analysis;
PEK_K02 – shows objectivity in the evaluation of arguments, the rational explanation and substantiation of her/his own point of view, using knowledge from the field of materials strength;
PEK_K03 – observes the customs and principles prevailing in the academic community.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Introductory information, basic definitions and assumptions, an analysis of a structural member under load, the definition of stress, the definition of strain.	2
Lec2	The tension and compression of the prismatic bar, Hooke's law, the experimental foundations for determining the mechanical properties of materials, typical stress-strain curves in tension and compression, the effects of time and temperature.	2
Lec3	The fundamentals of the state of stress, the internal equilibrium conditions, the graphical determination of stresses, typical states of stress.	2
Lec4	The fundamentals of stress theory, the geometric conditions, dilatational and nondilatational strain.	2
Lec5	The generalized Hook law, elastic strain energy.	2
Lec6	Technical cutting, calculations of welded and riveted joints.	2
Lec7	The torsion of straight bars; bars circular in cross section, bars with any cross section.	2
Lec8	The torsion of thin-walled open and closed cross section bars, examples of torsional strength calculations.	2
Lec9	The bending of straight bars, special cases of bending, straight bending, stress under pure and transverse bending, strength calculations of beams subjected to bending.	2
Lec10	Differential equations for the beam bending line, the analytical method of determining the bending line of beams subjected to bending by the Clebsch method.	2
Lec11	The analytical-graphical method of determining the deflections of bent beams.	2
Lec12	Skew bending, stress and strain determination, the shear centre.	2
Lec13	Bending with tension or compression, eccentric tension, the compression of stubby bars.	2
Lec14	The strength of thin-walled tanks.	2
Lec15	Written test.	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Statics equations; tension, compression – statically determinate systems.	2
Cl 2	Tension, compression – statically indeterminate systems.	2
Cl 3	The analysis of plane stress, the application of the generalized Hooke law.	2
Cl 4	Shear calculations.	2
Cl 5	Torsion calculations.	2
Cl 6	Calculations of the stresses and deflections of beams subjected to bending.	3
Cl 7	Written test.	2
	Total hours	**15**

TEACHING TOOLS USED
N1. The traditional lecture with the use of audio-visual aids.
N2. Calculation exercises – the discussion of problem solutions.
N3. Tutorials.
N4. Self-study – preparation for laboratory classes.
N5. Self-study – preparation for the test.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W02 PEK_K01÷PEK_K03	Major test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1 the arithmetic mean of the grades received in classes	PEK_U01÷PEK_U02 PEK_K01÷PEK_K03	Oral answers, written tests
F2		Major test
C = 0,2 F1 +0,8 F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[75] Żuchowski R.: *Wytrzymałość materiałów*, Oficyna Wydawnicza Pol. Wr., Wrocław, 1996
[76] Jakubowicz A., Orłoś Z.: *Wytrzymałość materiałów*, WNT, Warszawa, 1984
[77] Niezgodziński M.E. Niezgodziński T.: *Wytrzymałość materiałów*, WN PWN, Warszawa, 2009
[78] Niezgodziński M.E. Niezgodziński T.: *Zadania z wytrzymałości materiałów*, WNT, Warszawa, 2012
[79] Rajfert T., Rżysko J.: *Zbiór zadań ze statyki i wytrzymałości materiałów*, PWN, Warszawa, 1976

SECONDARY LITERATURE:

[23] Malinin N.N., Rżysko J.: *Mechanika materiałów*, PWN, Warszawa, 1981
[24] Brzoska Z.: *Wytrzymałość materiałów*, PWN, Warszawa, 1979
[25] Niezgodziński M.E. Niezgodziński T.: *Wzory, wykresy i tablice wytrzymałościowe*, WNT, Warszawa, 2009

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

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	K1MBM_W05	C1	Lec1÷Lec15	N1, N3, N5
PEK_W02				
PEK_U01	K1MBM_U05	C1, C2	Cl 1÷Cl 7	N2, N3, N4
PEK_U02				
PEK_K01 PEK_K02 PEK_K02	K1MBM_K02 K1MBM_K04	C3	Lec1÷Lec15 Cl 1÷Cl 7	N3, N5

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Pompy**
Name in English	Pumps
Main field of study	**Mechanics and machine construction**
Specialization	**Thermo-power Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0841**
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			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of issues related to solid mechanics and fluid mechanics
3. Ability to use spreadsheets and CAD programs

SUBJECT OBJECTIVES

C.1 Learning by students, classification, construction and operation of pumps used for transportation of clean and mixed fluids.
C.2 Learning by students the role and purpose of main pump elements.
C.3 Learning by students exploatation and energy properties
C.4 To provide students with the construction of hydroelectric power.
C.5 Developing skills of simple pumps design. Focusing on centrifugal pumps.
C.6 Developing skills of pump selection and system cooperation analysis.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – understands importance of pumps in water management and knows classification of pumps
PEK_W02 – knows construction and one-dimension theory of centrifugal pump operation
PEK_W03 – knows rules of pump properties description using characteristics
PEK_W04 – have knowledge of centrifugal pump flow elements design algorithms
PEK_W05 – have knowledge of phenomena causing occurrence of forces in centrifugal pumps
PEK_W06 – knows cavitation phenomena, methods of cavitation description and pump design methods with improved anti-cavitation properties
PEK_W07 – knows methods of pump working within system operating point determination and knows rules of multiple pump cooperation
PEK_W08 – knows methods of pump regulation and energetic effect they are causing

relating to skills:

PEK_U01 – able to design simple centrifugal radial pump for given parameters
PEK_U02 – able to recognize pump type and assess its performance characteristics
PEK_U03 – able to select pump to the system

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Requirements, introduction to pump technology	2
Lec2	Division Classification of pumps, scope, parameters.	2
Lec3	The construction of centrifugal pumps, the role and importance of the key elements of the pump.	2
Lec4	Basics of centrifugal pumps.	2
Lec5	Characteristics, losses and efficiency of centrifugal pumps.	2
Lec6	The basis of calculation of centrifugal pumps.	2
Lec7	Hydrodynamic forces and ways of compensation.	2
Lec8	Cavitation and cavitation prevention	2
Lec9	Propeller pumps, construction and operation.	2
Lec10	Circulatory pumps and self-priming pumps.	2
Lec11	Pumping system, pumps cooperation with each other and the system. Selection of pumps in the system.	2
Lec12	Adjusting the pump parameters.	2
Lec13	Positive displacement pumps - the division classification.	2
Lec14	Positive displacement pumps with rotary movement of the operating member.	2
Lec15	**Examination**	2
	Total hours	**30**
Form of classes - exercises		**Number of hours**
Ex1	Calculation and desing of the low specific speed pump impeller.	8
Ex 2	Calculate and design of liquid discharge element from the low specific speed pump.	3
Ex 3	Calculation of the characteristics of the selected pumping system.	1
Ex 4	Pump selection to the selected pumping system.	3
	Total hours	**15**

TEACHING TOOLS USED

N1. Traditional lecture using slides, animation and presentation software.
N2. Exercise: discussion of the calculation algorithms
N3. Own work:

- Pump selection based on manufacturer data, internet and available software,
- Impeller parameters and dimensions calculation using MathCad/Excel

N4. Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture*

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
P	PEK_W01…W15	Test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- exercises*

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U1	Raport from calculation
F2	PEK_U2, PEK_U3	Raport from pump selection

P=0,75F1+0,25F2

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[60] W. Jędral - Pompy wirowe, Wydawnictwo Naukowe PWN Warszawa 2001
[61] A. Korczak, J. Rokita - Pompy i układy pompowe,
[62] Sz. Łazarkiewicz, A.T. Troskolański - Pompy wirowe,
[63] M. Skowroński - Układu pompowe, Wydawnictwo Politechniki Wrocławskiej, Wrocław 2009
[64] M. Stępniewski - Pompy, WNT, Warszawa 1985

SECONDARY LITERATURE:

[80] Pompy Pompownie - czasopismo użytkowników pomp
[81] World Pumps - czasopismo użytkowników pomp
[82] Polska Norma PN-EN ISO 9906, „Pompy wirowe. Badania odbiorcze parametrów hydraulicznych. Klasy dokładności 1 i 2”.
[83] Polska Norma PN-EN 14343, „Obrotowe pompy wyporowe. Badania Parametrów odbiorczych”.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Pompy

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanics and machine construction

AND SPECIALIZATION **Thermo-power Engineering**

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01-W06	S1INC_W07	C1, C2,	W01…W10, W013,W15	N1, N4
PEK_W07-W08	S1INC_W07	C3,4	W011,W12	N1, N4
PEK_U01	S1INC_U08	C5	Ćw1,Cw2	N2, N3, N4
PEK_ U02-U03	S1INC_U08	C6	Ćw3,Cw4	N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Projektowanie samolotów**
Name in English	**Designing of airplanes**
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Engineering of Aviation**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN0900**
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	
For group of courses mark (X) final course					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes	0			2	
including number of ECTS points for direct teacher-student contact (BK) classes	1			1,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Aerodynamics

SUBJECT OBJECTIVES

C1 – Consolidate and extend the knowledge of aerodynamics
C2 – Present classifications of aircraft
C3 – Refer to the procedure of preliminary calculations of the proposed aircraft
C4 – Provide a methodology for calculating the necessary and disposable thrust
C5 – Refer students to the calculation of the masses and the calculation center of mass
C6 – Present initial calculation algorithms designed aircraft
C7 – Present the main purpose of aircraft assemblies, functions of systems and installations and aircraft equipment
C8 – Refer students to the characteristics of the aircraft stability and maneuverability
C9 – Explain the development of reliable methods for aircraft
C10 – Present affect the aircraft aerodynamic configuration to the aerodynamic characteristics

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Explain the procedure for aircraft design
PEK_W02 Define basic terms of aircraft aerodynamics
PEK_W03 Present a classification of aircraft
PEK_W04 Determine the technical requirements for planes
PEK_W05 Provide procedures for the calculation of aerodynamic aircraft
PEK_W06 Define the stability and controllability of the airplane
PEK_W07 Specify the functions of the aircraft systems
PEK_W08 Explain how to design reliability of plane
PEK_W09 Specify purpose of main parts of aircraft

relating to skills:

PEK_U01 Design aircraft airframe in terms of aerodynamics and choose the basic aircraft equipment

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Introduction to aircraft design process	2
Lec2	Aerodynamic characteristics of the aircraft	2
Lec3	Classification of flying ships	2
Lec4	Create technical requirements for aircraft	2
Lec5	Aircraft aerodynamic layout	2
Lec6	Initial calculations of aerodynamic	2
Lec7	Necessary and disposable thrust of aircraft	2
Lec8	Determining the aircraft component masses	2
Lec9	Determining the size of the plane geometry	2
Lec10	Calculation of the center of mass	2
Lec11	Stability and controllability of the airplane	2
Lec12	Systems of aircraft	2
Lec13	Shaping reliability in the design proce	2
Lec14	Shaping reliability in the design process	2
Lec15	Completion of the course	2
	Total hours	**30**
Form of classes - project		
Proj1	Introduction to aircraft design process	2
Proj2	Create technical requirements for aircraft	2
Proj3	Comparative Aircraft Structural Analysis	2
Proj4	The conclusions of the comparative structural analysis of aircraft	2
Proj5	The selection of the aircraft aerodynamic layout	2
Proj6	Rough draft of the designig aircraft	2
Proj7	Initial calculations of aerodynamic aircraft	2
Proj8	Calculation necessary and disposable thrust of aircraft	2
Proj9	Estimating the total weight of the airplane	2
Proj10	Specify the dimensions of the airframe components	2
Proj11	Estimating the masses of aircraft components	2
Proj12	Calculation of the center of mas	2
Proj13	Selection of equipment aircraft	2
Proj14	Rough draft plane	2
Proj15	Completion of the course	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture with multimedia N2. Classes – project: – teaching for the algorithms of design – presentation by students of current developments in the project – discussion of the solutions applied in the project N4. Office hours N5. Individual work: – development of the various stages of the project – preparation for the presentation of the results of the project – individual study – prepare students to final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W09	Final test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01	Implementation of the project, performance report, defense of project

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] Danilecki S.: Projektowanie samolotów. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000 [2] Raymer D.P.: Aircraft Design. A conceptual approach. Virginia Polytechnic Institute and State University, Blacksburg, Virginia 2006 [3] Brusow W.: Optymalne projektowanie wielozadaniowych statków latających. Biblioteka Instytutu Lotnictwa, Warszawa 1996 [4] Roskam J.: Aeroplan design. Part I ÷ VII. Lawrence, Kansas, USA 2005 SECONDARY LITERATURE: [1] Cichosz E., Trościenko S.: Poradnik do projektowania samolotów. Część I. Wojskowa Akademia Techniczna, Warszawa 1970 [2] Cichosz E., i inni.: Poradnik do projektowania samolotów. Część II. Wojskowa Akademia Techniczna, Warszawa 1971 [3] Sołtyk T.: Amatorskie projektowanie samolotów. Biblioteka Instytutu Lotnictwa, Warszawa 1995

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Designing of airplanes

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1ILO_W05	C3	Wy1	N1, N3, N4
PEK_W02		C1	Wy2	
PEK_W03		C2	Wy3	
PEK_W04		C3	Wy4	
PEK_W05		C3, C6	Wy6 ÷10	
PEK_W06		C8	Wy11	
PEK_W07		C7	Wy12	
PEK_W08		C9	Wy13 ÷14	
PEK_W09		C7	Wy1,3,5,13	
PEK_U01	S1ILO_U05	C1, C3, C5, C6, C7, C10	Pr 1 ÷ 14	N2, N3, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Reaktory jądrowe**
Name in English	Nuclear Reactors
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Power Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional/specialization**
Subject code	**MSN0931**
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		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes	0		1		
including number of ECTS points for direct teacher-student contact (BK) classes	0,5		0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of physics, thermodynamics.

SUBJECT OBJECTIVES

C1. Provides basic knowledge, taking into account aspects of its application, in the field of:
- C1.1. Nuclear physics and reactor theory.
- C1.2. Design, operation and safety principles of Generation II nuclear reactors.
- C1.3. Design and safety features of Generation III/III+ nuclear reactors.

C2. Develops the skills and practice to:
- C2.1. Use computer program for simulation of nuclear power plant operation.
- C2.2. Analyse and interpret operational parameters variation of nuclear power plant.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Should have a basic knowledge in the field of nuclear physics and reactor theory.

PEK_W02 Should be able to describe the history, evolution and basic classification of nuclear reactors.

PEK_W03 Should be able to discuss selected issues related to design, operation and safety principles of Generation II nuclear power plants. Should be familiar with their conception, thermal diagrams, operational parameters, core and fuel elements design, and unit power control principles.

PEK_W04 Should be able to describe major innovations in design and safety of

Generation III/III+ nuclear power plants.

relating to skills:

PEK_ Should have the skills and practical experience to use computer program for simulation of PWR nuclear power plant operation.

PEK_U02 Should have the ability to analyse and interpret operational characteristics of PWR and its response to perturbations and accident situations.

PROGRAMME CONTENT		
Form of classes – lecture		**Number of hours**
Lec 1, 2	The scope and course completion conditions. Selected issues in the field of nuclear physics and reactor theory.	4
Lec 3	History, evolution and classification of nuclear reactors.	2
Lec 4÷6	Generation II nuclear power plants – thermal-hydraulic characteristic and operational parameters. Reactor design and operation principles. Core and fuel elements design. Auxiliary and emergency safety systems.	6
Lec 7	Generation III/III+ nuclear power plants – general overview. Operational parameters. Major innovations in design. and safety.	2
Lec 8	Colloquium.	1
	Total hours	**15**

Form of classes - laboratory		**Number of hours**
Lab 1	Theoretical introduction to building and operating principles of computer program to simulate the operation of PWR nuclear power plant.	2
Lab 2	Basic exercises on the use of the PWR nuclear power plant simulator.	2
Lab 3, 4	Investigation and analysis of selected operational parameters variations during normal nuclear power plant operation in steady and unsteady states.	4
Lab 5÷7	Investigation and analysis of operational characteristics response to perturbations and accident situations.	6
Lab 8	Colloquium.	1
	Total hours	**15**

TEACHING TOOLS USED
N1 Multimedia presentation. N2 Exercises using the computer program for simulation of nuclear power plant operation, results discussion. N3 Consultations. N4 Student's own work – preparation for colloquium.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷ PEK_W04	Colloquium

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01÷ PEK_U02	Colloquium

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Kubowski J., Nowoczesne elektrownie jądrowe, WNT 2010 [2] Praca zbiorowa, Wszystko o energetyce jądrowej, AREVA, 2008 [3] Celiński Z., Energetyka jądrowa, PWN 1991 [4] Jezierski G., Energia jądrowa wczoraj i dziś, WNT 2005 **SECONDARY LITERATURE:** [1] Lech M., Elektrownie jądrowe, WPWr 1992 [2] Kierunki rozwoju elektrowni jądrowych, WPWr 1997 [3] Laudyn D., Pawlik M., Strzelczyk F., Elektrownie, WNT 2005

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Reaktory jądrowe
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1INC_W09	C1.1	Lec 1, 2	N1, N3, N4
PEK_W02		C1.2	Lec 3	
PEK_W03			Lec 4÷6	
PEK_W04		C1.3	Lec 7	
PEK_U01	S1INC_U10	C2.1	Lab 1, 2	N2, N3, N4
PEK_U02		C2.2	Lab 3÷7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Rysunek techniczny**
Name in English	Technical Drawing
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN0971**
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	
For group of courses mark (X) final course					
Number of ECTS points				3	
including number of ECTS points for practical (P) classes				3	
including number of ECTS points for direct teacher-student contact (BK) classes				2,25	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills of descriptive geometry

SUBJECT OBJECTIVES

C1 – Developing skills of creating working drawing and assembly drawing with respects of drawing standards
C2 – acquaintance students with diagrams

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – can use standardized technical drawing elements: drawing sheet size, dashed line, can make technical drawing in proper scale,
PEK_U02 – can draw orthogonal projections based on axonometric draw utilizing first and third angle projection method,
PEK_U03 – can mark cutting planes on main presentation of part, and then draw sections in those planes,
PEK_U04 – can draw axisymmetric part utilizing half view and half section,
PEK_U05 – can mark and draw local sections and removed sections, can draw partial sections, can draw rib section,
PEK_U06 – can dimension a part utilizing signs, can locate dimensions in proper place,
PEK_U07 – can dimension a part in parallel, serially or mixed method,
PEK_U08 – can dimension a part utilizing constructional base, treatment base and measurement base,
PEK_U09 – can mark tolerance surface on a part, can select proper shape and position tolerance, and describe them by symbolic and letter method,
PEK_U10 – can choose and mark surface treatment, the obtain method and surface roughness,
PEK_U11 – can choose and mark heat treatment,
PEK_U12 – can mark and dimension parts with tread (bolts and nuts), can draw screwed joint in section,
PEK_U13 – can mark and dimension welded joint utilizing reference line and proper signs,
PEK_U14 – can draw, dimension and describe part on a production drawing,
PEK_U15 – can draw, dimension and describe assembly drawing of valve,
PEK_U16 – can fold drawings to A4 drawing size, can arrange production and assembly drawings into device technical documentation
PEK_U17 - can draw diagram of mechanism and machine utilizing proper signs

PROGRAMME CONTENT

Form of classes - project		Number of hours
Proj1	Standardized technical drawing elements: drawing sheet size, types and application of lines, lettering, scales, title blocks. Orthogonal projections.	2
Proj2	Views, sections, local sections - location on drawing sheet and describing. Sections types: partial sections and views, local sections, sections of walls and ribs, sections of symmetric parts, sections of axisymmetric parts, parts breaking, removed views and sections.	6
Proj3	Dimensioning – dimensions, dimension lines, dimensioning by utilizing reference line, locating dimensions in proper place. General dimension rules, parallel, serially and mixed dimensioning method, dimensioning a part by utilizing constructional base, treatment base and measurement base, special dimensioning issues.	4
Proj4	Tolerance of dimension, shape and position of surface. Describing methods.	2
Proj5	Describing of surface roughness, surface treatment, lay, heat treatment.	2
Proj6	Joints drawing. Separable joints: screwed joints, groove joints, wedge joints, multigroove joints. Permanent joints: welded joints (kinds and describing methods), soldered joints, glue joints, rivet joints.	4
Proj7	Production drawing (general directives), sketch.	4
Proj8	Assembly drawing (general directives), dimensioning and special issues, draft assembly drawing,.	4
Proj9	Reading of assembly drawing, diagrams, changes in technical drawings, drawing archiving, other technical documentation preparing methods.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. project – short (15min) introduction, e-learning http://www.itcimp.pwr.wroc.pl/~rysunek_techniczny/ N2. project – individual conversation with student about his drawing, N3. project – short (10min) test, N4. project – own work, individually prepared technical drawing, N5. project - consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project*

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-U17	Tests
F2	PEK_U01-U17	Defence of prepared technical drawing
P=0,5F1+0,5F2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] Polskie Normy, Rysunek Techniczny, Rysunek Techniczny Maszynowy [2] Dobrzański T.: Rysunek techniczny maszynowy, WNT, 2009 [3] Rydzanicz L: Zapis konstrukcji. PWN. Warszawa 2000 [4] Chycińska B., „Poradnik Mechanika”, Rea, 2008 SECONDARY LITERATURE: [26] http://www.itcimp.pwr.wroc.pl/~rysunek_techniczny/

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

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_U01-U02	K1MBM_U07	C1	Pr1	N1÷N5
PEK_U03-U05			Pr2	
PEK_U06-U08			Pr3	
PEK_U09-U11			Pr4, Pr5	
PEK_U12-U13			Pr6	
PEK_U14			Pr7	
PEK_U15			Pr8	
PEK_U16			Pr9	
PEK_U17		C2	Pr9	N1, N4

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Siłownie cieplne**
Name in English	Thermal power stations
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**Optional-specialization**
Subject code	**MSN 1000**
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		
For group of courses mark (X) final course					
Number of ECTS points	2		1		
including number of ECTS points for practical (P) classes	0		1		
including number of ECTS points for direct teacher-student contact (BK) classes	1		0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of thermodynamics, fuel combustion, energetic boilers, heat engines.

SUBJECT OBJECTIVES

Provides basic knowledge, taking into account aspects of its application, in the field of::
C1. Classification and general characteristic of power and thermal-electric power stations.
C2. Design and operation of thermal power stations.
C3. Main building composition and site planning of the power station.
C4. Development of power and thermal-electric power stations in Poland.
C5. Develops the ability to analyze and solve selected issues related to thermal power stations.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – Should be able to classify and characterize thermal power stations.
PEK_W02 – Should be able to discuss the methods of thermal power stations efficiency improvement.
PEK_W03 – Should have the knowledge related to design and operation principles of primary and auxiliary devices at thermal power stations.
PEK_W04 – Should be able to discuss power station main building composition and explain site planning principles.
PEK_W05 – Should be able to describe fuel and water management at power station.
PEK_W06 – Should be able to characterize development power and thermal-electric power stations in Poland.

relating to skills:

PEK_U01 – Should have the ability to describe design and operation principles of primary and auxiliary devices at thermal power stations.
PEK_U02 – Should have the ability to analyze and solve selected issues related to thermal power stations.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	Classification and general characteristic of thermal power station.	2
Lec 2	Rankin cycle.	2
Lec 3	The methods of thermal power stations efficiency improvement.	2
Lec 4	Cost of produce electric energy and heat	2
Lec 5	Design and operation principles of regenerative heating systems.	2
Lec 6	Design and operation principles of feed water pumping and deaerating systems.	2
Lec 7	Process flow diagrams of combined heat and power station.	2
Lec 8	Process flow diagrams of thermal-electric power station.	2
Lec 9	Process flow diagrams of thermal power station.	2
Lec 10	Power station location.	2
Lec 11	General plan of power station.	2
Lec 12	Main building composition.	2
Lec 13	Fuel and water management at power station.	2
Lec 14	Selected issues of development power and thermal-electric power stations in Poland.	2
Lec 15	Colloquium.	2
	Total hours	**30**
Form of classes - laboratory		**Number of hours**
Lab 1	Basic information about Wrocław CHP plant, OHS instruction.	1
Lab 2	Fuel management at power station.	2
Lab 3	Ash management at power station.	2
Lab 4	Main devices in CHP	2
Lab 5	Auxiliary devices in CHP	2
Lab 6	Hot water boilers in CHP	2
Lab 7	Water management at power station.	2
Lab 8	Colloquium.	2
	Total hours	**15**

TEACHING TOOLS USED
N1. Lecture: – Multimedia presentation, – Student's own work – preparation for colloquium. N2. Laboratory: – Instructions for laboratory, – Student's own work – preparation for colloquium. N3. Consultations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W06	Colloquium

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01, PEK_U02	Colloquium

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [84] Pawlik M., Strzelczyk F., Elektrownie, WNT 2009 [85] Marecki J., Podstawy przemian energetycznych, WNT 2007 [86] Szymocha K., Zabokrzycki J., Elektrownie parowe, WPWr 1980 [87] Tatarek A., Siłownie cieplne, Raport ITCiMP PWr, Ser. PRE nr 1/2012 SECONDARY LITERATURE: [27] Andrzejewski S., Podstawy projektowania siłowni cieplnych, WNT 1974 [28] Kalinowski E., Termodynamika, WPWr 1994 [29] Kordylewski W. (pod red.), Spalanie i paliwa, OWPWr 2008 [30] Kruczek S., Kotły – konstrukcje i obliczenia, OWPWr 2001 [31] Nehrebecki L., Elektrownie cieplne, WNT 1974 [32] Sikorski W., Szymocha K., Urządzenia pomocnicze elektrowni parowych, WPWr 1981 [33] Szargut J., Ziębik A., Skojarzone wytwarzanie ciepła i elektryczności - elektrociepłownie, WPK JS, 2007

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Thermal power stations
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	S1INC_W13	C1	Lec 1	N1, N3
PEK_W02		C2	Lec 2	
PEK_W03		C2	Lec 4 ÷ Lec 9	
PEK_W04 PEK_W05		C3	Lec 10÷Lec 13	
PEK_W06		C4	Lec 14	
PEK_U01 PEK_U02	S1INC_U14	C5	Lab 2 ÷ Lab 7	N2, N3

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Solid Edge**
Name in English	Solid Edge
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional**
Subject code	**MSN1001**
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	crediting with grade	crediting with grade	crediting with grade	crediting with grade
For group of courses mark (X) final course					
Number of ECTS points			3		
including number of ECTS points for practical (P) classes			3		
including number of ECTS points for direct teacher-student contact (BK) classes			2,25		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge of issues related to creating of technical drawings
Computer literacy in MS Windows
Knowledge of Euclidian geometry and descriptive geometry
Acquaintance with basics of machine design

SUBJECT OBJECTIVES

C1 – Developing the ability to make use of Solid Edge to create solid models of mechanical parts, assemble them and produce technical drawings.
C2 – Developing the ability of designing 3D models of mechanical devices and documenting the design in form of technical drawings.

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – skills in creating and editing solid models
PEK_U02 – skills in creating and editing assemblies
PEK_U03 – skills in creating and editing technical drawings

PROGRAMME CONTENT

	Form of classes - laboratory	**Number of hours**
Lab1	Solid Edge overview, interface and operating rules.	2
Lab2	Sketching and using constrains (geometrical, dimension and algebraic)	2
Lab3	Introduction to part modeling	2

Lab4	Solid modeling using protrusion and cutout	2
Lab5	Solid modeling using revolved and helical protrusion and cutout	2
Lab6	Synchronous modeling – constructing base features	2
Lab7	Synchronous modeling – part modification	2
Lab8	Treatment features - holes, threads, thinning parts	2
Lab9	Copying and pattern features	2
Lab10	Introduction to assembly	2
Lab11	Assembly-based features	2
Lab12	Designing in the context of an assembly	2
Lab13	Creating drawings – drawing views of parts and assemblies	2
Lab14	Creating drawings – Dimensions, Annotations, and PMI	2
Lab15	Final assessment of student's work	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Introduction to classes using electronic presentation system N2. Individual work – preparation for classes, improvement for skills N3. Monitoring the progress of students/ revision activities N4. Final test N5. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷ PEK_U03	Revision during classes, oral explanations
F2	PEK_U01÷ PEK_U03	Final assessment of student's work
C = (F1+ 3 × F2)/4		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [88] Course guides (www.paliwa.pwr.wroc.pl) [89] Solid Edge textbooks and handbooks

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

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_U01	K1MBM_U07	C1,C2	Lab1 ÷ Lab9	N1, N2, N3, N4, N5
PEK_U02			Lab10 ÷ Lab12	
PEK_U03			Lab13 ÷ Lab14	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Spalanie i paliwa**
Name in English	Combustion and Fuels
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN1010**
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		30		
Form of crediting	Examination		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3		1		
including number of ECTS points for practical (P) classes	0		1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.5		0.75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge, skills and other competences in the range of: fundamentals of fluid mechanics, thermodynamics, chemistry and physics.

SUBJECT OBJECTIVES

C1 – Introduction into standard fuels used for transport and industry, mechanisms of their combustion and determination the stoichiometric combustion air and caloric effects of combustion.
C2 – Introduction into combustion patterns in standard engines and combustion chambers including emissions of selected pollutants and explosive hazards.
C3 – Skills practice by students of the use of gaseous, liquid and solid fuels and diagnostics of combustion standards.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

As a result of the performed classes a student should:

PEK_W01 – understand the physicochemical of combustion processes.
PEK_W02– to know the properties and uses of fossil fuels, alternative fuels and biofuels.
PEK_W03– understand the combustion mechanisms of gas, liquid and solid fuels.
PEK_W04– know the organization of combustion processes in engines and gas turbines.
PEK_W05– understand the mechanisms of major pollutants generation during combustion.
PEK_W06 – familiar with the operation and application of catalysts in combustion processes and in reducing pollutants emissions of these processes.
PEK_W07– to know the explosive characteristics of dusts and risk posed by them.
PEK_W08– know the basic methods of combustion processes diagnostic.

relating to skills:

As a result of the performed classes a student should be able:

PEK_U01 – to assess the type and nature of the flame.
PEK_U02 – to assess the stability of the flame.
PEK_U03 – to determine the quality of the fragmentation of liquid and solid fuels.
PEK_U04 – to determine air excess on the basis of measured flue gas content.
PEK_U05 – to determine the explosive parameters of fuels.
PEK_U06 – to use catalysts to reduce emissions from combustion processes.
PEK_U07 – to prepare reports from laboratory tests.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Introduction to combustion processes and gaseous fuels properties.	2
Lec2	Internal combustion engines' and heating liquid fuels.	2
Lec3	Coal, biomass and waste fuels.	2
Lec4	Stoichiometry and chemical kinetics.	2
Lec5	Thermochemistry of combustion.	2
Lec6	Flame aerodynamics and gas combustion.	2
Lec7	Combustion of liquid fuels and oil dispersion.	2
Lec8	Combustion and gasification of solid fuels.	2
Lec9	Spark ignition internal combustion engines.	2
Lec10	Diesel internal combustion engines.	2
Lec11	Gas turbine combustion.	2
Lec12	Generation of pollutant in combustion processes.	2
Lec13	Application of catalysts in combustion and flue gas cleaning.	2
Lec14	Explosibility of gases and dusts.	2
Lec15	Diagnostic of combustion processes.	2
	Total hours	**30**
Form of classes - laboratory		**Number of hours**
Lab1	Introduction. Gaseous flames structure.	2
Lab2	Combustion aerodynamic.	2
Lab3	Combustion of liquid fuels.	2
Lab4	Liquid fuels dispersion.	2
Lab5	Explosive properties of dusts.	2
Lab6	Catalytic reburning of CO and CH.	2
Lab7	Pyrolysis of solid fuels.	2
Lab8	Crediting	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Traditional lecture with the use of multi-media presentation. N2. Consultations. N3. Preparation of laboratory reports.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W08	Exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 ÷ PEK_U07	Laboratory reports
F2	PEK_U01 ÷ PEK_U06	Knowledge evaluation before lab exercises
F3	PEK_U01 ÷ PEK_U06	Activity
C=(2·F1+F2+F3)/4		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[90] „Spalanie i Paliwa" - skrypt, red. W. Kordylewski, Politechnika Wrocławska, Wrocław 2008
[91] „Techniki Czystego Spalania" J. Jarosiński, WNT, Warszawa, 1996
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SECONDARY LITERATURE:

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[39] „Ocena zagrożenia wybuchem" Woliński M., Ogrodnik G., Tomczuk J., SzGSP, Warszawa 2007
[40] „Spalanie i współspalanie biopaliw stałych", W. Rybak, Politechnika Wrocławska, Wrocław 2005.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Spalanie i paliwa

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W15	C1, C2	Lec1 - Lec5	N1, N2
PEK_W02			Lec2, Lec3	
PEK_W03			Lec6 - Lec8	
PEK_W04			Lec9 - Lec11	
PEK_W05			Lec12, Lec13	
PEK_W06			Lec13	
PEK_W07			Lec14	
PEK_W08			Lec15	
PEK_U01	K1MBM_U14	C3	Lab1	N2, N3
PEK_U02			Lab2	
PEK_U03			Lab3, Lab4	
PEK_U04			Lab3, Lab6	
PEK_U05			Lab5	
PEK_U06			Lab6	
PEK_U07			Lab1 - Lab7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Sprężarki i wentylatory**
Name in English	Fans and compressors
Main field of study	Mechanical Engineering and Machine Building
Specialization	Thermal Engineering
Level and form of studies	1st level, full-time
Kind of subject	optional-specialization
Subject code	MSN1030
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			
For group of courses mark (X) final course					
Number of ECTS points	1	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	0,5	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Basic knowledge of mechanics and strength of materials, fluid mechanics, thermodynamics and the basis of materials.

SUBJECT OBJECTIVES

C1 – to acquaint students with the analysis of the degree of work the compressor and fan
C2 – learn how to understand and interpret the concept of energy conversion in degrees compressors and fans
C3 – acquaint students with kinematics stage axial and radial diagonal
C4 – acquire the skill of determining the flow characteristics of the fan from running tests

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 has ordered knowledge of compressors and fans
PEK_W02 knows and has basic channels in degrees compressors and fans
PEK_W03 has the knowledge to explain the one-dimensional theory of the degree of axial and radial
PEK_W04 has the expertise to determine the work and efficiency of the compressor
PEK_W05 has the knowledge to prepare the flow characteristics of fans
PEK_W06 has knowledge of the ways of controlling fans and compressors.

relating to skills:

PEK_U01 calculate the work and efficiency of the compressor and fan
PEK_U02 compute the flow parameters in the control sections of the compressor step
PEK_U03 calculate the static pressure and the accumulation of static and total
PEK_U04 calculate and construct triangles fan speed for stage
PEK_U05 calculate and plot the distribution of pressure in the system with fan
PEK_U06 compute the flow parameters to determine the flow characteristics of the fan

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec1	Fans in the human environment, the basic thermodynamic equation compression, compression without refrigeration and cooling	2
Lec2	Energy conversion in the compressing axial and radial extent in terms of one-dimensional	2
Lec3	Structural elements flow axial and radial extent, determine the dimensionless ratios	2
Lec4	The share of the rotor in the compression process, the choice of outlet blade angle, velocity triangles at the inlet and outlet channel degree of axial and radial	2
Lec5	Kinematic systems with constant flow without turbulence Crete initial	1
Lec6	Dimensional characteristics, individual and universal – identify the work, the conversion characteristics of the contractual conditions	2
Lec7	Control systems of fans and compressors, serial and parallel cooperation of receiving devices	2
Lec8	The noise emitted by the fan, the possibility of its reduction, special fans – proof, hot gas, gas-tight	2
	Total hours	**15**
Form of classes - class		**Number of hours**
Cl 1	Determination of thermodynamic parameters without cooling the compressed medium	2
Cl 2	Determination of thermodynamic parameters of the compressed medium from an external cooling	2
Cl 3	Cooperation fans receiving devices	2
Cl 4	Determination of the relative and absolute increase in temperature and pressure during full braking	2
Cl 5	Calculation of the isentropic efficiency level and its elements	2
Cl 6	Determination of inlet and outlet velocity triangles	2
Cl 7	Solving equations using basic turbomachinery	2
Cl 8	The conversion characteristics of the contractual conditions and motor selection	1
	Total hours	**15**

TEACHING TOOLS USED

N1. Traditional lecture using transparency, multimedia presentation, board and chalk. Discussion of the problem.
N2. Tutorials and discuss solutions and results.
N3. Individual consultations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W06	Written test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U06	Replies verbal, active class participation
F2	PEK_U01÷PEK_U06	Accounting practice, colloquium
C=F2, F1 to influence the increase of the assessment.		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[1] Fortuna S., Wentylatory, Tachwent, Kraków 1999
[2] Kuczewski S., Wentylatory, WNT, Warszawa 1978
[3] Tuliszka E., Sprężarki, dmuchawy, wentylatory, WNT, Warszawa 1976
[4] Walczak J., Termodynamiczno–przepływowe podstawy procesów sprężania, Wydawnictwo Politechniki Poznańskiej, Poznań 2005
[5] Waniek E., Wyszyński R., Sprężarki i wentylatory, Politechnika Wrocławska, Wrocław 1982
[6] Witkowski A., Sprężarki wirnikowe: teoria, konstrukcja, eksploatacja, Wydawnictwo Politechniki Śląskiej, Gliwice 2004

SECONDARY LITERATURE:

[1] Perepeczko A., Okrętowe pompy, sprężarki i wentylatory, Wydawnictwo Morskie, Gdańsk 1976
[2] Cerkasskij V. M., Pumps fans compressors, MIR, Moscow 1985

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Sprężarki i wentylatory
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01 PEK_W02	S1INC_W07	C1	Lec1, Lec2	N1, N3
PEK_W03 PEK_W04 PEK_W05		C2, C3	Lec3, Lec4, Lec5	
PEK_W06		C4	Lec6, Lec7, Lec8	
PEK_U01 PEK_U02	S1INC_U08	C1	Cl1, Cl2	N2, N3
PEK_U03 PEK_U04 PEK_U05		C2, C3	Cl3, Cl4, Cl5	
PEK_U06		C4	Cl6, Cl7, Cl8	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish:	**Śmigłowce**
Name in English:	Helicopters
Main field of study:	Mechanical Engineering and Machine Building
Specialization:	Engineering of Aviation
Level and form of studies:	1nd level, full-time
Kind of subject:	Obligatory / Specialization
Subject code:	MSN0360
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				
For group of courses mark (X) final course					
Number of ECTS points	1				
Including number of ECTS points for practical (P) classes	0				
Including number of ECTS points for direct teacher-student contact (BK) classes	0,5				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of engineering and materials science.

SUBJECT OBJECTIVES

C1 - Introduction to classification and general characteristics of the helicopters.
C2 - Presentation of the design solutions, general construction and loads the airframe, main rotor and tail rotor helicopter.
C3 - Get to know the purpose, construction and operation of power units and power transmission systems helicopter.
C4 - Presentation of the effect of the position of the controls on the spatial position of a helicopter in flight.
C5 - Discover the purpose, construction and operation of the selected installation on board the helicopter.
C6 - Discover the latest developments helicopters.

SUBJECT EDUCATIONAL EFFECTS

KNOWLEDGE

Following the course, the student should be able to:

PEK_W01 - describe the general classification of helicopters and characterize the basic parameters of volatile
PEK_W02 - include the major components of the helicopter, to characterize the interactions that occur between them and explain how they work,
PEK_W03 - explain the principles of aerodynamic forces generated by the main rotor and tail rotor of the helicopter and define the basic parameters that characterize their work,

PEK_W04 - describe the construction and operation of power units selected power transmission systems and helicopters,
PEK_W05 - explain the rules controlling the spatial location of the helicopter in flight and replace the main components of control helicopter
PEK_W06 - explain the purpose, construction and operation of the selected installation on board the helicopter,
PEK_W07 - identify and characterize the main directions of development of helicopters.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Brief history of the development of helicopters and classification.	2
Lec 2	Helicopters construction and airframe load.	2
Lec 3	Main and tail rotor construction and load.	2
Lec 4	The drive unit and helicopter transmission systems.	2
Lec 5	Helicopter control systems.	2
Lec 6	Installations and airborne equipment.	2
Lec 7	Modern developments in helicopter construction.	2
Lec 8	Completion of the course.	1
	Total hours	**15**

TEACHING TOOLS USED

N1. Traditional lecture using multimedia presentations;
N2. Individual work – self – study and exam preparation.
N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation F – forming (during semester), C – summary (at semester end)	Number of training effect	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W07	Final test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[93] Sibilski K., Sobieraj W.: Ilustrowany leksykon lotniczy. Pionowzloty. WKŁ, Warszawa 1992.
[94] Szabelski K. i in.: Wstęp do konstrukcji śmigłowców. WKŁ, Warszawa, 2002.
[95] Witkowski R.: Budowa i pilotaż śmigłowców. WKŁ, Warszawa 1986.
[96] Witkowski R.: Wprowadzenie do wiedzy o śmigłowcach. Wydawnictwa Naukowe IL. 1998.

SECONDARY LITERATURE:

[41] Bratuchin J. P.: Projektowanie i konstrukcja śmigłowców. WNT, Warszawa 1958.
[42] Korzeniowski A.: Mechanika lotu śmigłowców. WAT, Warszawa 2010.
[43] Seddon J.: Basic Helicopter Aerodynamics. BSP Professional Books, Oxford 1990.
[44] Stępniewski W. Z.: Ciche wiropłaty. Wydawnictwa Naukowe IL, Warszawa 1999.
[45] Witkowski R., Wojciechowski J., Elsztein P.: Śmigłowce. Wydawnictwa Komunikacyjne, Warszawa 1958.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Śmigłowce
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1ILO_W14	C1	Lec 1	N1, N2, N3
PEK_W02		C2	Lec 2	
PEK_W03			Lec 3	
PEK_W04		C3	Lec 4	
PEK_W05		C4	Lec 5	
PEK_W06		C5	Lec 6	
PEK_W07		C6	Lec 7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Techniczna mechanika płynów**
Name in English	Technical Fluid Mechanics
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN1070**
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	30			
Form of crediting	Examination	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	3	1			
including number of ECTS points for practical (P) classes		1			
including number of ECTS points for direct teacher-student contact (BK) classes	1,5	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1 .Skills in mathematics and physics.
2. Knowledge of issues concerning the modeling of ideal fluid.

SUBJECT OBJECTIVES

C1 Transfer basic knowledge of modeling viscous flow
- C1.1. To familiarize students with the phenomena and physical processes occurring at a flow of viscous fluid.
- C1.2. To familiarize students with the basic equations and modeling viscous flow.
- C1.3. Detailed preparation of students for design and calculation of selected hydraulic systems and the plotting of energy-line distribution.
- C1.4. To familiarize students with the most common components of hydraulic systems and measuring instruments and methods used in the technology.

C2 Formation of the skills to perform hydraulic calculations for viscous fluid,
- C2.1. The calculation of simple and complex hydraulic systems.
- C2.2. Plotting of the energy distribution in the hydraulic system.
- C2.3. Determination of basic hydraulic systems.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge: have a basic knowledge of modeling viscous fluid

PEK_W01 - knows the basic phenomena occurring in the flow of viscous fluid and equations and definitions used for the modeling.

PEK_W02 - know the basic methods for solving some hydraulic systems.

PEK_W03 - knows the rules for drawing up the energy distribution of the hydraulic system.

PEK_W04 - can describe the most common methods of measurement and hydraulic components

relating to skills: can apply the learned models and methods for solving engineering of viscous flow

PEK_U01 - can calculate the losses hydraulic systems.

PEK_U02 - can draw the energy distribution of the hydraulic system.

PEK_U03 - can solve with a variety of methods simple and complex hydraulic systems.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Basic terms of fluid mechanics.	2
Lec2	Generalized Bernoulli equation	2
Lec3	The problem of the flow between the tanks	2
Lec4	Ancona graph.	2
Lec5	The problem the flow between the three tank. The regulation of three tanks.	2
Lec6	Calculations of the series-parallel hydraulic systems	2
Lec7	The flow through the porous layers. Filtration.	2
Lec8	Dimensional analysis and similarity phenomena.	2
Lec9	Flow in opened channels.	2
Lec10	Methods for measuring velocities, volume flow and mass flow in fluids.	2
Lec11	Pumps and pumping systems.	2
Lec12	The phenomenon of cavitation.	2
Lec13	Two-phase flows.	2
Lec14	Summary of material examining issues	2
Lec15	Written exam - the term zero	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	General principles for solving hydraulic systems with viscous fluid. Calculation of hydraulic losses. Rules for writing and solving the Bernoulli equation.	2
Cl 2	Analytical and graphical methods to solve problems the flow between two tanks.	2
Cl 3	Plotting Ancona graph for the serial hydraulic system. Interpretation of Ancona graph.	2
Cl 4	The method of solving the flow problems between the three tanks. The regulation of three tanks.	2
Cl 5	Analytical and graphical method for solving series-parallel hydraulic systems.	2
Cl 6	Complex hydraulic systems - summary.	2
Cl 7	Final test	3
	Total hours	**15**

TEACHING TOOLS USED

N1. Traditional lectures using multimedia presentation containing the basic knowledge and examples of its application.

N2. Classes - discussion of the tasks.

N3. Classes - short skill tests.

N4. Tutorials - final test. N5. Consultation. N6. Students work to preparing for classes. N7. Students work to preparing for exam.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W04	Written exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U03	Short written test
F2		Final test
C = max{F1, F2}, F1 – points for short tests		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[5] Jeżowiecka-Kabsch K., Szewczyk H., Mechanika płynów, Wydawnictwo Politechniki, Wrocławskiej, Wrocław 2001.

[6] Bechtold Z.(red.), Mechanika płynów. Zbiór zadań, Wydawnictwo Politechniki Wrocławskiej, Wrocław 1993.

[7] Burka E.S., Nałęcz T.J., Mechanika płynów w przykładach , PWN, Warszawa, 1994

SECONDARY LITERATURE:

[97] Orzechowski Z., Prywer J., Zarzycki R., Mechanika płynów w inżynierii środowiska, Wydawnictwo Naukowo-Techniczne, Warszawa 1997

[98] Ratajczak R., Zwoliński W., Zbiór zadań z hydromechaniki, PWN, Warszawa, 1981

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Techniczna mechanika płynów
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	S1INC_W03	C1.1, C1.2	Lec1, Lec2	N1, N5, N7
PEK_W02		C1.3	Lec3, Lec5, Lec6	
PEK_W03		C1.3	Lec4	
PEK_W04		C1.4	Lec7÷Lec14	
PEK_U01	S1INC_U03	C2.3	Cl1, Cl2	N2,N3,N4,N5,N6
PEK_U02		C2.2	Cl4	
PEK_U03		C2.1	Cl3, Cl5, Cl6	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Techniki wytwarzania**
Name in English	Production Technics
Main field of study	**Mechanical Engineering and Machine Building**
Level and form of studies	**1st level, full-time**
Kind of subject	**obligatory**
Subject code	**MSN 1100W, MSN1080 L**
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)	90		60		
Form of crediting	crediting with grade		crediting with grade		
For group of courses mark (X) final course					
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	1,5		1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge, skills courses: technical drawing, materials science

SUBJECT OBJECTIVES

C1 –Introduction to the design and construction of the foundry and welding instruments.
C2 – Provide a method of metal forming and plastic thermoforming plastics
C3 - Explanation of the methodology for removing the machining allowance in different ways machining of .
C4 – Skills improvement regarding capacity of foundry process, metal forming, welding techniques and lossless working.
C5 - Development of skills in analyzing the results to optimize processes conducted
C6 - Improving skills in specialized programs used in manufacturing techniques

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - explain the methodology of molds, cores production as well as casting methods and their cleaning.
PEK_W02 – explain using of the welding techniques in materials joining
PEK_W03 - discuss the conditions for obtaining metals plasticity to their plastic forming,
PEK_W04 – provide a influence of temperature in thermoforming plastics
PEK_W05 – identify the tools and parameters to be used in the machining

relating to skills:

PEK_U01 apply learned method for molds, cores production and cleaning processes
PEK_U02 rate of joint kind, welds and welding techniques
PEK_U03 identify methods of treating and technological parameters in order to metal plastic flow
PEK_U04 - to illustrate the possibilities of thermoforming plastics
PEK_U05 - perform calculations cutting speeds for machining ubytkowych.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Fundamentals of casting design and production.	3
Lec2	Materials for casting production.	3
Lec3	Manufacturing of mold and cores, foundry furnaces, cleaning of casting.	3
Lec4	Base issues regarding metal joining process	3
Lec5	Specification of joints and welds	3
Lec6	Gas (torch) welding, electrical welding, plasma-arc welding	3
Lec7	Physics and mechanism of plastic deformation	3
Lec8	Machines and tools used in metal forming metals	3
Lec9	Technologies rolling, extrusion, drawing and forging	3
Lec10	Technology injection and thermoforming of plastics technology.	3
Lec11	Methods for machining of metallic and non-metallic materials.	3
Lec12	Features rolling phenomena, tools and machines.	3
Lec13	Development of a method for milling materials, types of cutters and milling machines	3
Lec14	Abrasive Machining spojonymi tools, grinding off machines and conveyors.	3
Lec15	Finishing materials, lapping, honing, polishing and EDM metals.	3
	Total hours	**45**
Form of classes - laboratory		**Number of hours**
Lab1	Construction of patterns, core boxes. Sand molding materials.	2
Lab2	Green sand casting.	2
Lab3	Permanent mold casting.	2
Lab4	Forming bulk materials.	2
Lab5	Sheet metal forming processes.	2
Lab6	Limiting phenomena of metal forming processes.	2
Lab7	Gas welding of steel. Brazing and soldering	2
Lab8	Arc welding flux coated welding, TIG welding, MAG welding, hidden arc welding	2
Lab9	Electric resistance welding, friction welding	2
Lab10	Injection molding of polymers.	2
Lab11	Opportunities to develop methods of surface machining is.	2
Lab12	Methods of execution threads and spur gear.	2
Lab13	Opportunities to shape the surface of the abrasive machining methods.	2
Lab14	Formation of surface drill-down capabilities elektroerozyjnym.	2

Lab15	Tool materials. Examination	2
	Total hours	**30**

TEACHING TOOLS USED
N1 Traditional lecture-lecture using multimedia presentation - individual work, self-study and preparation for credit. N2. Lab-work self - preparation for the lab - short written tests real-observation techniques production processes. N3 Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01÷PEK_W03	Test
F2	PEK_W04, PEK_W05	Test
P=(F1+F2)/2		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1, F2 ... F15	PEK_U01 ÷ PEK_U05	Quiz, entrance ticket, oral answer
P=(F1+F2+F3+...+F15)/15		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[8] Lewandowski J.L., Maszyny formierskie i rdzeniowe. PWN, Warszawa 1991.
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[14] Erbel S. Kuczyński K. Marciniak Z., Obróbka plastyczna. WNT, Warszawa 1981.
[15] Cichosz P. (red.), Techniki wytwarzania - obróbka ubytkowa. Laboratorium, Oficyna Wyd. PWr. Wrocław 2002.
[16] Żebrowski H. (red.), Techniki wytwarzania – obróbka wiórowa, ścierna, erozyjna. Oficyna Wyd. PWr., Wrocław 2004.

SECONDARY LITERATURE:

[99] Tabor A., Rączka J.S., Odlewnictwo. Wyd. Fotobit, Kraków 1996.
[100] Piwowarczyk J. (red.), Poradnik inżyniera. Spawalnictwo. T1 i T2, WNT, Warszawa 2005
[101] Gronostajski J. i inni., Laboratorium z obróbki plastycznej metali. Wyd. Polit. Wrocławskiej, Wrocław 1973.
[102] Koch J., Systemy wytwarzania. Skrypt PWr., Wrocław 1997.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W11	C1	Lec1-Lec3	N1,N3
PEK_W02		C1	Lec4-Lec6	
PEK_W03		C2	Lec7-Lec9	
PEK_W04		C2	Lec10	
PEK_W05		C3	Lec11-Lec15	
PEK_U01	K1MBM_U11	C4	Lab1-Lab3	N2, N3
PEK_U02		C4	Lab7-Lab9	
PEK_U03		C4	Lab4-Lab6	
PEK_U04		C5	Lab10	
PEK_U05		C4, C6	Lab11-Lab15	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Technologia produkcji i remontu**
Name in English	Technology of development and repair
Main field of study	Mechanical Engineering and Machine Building
Specialization	Engineering of Aviation
Level and form of studies	1nd level, full-time
Kind of subject	Optional/specialization
Subject code	MSN 1131
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		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes	0		0		
including number of ECTS points for direct teacher-student contact (BK) classes	0,5		0,75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of aircraft design, avionics and control of aircraft and the aircraft equipment.

SUBJECT OBJECTIVES

C1 – Familiar with the methods of mapping the airframe geometry.
C2 – Presentation of metal sheet treatment by extension and spinning.
C3 – Presentation of shaping the elements of aircraft structures using high-pressure energy.
C4 – Introduction to the methods of preparation of integral construction and the methods of fabrication of composite airframe.
C5 – Get to know the technological processes of airframe assembly.
C6 – Development of the ability to assess the technical components of the aircraft.
C7 – Skills development of diagnostic tasks independently and as a team.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

following the course, the student should be able to:
PEK_W01 – discuss methods of airframe mapping for production purposes.
PEK_W02 – describe methods of metal sheet treatment by extension and spinning.
PEK_W03 – illustrate methods of components forming by high pressure energy.
PEK_W04 – describe the producing methods of aerial integral structure.
PEK_W05 – discuss the production of airframe components made of composite materials.
PEK_W06 – describe the airframe assembly processes.
PEK_W07 – describe ways to connect components by riveting.
PEK_W08 – explain the course of typical technological processes involved in the production of airframe.

relating to skills:

following the course, the student should be able to:
PEK_U01 – conduct a review of airframe structural components.
PEK_U02 – assess the performance of the selected parts.
PEK_U03 – verify joints of riveted components.
PEK_U04 – check the condition of the structural components made of magnesium alloy.
PEK_U05 - assess the performance of parts made of composites.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Methods of mapping the airframe geometry.	2
Lec2	Metal sheet extension and spinning.	2
Lec3	Shaping the elements using high-pressure energy.	2
Lec4	Preparation of integral construction.	2
Lec5	Preparation of airframe components made of composite materials.	2
Lec6	Technological processes of airframe assembly.	2
Lec7	Riveting.	2
Lec8	Final test.	1
	Total hours	**15**

Form of classes - laboratory		Number of hours
Lab1	Check the condition of the airframe coverage.	2
Lab2	Evaluation of technical condition of the inlet and the first stage of engine compressor.	2
Lab3	Evaluation of technical condition of helicopter rotor.	2
Lab4	Verification of components of the aircraft landing gear.	3
Lab5	Verification of riveted joints of airframe coverage.	2
Lab6	Checking the technical parts made of magnesium alloy.	2
Lab7	Checking the technical parts made of composite materials.	2
	Total hours	**15**

TEACHING TOOLS USED

N1. Lecture:
- traditional lecture using multimedia presentation,
- individual work - self-study and preparation to pass the course.

N2. Laboratory:
- individual work - analysis of the technical documentation for aircraft maintenance,
- laboratory exercises,
- report on conducted exercises.

N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT - lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W 08	Written and oral test.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT - laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01; PEK_U02	Short written tests, laboratory exercises and reports.
F2	PEK_U01; PEK_U02	Short written tests, laboratory exercises and reports.
F3	PEK_U01; PEK_U02	Short written tests, laboratory exercises and reports.
F4	PEK_U01; PEK_U02	Short written tests, laboratory exercises and reports.
F5	PEK_U01; PEK_U02; PEK_U03	Short written tests, laboratory exercises and reports.
F6	PEK_U01; PEK_U02; PEK_U04	Short written tests, laboratory exercises and reports.
F7	PEK_U01; PEK_U02; PEK_U05	Short written tests, laboratory exercises and reports.
C=(F1+F2+F3+F4+F5+F6+F7)/7		Assessment condition is that all forming evaluations are positive.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[1] Feld M.: Technologia budowy maszyn. PWN, Warszawa 1995.
[2] Godzimirski J.: Technologia produkcji płatowców. Wydział Wydawniczy WAT, Warszawa 2000.

SECONDARY LITERATURE:

[1] Bieżący i średni remont sprzętu lotniczego. DWL, Poznań 1990.
[2] Szaniawski K., Tkaczyk Z.: Technologia samolotu. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 1977.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technologia produkcji i remontu
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1ILO_W13	C1	Lec1	N1; N3
PEK_W02		C2	Lec2	
PEK_W03		C3	Lec3	
PEK_W04		C4	Lec4	
PEK_W05		C4	Lec5	
PEK_W06		C5	Lec6	
PEK_W07		C5	Lec7	
PEK_W08		C5	Lec8	
PEK_U01	S1ILO_U16	C6	Lab1; Lab2; Lab3; Lab4; Lab5; Lab6; Lab7	N2; N3
PEK_U02		C7	Lab2; Lab3; Lab4; Lab5; Lab6; Lab7	
PEK_U03		C7	Lab5	
PEK_U04		C7	Lab6	
PEK_U05		C7	Lab7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Teoria maszyn cieplnych**
Name in English	Theory of Thermal Machines
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN 1170**
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	Exam	crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	2	2			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1	1,5			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

The basic knowledge and skills in physics and mathematics

The basic knowledge and skills in thermodynamics

SUBJECT OBJECTIVES

C1 – to pass on the basic knowledge and develop skills in analysis of the gas compression processes
C2 – to pass the knowledge as to ideal power cycles and acquire the thermodynamic rules for the thermal efficiency calculation
C3 – to pass the knowledge and to acquire skills in respect of calculating the gas engines as well as gas turbines
C4 – to pass the knowledge and to acquire skills in respect of calculating both the refrigeration devices and heat pumps
C5 – transfer the basic knowledge as to gas condensation processes
C6 – develop skills in calculating the moisture-air processes
C7 – develop skills in stoichiometric calculations in respect of burning fuels processes
C8 – develop skills in calculating gas flow processes in nozzles and diffusers

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 know the theory of the selected heat machines
PEK_W02 have the knowledge as to gas compression processes
PEK_W03 be acquainted with the ideal power cycles and know how to improve the thermal efficiency for power plants
PEK_W04 know and can explain the ideal gas cycles in heat engines as well as gas turbines
PEK_W05 know the knowledge as to decrease temperature processes using the refrigeration systems as well as heating processes using heat pump systems
PEK_W06 have the basic knowledge as to condensation processes

relating to skills:

PEK_U01 can make energy as well as mass balance analysis for moisture-air systems
PEK_U02 have skills in stoichiometric calculation for gas, liquid, and solid fuels combustion processes
PEK_U03 can make calculations for gas flow processes in subsonic as well as supersonic nozzles
PEK_U04 have skills in calculation for gas reciprocating compressors
PEK_U05 have skills in calculation the thermal efficiency for the following ideal cycles: steam-power, internal-combustion engine, and gas-turbine

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Introduction to the theory of the heat machines.	1
Lec2	Thermodynamic analysis for the gas compression processes.	2
Lec3	Steam power plants.	2
Lec4	Methods for increasing the thermal efficiency of the steam power cycles.	2
Lec5	Internal combustion engines.	2
Lec6	Gas turbine engines.	2
Lec7	Refrigerators and heat pumps.	2
Lec8	Thermodynamic analysis for condensation processes.	2
	Total hours	**15**
Form of classes - class		**Number of hours**
Cl1	Organizational affairs Moisture-air processes.	2
Cl2	Moisture-air processes.	2
Cl3	Moisture-air processes.	2
Cl4	Combustion processes.	2
Cl5	Combustion processes.	2
Cl6	Gas flow processes.	2
Cl7	Gas flow processes.	2
Cl8	Computational test.	2
Cl9	Gas compression processes.	2
Cl10	Steam power cycles.	2
Cl11	Steam power cycles.	2
Cl12	Steam power cycles.	2
Cl13	Internal combustion engines	2
Cl14	Gas turbine engines	2
Cl15	Computational test.	2
	Total hours	**30**

TEACHING TOOLS USED

N1. Traditional lecture.
N2. Computational classes.
N3. Consultations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W06	Exam

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01÷PEK_U03	Computational test
F2	PEK_W04÷PEK_U05	Computational test
C=(F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[17] Kalinowski E.: Termodynamika. Politechnika Wrocławska, Wrocław 1994
[18] Szargut J., Termodynamika Techniczna, WPŚl., Gliwice 2005
[19] Wiśniewski S., Termodynamika Techniczna wyd. II i dalsze, WNT, Warszawa 1987 i dalej

SECONDARY LITERATURE:

[46] Wark W., Richards D., Thermodynamics, McGraw-Hill, Sixth Edition, Boston 1999.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Teoria maszyn cieplnych
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	**Correlation between subject educational effect and educational effects defined for main field of study/ specialization**	**Subject objectives**	**Programme content**	**Teaching tool number**
PEK_W01	S1INC_W02	C1-C4	Lec1-Lec8	N1, N3
PEK_W02		C1	Lec2	
PEK_W03		C2	Lec3, Lec4	
PEK_W04		C3	Lec5, Lec6	
PEK_W05		C4	Lec7	
PEK_W06		C5	Lec8	
PEK_U01	S1INC_U02	C6	Cl1-Cl3, Cl8	N2, N3
PEK_U02		C7	Cl4, Cl5, Cl8	
PEK_U03		C8	Cl6-Cl8	
PEK_U04		C1	Cl9	
PEK_U05		C2, C3	Cl10-Cl15	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Termodynamika – lab.**
Name in English	Thermodynamics – Lab.
Main field of study	Mechanical Engineering and Machine Building
Specialization	Thermal Engineering
Level and form of studies	1st level, full-time
Kind of subject	optional-specialization
Subject code	MSN1210
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		
For group of courses mark (X) final course					
Number of ECTS points			2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes			1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge of thermodynamic processes.

SUBJECT OBJECTIVES

C1 Training of the practical application measuring apparatus of thermodynamic values in research of thermal processes.

C2 Training skills to recognize the phenomena of energy processes.

SUBJECT EDUCATIONAL EFFECTS

relating to skills:

PEK_U01 – skill to calculated and plotted determine relative humidity dependency on temperature

PEK_U02 – ability to describe the pressure dependence of the temperature for the water saturation line

PEK_U03 – ability to able to determine the specific volumes of solutions and partial volumes of the components

PEK_U04 – ability to explain the dependence of pressure of medium flow through the nozzle

PEK_U05 – ability to able to determine the heat of melting of ice and ice specific heat and designate a specific volume of ice

PEK_U06 – ability to able to determine the heat capacity of the solid and liquid

PEK_U07 – ability to explain the effect of the finned surface on heat transfer process

PEK_U08 – ability to able to assess the impact of the heat transfer coefficient on the process of

heat transfer through a flat barrier
PEK_U09 – ability to explain the effect of boundary conditions on the heat transfer process through the rod and set the temperature distribution in it
PEK_U10 – ability to able to determine the heat transfer coefficient for forced convection during the heating and cooling
PEK_U11 – ability to able to determine the heat output of the solar collector and can consciously choose the best location for mounting the collector
PEK_U12 – ability to explain the differences in co-current and counter-current flow in the heat exchanger, given the differences in the heat transfer surfaces and achieved temperatures
relating to social competences:
PEK_K01 – knowledge the rules of safety and health at the workplace

PROGRAMME CONTENT

Form of classes - laboratory		**Number of hours**
Lab1	Introduction - health and safety regulations, the division of the group	2
Lab2	Exercise 5: Elementary experience with humid air	2
Lab3	Exercise 6: Determination of water saturation line	2
Lab4	Exercise 10: Determination of the specific volume of the solution and the partial specific volumes of components	2
Lab5	Exercise 12: Testing adiabatic nozzle outflow in $\beta = (0-1)$	2
Lab6	Exercise 20/21: Determination of specific heat and specific volume of ice H_2O	2
Lab7	Exercise 30a: Determination of the heat of combustion and calorific value of natural gas by calorimetric method and calculation for the composition of the gas	2
Lab8	Exercise 14: Experimental investigation of finned surface	2
Lab9	Exercise 16: Study of heat transfer through the flat barrier	2
Lab10	Exercise 17: Determination of the temperature distribution in the rod	2
Lab11	Exercise 18: Determination of the heat transfer coefficient for forced convection	2
Lab12	Exercise 32: The study of heat transfer phenomena in a flat liquid solar collector	2
Lab13	Exercise 33: Study co-current and counter-current heat exchanger	2
Lab14	Additional meeting	2
Lab15	Additional meeting	2
	Total hours	30

TEACHING TOOLS USED

N1. laboratory short 10 min. written tests
N2. laboratory – discuss the principles of experimental set-up
N3. laboratory – measurements
N4. own work - preparation before exercises
N5. preparing a report of performed measurements
N6. consultation hours

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C–	Educational effect	Way of evaluating educational effect achievement

concluding (at semester end)	number	
F1	PEK_U01	Laboratory reports
F2	PEK_U02	Laboratory reports
F3	PEK_U03	Laboratory reports
F4	PEK_U04	Laboratory reports
F5	PEK_U05	Laboratory reports
F6	PEK_U06	Laboratory reports
F7	PEK_U07	Laboratory reports
F8	PEK_U08	Laboratory reports
F9	PEK_U09	Laboratory reports
F10	PEK_U10	Laboratory reports
F11	PEK_U11	Laboratory reports
F12	PEK_U12	Laboratory reports
C=(F1+F2+F3+F4+F5+F6+F7+F8+F9+F10+F11+F12)/12		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[20] *Instrukcje laboratoryjne*
[21] *Kostowski E.: Przepływ ciepła. Politechnika Śląska, Gliwice 2000*
[22] *Wiśniewski St.: Termodynamika techniczna, WNT, Warszawa, 1993*
[23] *Szargut J.: – Termodynamika techniczna, PWN, Warszawa 1991*
[24] *Kalinowski E.: Termodynamika techniczna, Politechnika Wrocławska, Wrocław 1994*

SECONDARY LITERATURE:

[103] *Wiśniewski St., Wiśniewski T.: Wymiana ciepła, WNT, Warszawa 1999*
[104] *Madejski J.: Teoria wymiany ciepła. Politechnika Szczecińska, Szczecin 1998*

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **Termodynamika – lab.** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Mechanika i Budowa Maszyn** AND SPECIALIZATION Inżynieria cieplna

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_U01	K1MBM_U10	C1, C2	Lab2	N1÷N6
PEK_U02		C1, C2	Lab3	
PEK_U03		C1, C2	Lab4	
PEK_U04		C1, C2	Lab5	
PEK_U05		C1, C2	Lab6	
PEK_U06		C1, C2	Lab7	
PEK_U07		C1, C2	Lab8	
PEK_U08		C1, C2	Lab9	
PEK_U09		C1, C2	Lab10	
PEK_U10		C1, C2	Lab11	
PEK_U11		C1, C2	Lab12	
PEK_U12		C1, C2	Lab13	
PEK_K01	K1MBM_K03	C1	Lab1	N2

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Tłokowe silniki lotnicze**
Name in English	**Aero-piston engines**
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Engineering of Aviation**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN1250**
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	30			
Form of crediting	Examination	Crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	3	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1,5	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of thermodynamics, theory of aircraft propulsion, combustion and fuels

SUBJECT OBJECTIVES

C1 – Introduction to classification, general characteristics and performance of the aircraft piston engines.
C2 – Familiarize students with the problems of the producing flammable mixtures in piston engines and with differences in work between supercharged and naturally aspirated engines.
C3 – Introduction of a simplified method of determining the parameters of the working medium in the nodal points of a piston engine cycle.
C4 – To acquaint students with issues concerning the kinematics and dynamics of the crank–piston system and with balancing of the piston engines.
C5 – Discover the purpose, construction and operation of the piston engines systems.
C6 – Develop of the ability to set the basic parameters of the operation and performance of piston engines.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

As a result of the performed classes a student should be able:

PEK_W01 – to describe the general classification of piston engines and their basic performance,

PEK_W02 – to explain the basic concepts associated with the production of the air-fuel mixture and with the supercharging of piston engines,

PEK_W03 – to explain the operation of the four-stroke piston engine with spark ignition and characterize the sequences of each strokes,

PEK_W04 – to distinguish the indicated and effective parameters and specify the relationship between them,

PEK_W05 – to describe the main work characteristics of air piston engines work: the external, propeller, loading, general and altitude performance of an engine

PEK_W06 – to present the effect of the geometric parameters of the crank-piston on the kinematics and dynamics of sliding and rotating masses,

PEK_W07 – to explain the purpose and methods of piston engines balancing, describe the phenomenon of crankshaft torsional vibration and the possibility of its limiting,

PEK_W08 – to explain construction and operation of the engines systems.

relating to skills:

As a result of the performed classes a student should be able:

PEK_U01 – to perform the basic calculations of parameters of the working medium in the nodal points of the cycle of the naturally aspirated piston engine and the supercharged engine, and interpret the obtained results,

PEK_U02 – to estimate the loads in the crank-piston system, specify the balancing parameters and analyze its structure due to vibration,

PEK_U03 – to choose the values of the coefficients required to perform the calculations.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Characteristics of aero-piston engines.	2
Lec2	Air-fuel mixture and supercharging.	2
Lec3	Ideal and real cycle of a piston engine	2
Lec4	Filling of the cylinder and compression of the mixture	2
Lec5	Combustion of the mixture, expansion and exhaust	2
Lec6	Indicated and effective parameters	2
Lec7	Characteristics of aero-piston engines	2
Lec8	Kinematics of piston motion	2
Lec9	Loads in the crank-piston system	2
Lec10	Balancing of in-line and radial engines	2
Lec11	Torsional vibration of the crankshafts	2
Lec12	Resonance and the mufflers of vibration of the crankshafts.	2
Lec13	Engines fuelling and electric ignition of the mixture	2
Lec14	Lubrication system and its basic elements.	2
Lec15	Engine cooling and fire protection	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Solving of problems relating to thermodynamic cycle of a piston spark-ignition engine and combustion of air-fuel mixtures.	2
Cl 2	Determination of the work of cycle on the basic of indicator diagram and calculation of parameters of the working medium during the filling of the cylinder and the compression stroke.	2
Cl 3	Calculation of the parameters of the working medium during the power stroke and	2

	the exhaust stroke.	
Cl 4	Solving problems relating to relationship between the indicated and effective parameters.	2
Cl 5	Determination of kinematic parameters of convergent-axial crank-piston system.	2
Cl 6	Determination of loads in the crank-piston system and balancer mass of in-line and radial engines.	2
Cl 7	Determination of the natural frequency and forcing frequency vibration of crankshafts.	2
Cl 8	Final test.	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Lecture: – Traditional lecture with the use of multi-media presentation. – self-studies and preparation for the final test N2. Class: – computational problems; – the analysis of results; – short written tests; – individual work - preparation for classes. N3. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W08	Examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02	Activity, short tests
F2	PEK_U01÷PEK_U03	Final test
C=(2·F2+F1)/3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[105] Borodzik F.: Budowa silnika. WKŁ, Warszawa 1973.
[106] Cichosz E. i inni: Charakterystyka i zastosowanie napędów. WKŁ, Warszawa 1980.
[107] Dzierżanowski P. i inni: Silniki tłokowe. WKŁ, Warszawa 1981.
[108] Jeż M.: Silniki spalinowe: zasady działania i zastosowania. Wydawnictwa Naukowe Instytutu Lotnictwa, Warszawa 2003.
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SECONDARY LITERATURE:

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[48] Jędrzejowski J.: Obliczanie tłokowego silnika spalinowego. WNT, Warszawa 1988.
[49] Jeż M.: Dynamika silnika tłokowego: zagadnienia wybrane. Wydawnictwa Naukowe Instytutu Lotnictwa, Warszawa 2003.
[50] Niewiarowski K.: Tłokowe silniki spalinowe, T.1, T.2. WKŁ, Warszawa 1983.
[51] Wajand J.A., Wajand J.T.: Tłokowe silniki spalinowe. WNT, Warszawa 2000.
[52] Wajand J.A., Wajand J.T.: Tłokowe silniki spalinowe średnio- i szybkoobrotowe. WNT, Warszawa 2005.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Aero-piston engines
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01 **PEK_W05** **PEK_W04**	S1ILO_W06	C1	Lec1, Lec6, Lec7	N1, N3
PEK_W02		C2	Lec2	
PEK_W03		C3	Lec3÷Lec5	
PEK_W06 **PEK_W07**		C4	Lec8÷Lec12	
PEK_W08		C5	Lec13÷Lec15	
PEK_U01	S1ILO_U06	C6	Cl 1÷Cl 4	N2, N3
PEK_U02 **PEK_U03**		C6	Cl 5÷Cl 7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Turbinowe silniki lotnicze**
Name in English	**Gas turbine engines**
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Engineering of Aviation**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN1300**
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	30			
Form of crediting	Examination	Crediting with grade			
For group of courses mark (X) final course					
Number of ECTS points	3	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1,5	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Knowledge and skills in the field of thermodynamics, the theory of aircraft propulsion, combustion of fuels

SUBJECT OBJECTIVES

C1 – Introduction to the classification and general characteristics of the aviation gas turbine engines.
C2 – Presentation of the design solutions, general construction and operation of the main unit of the gas turbine engine.
C3 – Discover the purpose, construction and operation of the gas turbine engines systems
C4 – Presentation of the impact of flight conditions and rotational speed on the performance of gas turbine engines.
C5 – Presentation of the development trends in aviation gas turbine engines.
C6 – Develop skills of determine the value of the main operating parameters and performance of gas turbine engines and their units.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

As a result of the performed classes a student should be able:

PEK_W01 – to describe the general classification of gas turbine engines and their basic performance,
PEK_W02 – to list the main units of a jet turbine engine, indicate the location of specific sections of the stream and explain the principle of its work,
PEK_W03 – to explain the operation of main engine's components and define the key parameters that characterize its work,
PEK_W04 – to describe the construction and operation of the lubrication, control, fuelling and cooling system of the gas turbine engines,
PEK_W05 – to identify the characteristics of the jet, turbofan, turbo propeller and turboshaft engines,
PEK_W06 – to define and characterize the main directions of improving of air turbine propulsion systems.

relating to skills:

As a result of the performed classes a student should be able:

PEK_U01 – to calculate the parameters of thermodynamic cycles and performances of gas turbine engines,
PEK_U02 – to apply the known formulas for calculating parameters of air and combustion gases stream in specific sections of the main engine's units and interpret the obtained results,
PEK_U03 – to choose the values of the coefficients required to perform the calculations.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	General characteristics of aviation gas turbine engines.	2
Lec2	Inlet systems.	2
Lec3	Axial-flow compressors.	2
Lec4	Centrifugal and mixed-flow compressors.	2
Lec5	Unstable work of the compressor.	2
Lec6	Combustion chambers.	2
Lec7	Processes inside the combustion chambers and their characteristics.	2
Lec8	Axial-flow turbines.	2
Lec9	Outlet systems.	2
Lec10	Special devices of the outlet systems.	2
Lec11	Lubrication systems.	2
Lec12	Control and fuelling systems.	2
Lec13	Cooling of the gas turbine engines.	2
Lec14	The characteristics of gas turbine engines.	2
Lec15	Directions of improving of the gas turbine engines.	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl 1	Solving of problems relating to thermodynamic cycles and basic performances of turbine engines: work of cycle, thrust, power, specific thrust, mass flow of air.	2
Cl 2	Solving of problems relating to air stream flow through inlets.	2
Cl 3	Determination of the basic parameters of axial-flow compressors.	2
Cl 4	Determination of the basic parameters of centrifugal compressors.	2
Cl 5	Solving of basic thermodynamic problems relating to combustion chambers, calculation of excess air number, fuel consumption and heat load of the combustion chambers.	2
Cl 6	Determination of the basic parameters of the axial reaction turbines	2
Cl 7	Solving problems relating to exhaust gas flow through subsonic and supersonic nozzles.	2

Cl 8	Final test.	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Lecture: – Traditional lecture with the use of multi-media presentation. – self-studies and preparation for the final test N2. Class: – computational problems; – the analysis of results; – short written tests; – individual work - preparation for classes. N3. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W08	Examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02	Activity, short tests
F2	PEK_U01÷PEK_U03	Final test
C=(2·F2+F1)/3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[110] Balicki W. i inni: Historia i perspektywy rozwoju napędów lotniczych. Wydawnictwa Naukowe Instytutu Lotnictwa, Warszawa 2005.
[111] Balicki W. i inni: Lotnicze silniki turbinowe. Konstrukcja – eksploatacja – diagnostyka. Część 1. Wydawnictwa Naukowe Instytutu Lotnictwa, Warszawa 2010.
[112] Cichosz E. i inni: Charakterystyka i zastosowanie napędów. WKŁ, Warszawa 1980.
[113] Dzierżanowski P. i inni: Turbinowe silniki odrzutowe. WKŁ, Warszawa 1983.
[114] Dzierżanowski P. i inni: Turbinowe silniki śmigłowe i śmigłowcowe. WKŁ, Warszawa 1985.
[115] Dżygadło Z. i inni: Zespoły wirnikowe silników turbinowych. WKŁ, Warszawa 1982..

SECONDARY LITERATURE:

[53] Dzierżanowski P. i inni: Konstrukcja silników lotniczych. Projektowanie przejściowe i dyplomowe. WAT, Warszawa 1972.
[54] Farokhi, S.: Aircraft propulsion. John Wiley & Sons, Hoboken 2008.
[55] Gajewski T. i inni: Przepływowe silniki odrzutowe. WNT, Warszawa 1973.
[56] Gieras M.: Komory spalania silników turbinowych. Organizacja procesu spalania. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2010.
[57] Jeż M.: Silniki spalinowe: zasady działania i zastosowania. Wydawnictwa Naukowe Instytutu Lotnictwa, Warszawa 2003.
[58] Kerrebrock, Jack L.: Aircraft Engines and Gas Turbines [Dokument elektroniczny, http://www.knovel.com/web/portal/main].
[59] Oates, Gordon C.: Aircraft propulsion systems technology and design [Dokument elektroniczny, http://www.knovel.com/web/portal/main].
[60] The jet engines. The Technical Publications Department of Rolls-Royce, Derby 1986.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Gas turbine engines
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01 **PEK_W02**	S1ILO_W11	C1	Lec1	N1, N3
PEK_W03		C2	Lec2 ÷ Lec10	
PEK_W04		C3	Lec11 ÷ Lec13	
PEK_W05		C4	Lec14	
PEK_W06		C5	Lec15	
PEK_U01	S1ILO_U14	C6	Cl 1	N2, N3
PEK_U02 **PEK_U03**		C6	Cl 2 ÷ Cl7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**URZĄDZENIA KOTŁOWE**
Name in English	Boiler Devices
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	MSN1340
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	examination			crediting with grade	
For group of courses mark (X) final course					
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	1,5			1,5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge in thermodynamics, heat exchange, fluid mechanics, fuel combustion and theory of machines.
2. Skill of using spreadsheet (Mathcad, MS Excel) for engineering calculations.

SUBJECT OBJECTIVES

C1 – Construction and principle of operation of power and utility boilers burning gas, oil and solid fuels..
C2 – Presentation of fuels in thermal power engineering.
C3 – Become familiar with boiler's auxiliary devices – mills, crushers, de-slagging and de-dusting installations.
C4 – Become familiar with future development in boiler's design.
C5 – Become familiar with heat balance in boiler, heat losses and calculations of boiler's efficiency.
C6 – Preparing for design calculations of heat exchangers in utility boiler with MATHCAD spreadsheet.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – specify and describe type and construction of: power, utility and waste-heat boilers
PEK_W02 – describe boiler's flow scheme of water and steam
PEK_W03 – specify fuels in thermal power engineering and methods and devices for preparing solid fuels for combustion in boilers
PEK_W04 – specify and describe type of burners and combustion chambers in power boilers
PEK_W05 – formulate boiler's heat balance equations
PEK_W06 – know and describe boiler's heat losses and methods for their minimization
PEK_W07 – know future development in boiler's design

relating to skills:

PEK_U01 – calculate stoichiometric properties of fuel combustion process with MATHCAD spreadsheet
PEK_U02 – calculate: quantity, composition and enthalpy of flue gas for different type of fuels with MATCAD spreadsheet
PEK_U03 – formulate and calculate boiler's heat balance; calculate boiler's fuel consumption
PEK_U04 – calculate heat exchange in PF boiler's furnace
PEK_U05 – design calculations of single heat exchanger in boiler
PEK_U06 – calculate flow resistance in heat exchanger
PEK_U07 – can choice grade of steel from EU and Polish standards for designed heat exchanger

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1/2	Meaning of boiler's in an industrial and power station. Thermodynamics principles – C-R cycle, steam and water parameters. Flow of water and steam in a boiler. Type of construction of utility and power boilers.	3
Lec2/3	Type of fuels in power industry – properties of hard and brown coal, oil, natural gas and biomass.	2
Lec3/4	Solid fuels preparing – crushing, milling, dust separation. Coal breaker and mills for hard and brown coal. Installations for slag and dust removing.	3
Lec5	Construction of fire-tube water and steam boilers. Auxiliary devices. Boiler blowdown.	2
Lec6	Construction of water-wall boilers. Sub- and supercritical steam boilers.	2
Lec7/8	Construction and principle of operation of grate furnace. Type of grates. Spreader stoker furnace.	3
Lec8/9	Construction and principle of operation of PF furnace. Type of PF furnaces and burners.	3
Lec10/11	Construction and principle of operation of BFB and CFB furnace.	3
Lec11/12	Dutch oven construction and recovery heat boilers.	2
Lec12/13	Construction of sub- and supercritical boilers. Evaporators – construction, principle of operation.	2
Lec13/14	Boiler's heat balance. Calculation of efficiency, heat losses. Possibilities of efficiency improvement.	3
Lec15	Future development in boiler's design. New alloy materials.	2
	Total hours	**30**
Form of classes - project		**Number of hours**
Proj1	Introduce to MATHCAD software and steam and heat exchange numerical library. Assign of project data.	2
Proj2	Calculation of: fuel composition for different states, LHV and air consumption.	2

	Quantity, composition and enthalpy of flue gas.	
Proj3/4	Boiler's heat balance and fuel consumption calculations. Thermodynamics data calculations of water and steam.	4
Proj5/6	Algorithm of design calculations of PF boiler's furnace.	4
Proj7/8	Algorithm of design calculations of a single convective heat exchanger in a boiler (economizer or superheater).	4
Proj9/10	Algorithm of calculations of an air heater for PF boiler.	4
Proj11/12	Algorithm of calculations of flow resistance in a designed heat exchanger.	4
Proj13/14	Algorithm of calculations strength of steel materials in a designed heat exchanger. Choice of grade of steel from EU and Polish standards.	4
Proj15	Verification of a project, evaluation.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. lecture – multimedia presentation, self-learning - preparing to exam N2. project - algorithm of calculations, self-learning – preparing to project N3. consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W07	written examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- project

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01÷PEK_U07	attendance, evaluation of a project

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[116] Kruczek S., *Kotły: konstrukcje i obliczenia*, Oficyna PWr 2001

[117] Orłowski P., *Kotły parowe - konstrukcja i obliczenia*, WNT 1972, 1979

[118] Bis H., *Kotły fluidalne: teoria i praktyka*, Wydawnictwo Politechniki Częstochowskiej 2010

[119] Pawlik M. i in., *Elektrownie*, WNT 2010

[120] Tarnowska-Tierling A., *Kotły parowe. Przykłady obliczeń cieplnych*, Politechnika Szczecińska, 1987

[121] Rokicki H., *Urządzenia kotłowe: przykłady obliczeniowe*, Politechnika Gdańska, 1996

[122] PN-EN 10216-2+A2:2007 *Rury stalowe bez szwu do zastosowań ciśnieniowych. Warunki techniczne dostawy. Część 2: Rury ze stali niestopowych i stopowych z określonymi własnościami w temperaturze podwyższonej*

SECONDARY LITERATURE:

[1] *Warunki urzędu dozoru technicznego dla urządzeń ciśnieniowych* (nieobowiązkowe specyfikacje techniczne), UDT 2005

[2] Pronobis M., *Modernizacja kotłów energetycznych*, WNT 2002 i 2009

[3] Hobler T., *Ruch ciepła i wymienniki*, Wydawnictwa Naukowo-Techniczne 1986

[4] Kuznecov, N. V. i in., *Teplovoj rasčet kotel'nyh agregatov: normativnyj metod,* 1973, 1998

[5] Motyka R., Rasała D., *Mathcad: od obliczeń do programowania*, Helion 2012

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
URZĄDZENIA KOTŁOWE
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Thermal Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1INC_W10	C1	Lec6, Lec11/12	N1, N3
PEK_W02		C1	Lec1/2, Lec12/13	
PEK_W03		C2, C3	Lec2/3, Lec3/4	
PEK_W04		C1	Lec5, Lec7/8, Lec8/9, Lec10/11	
PEK_W05		C5	Lec13/14	
PEK_W06		C5	Lec13/14	
PEK_W07		C4	Lec15	
PEK_U01	S1INC_U11	C6	Proj1-2	N2, N3
PEK_U02		C6	Proj1-2	
PEK_U03		C6	Proj3/4	
PEK_U04		C6	Proj5/6	
PEK_U05		C6	Proj7-10	
PEK_U06		C6	Proj11/12	
PEK_U07		C6	Proj13/13	

FACULTY OF MECHANICAL AND POWER ENGINEERING
SUBJECT CARD

Name in Polish:	**Urządzenia Ochrony Atmosfery**
Name in English:	**Air Protection Installation**
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Power Engineering**
Level and form of studies	**1st/ full time**
Kind of subject	**optional-specialization**
Subject code	**MSN1350**
Group of courses	**No**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in university (ZZU)	16			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	crediting with grade			crediting with grade	
For group of courses mark (X) final course					
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			0,75	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of fluid mechanics, thermodynamics, mechanical engineering, basic construction of examinations confirmed

SUBJECT OBJECTIVES

C1 – To acquaint students with the basic knowledge of the current requirements for emission reduction of dust and gas,
C2 - To acquaint students with the technological processes, which created dust and gas pollution
C3 - Introduction to methods and devices protecting the atmosphere used in power generation,
C4 - The ability to analyze the effectiveness of exhaust after treatment devices.
C5 - Purchase social skills involving cooperation in the group of students in order to effectively solve tasks.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 - Can name and describe the basic impurities in the fuel combustion process,

PEK_W02 - Has a structured and theoretically founded general knowledge covering issues from the scope of atmospheric protection equipment,

PEK_W03 - Recognize the scheme of de-dusting equipment and technology to reduce gaseous pollutants (SO2, NOx, CO2),

PEK_W04 - Shows examples of application specific solutions and techniques to reduce dust and gas pollution

relating to skills:

PEK_U01 - Analyzes the technological data for the selection of equipment for the purification of exhaust gas,

PEK_U02 - Estimates of emissions from processes

PEK_U03 - Able to perform basic design calculations for air protection devices, based on data from manufacturing processes

PEK_U04 - Is able to assess the parameters that determine the effectiveness of aftertreatment of dust and gas

relating to social competences:

PEK_K01 – Understands the need for continuous self-education,

PEK_K02 – Is aware of the effects of engineering activities, including its impact on the environment.

PROGRAMME CONTENT		
Form of classes – lecture		**Number of hours**
Lec1	Legal status – emission limits. The required level of pollution reduction	2
Lec2	Overview of emissions reductions from fuel combustion processes	2
Lec3	Gas extraction process – general characteristics, basic concepts, systematics devices	2
Lec4	Mechanical filters	2
Lec5	Bag filters	2
Lec6	Basics of electrostatic precipitation gases	2
Lec7	Electrostatic precipitators	2
Lec8	Wet dust collectors	2
Lec9	FGD-general characteristics of the methods	2
Lec10	Method of dry and semi-dry flue gas desulfurization	2
Lec11	Wet FGD method	2
Lec12	Limitation of emissions of nitrogen oxides – the primary method	2
Lec13	Limitation of emissions of nitrogen oxides – the methods of non-catalytic	2
Lec14	Limitation of emissions of nitrogen oxides –the method of secondary catalytic	2
Lec15	Test	2
	Total hours	**30**

Form of classes – class		Number of hours
Proj1	Introduction (teaching method, the principle of assigning projects, etc.). Determination of the amount of particles of dust and SO2 from the boiler balance	4
Proj2	Design gravitational or inertial dust separator	2
Proj3	Project horizontal electro-chamber	2
Proj4	Electro-sectional design effectiveness	2
Proj5	Project of the wet FGD-selection of parameters	2
Proj6	Motion of the catalyst for purifying exhaust gases. Examination	3
	Total hours	15

TEACHING TOOLS USED
N1 - Informative lecture, presentation, lecture problem N2 - For the project: own work, presentation of the project, analysis of final N3 - Consultation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture*

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C1	PEK_W01÷PEK_W04	test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U04 PEK_K01÷PEK_K02	oral answer
F2	PEK_U01÷PEK_U04 PEK_K01÷PEK_K02	evaluation of the project
C =(F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

1. Warych J.: Oczyszczanie gazów. Procesy i aparatura. WNT, Warszawa 1998
2. Kordylewski W.: Spalanie i paliwa, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001,
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SECONDARY LITERATURE:

1. Kabsch P.: Odpylanie i odpylacze t.1, WNT, Warszawa 1992
2. Lutyński J.: Elektrostatyczne odpylanie gazów, WNT, Warszawa 1965
3. Jędrusik M: Elektrofiltry. Rozwinięcie wybranych technik podwyższania skuteczności odpylania, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2008

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Air Protection Installation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **MBM**
AND SPECIALIZATION **Thermal Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01 ÷ PEK_W04	S1INC_W11	C1÷C4	Lec1÷Lec15	N1, N3
PEK_U01÷ PEK_U04	S1INC_U12	C2÷C4	Proj1÷Proj6	N2, N3
PEK_K01, PEK_K02	K1MBM_K01, K1MBM_K02,	C4	Proj1÷Proj6	N2, N3

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Wymiana ciepła i wymienniki**
Name in English	Heat transfer and heat exchangers
Main field of study	**Mechanical Engineering and Machine Building**
Specialization	**Thermal Engineering**
Level and form of studies	**1st level, full-time**
Kind of subject	**optional-specialization**
Subject code	**MSN 1400**
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			
For group of courses mark (X) final course					
Number of ECTS points	2	1			
including number of ECTS points for practical (P) classes	0	1			
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge and skills of mathematics and physics.
2. Knowledge and skills of thermodynamics.

SUBJECT OBJECTIVES

C1 – providing basic knowledge concerning conduction, convection and radiation heat transfer processes
C2 – developing skills of calculating heat flux and temperature distribution in objects with different shapes
C3 - developing abilities of calculating heat transfer coefficients for different cases of convection (with and without change of phase)
C4 – providing basic knowledge and developing skills of heat exchangers thermal calculations
C5 – forming abilities to calculate heat fluxes during thermal radiation

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – knows basic laws and terms concerning heat transfer
PEK_W02 – has knowledge about determining temperature distribution and heat flux in plane, cylinder and sphere objects, simple rods and fins
PEK_W03 – is acquainted with range of usage and has knowledge about thermal calculations of heat exchangers
PEK_W04 – has knowledge of convection types and knows how to match appropriate undimensional equations in order to determine heat transfer coefficients
PEK_W05 – is able to explain mechanism of thermal radiation heat transfer for surfaces separated by transparent surfaces, gases and burning flames

relating to skills:

PEK_U01 – is able to determine temperature distribution and calculate heat flux conducted and transferred through plane, cylinder and sphere objects, simple rods and fins

PEK_U02 – knows how to calculate thermal processes in parallel-flow, counter-flow and cross-flow heat exchangers
PEK_U03 – knows how to use undimensional equations to determine heat transfer coefficients for natural and forced convection with and without phase change (boiling and condensation)
PEK_U04 – has abilities to calculate radiation heat flux

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Introduction. Basic terms and laws of heat transfer	2
Lec2	Steady one-dimensional conductivity heat transfer	2
Lec3	Steady one-dimensional diffusivity heat transfer	2
Lec4	Rods – differential equation of conductivity heat transfer in rods, boundary conditions	2
Lec5	Heat diffusion in simple rods	2
Lec6	Fins, finned surfaces, efficiency of fins and finned surfaces	2
Lec7	Classification and types heat exchangers	2
Lec8	Theory of recuperation – calculations of average temperature difference	2
Lec9	Convection – types, basic equations, undimensional analysis, natural convection without phase change	2
Lec10	Forced convection without phase change	2
Lec11	Convection with phase change (boiling, condensation)	2
Lec12	Basic terms and laws thermal radiation, heat transfer between surfaces separated by transparent mediums	2
Lec13	Thermal radiation of semi-transparent medium, gases thermal radiation, burning flame radiation	2
Lec14	Complex heat transfer	2
Lec15	Final test	2
	Total hours	**30**
Form of classes - class		**Number of hours**
Cl1	Introduction. Steady one-dimensional conductivity heat transfer	2
Cl2	Steady one-dimensional diffusivity heat transfer	2
Cl3	Heat transfer in simple rods. Steady one-dimensional diffusivity heat transfer through finned walls	2
Cl4	Thermal calculations of heat exchangers	2
Cl5	Natural convection. Forced convection. Convection with phase change (boiling, condensation)	2

Cl6	Radiation heat transfer between surfaces separated by transparent mediums	2
Cl7	Complex heat transfer	2
Cl8	Test	1
	Total hours	**15**

TEACHING TOOLS USED
N1. Lectures N2. Classes N3. Consultations

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W05	Test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_U01-PEK_U04	Test

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE :

[25] Kostowski E.: Przepływ ciepła. Politechnika Śląska, Gliwice 2000
[26] Kostowski E.: Zbiór zadań z przepływu ciepła. Politechnika Śląska, Gliwice 2000
[27] Kalinowski E.: Przekazywanie ciepła i wymienniki. Politechnika Wrocławska, Wrocław 1994

SECONDARY LITERATURE:

[123] Wiśniewski St., Wiśniewski T.: Wymiana ciepła, WNT, Warszawa 1999
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[128] Çengel Y. A., Heat and mass transfer: a practical approach, McGraw Hill 2006
[129] Pitts D. R., Sissom L. E., Schaum's outline of theory and problems of heat transfer, McGraw-Hill 1999
[130] Lienhard IV J. H., Lienhard V J. H., A heat transfer textbook, Phlogiston Press, Cambridge Massachusetts 2004

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

Heat Transfer and heat exchangers

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

Mechanical Engineering and Machine Building

AND SPECIALIZATION

Thermal engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1ENG_W21	C1	Lec1	N1, N3
PEK_W02		C1	Lec2- Lec6	
PEK_W03		C4	Lec7, Lec8	
PEK_W04		C1	Lec9-Lec11, Lec14	
PEK_W05		C1	Lec12 – Lec14	
PEK_U01	K1ENG_U28	C2	Cl1-Cl4	N2, N3
PEK_U02		C4	Cl4	
PEK_U03		C3	Cl5, Cl7	
PEK_U04		C5	Cl6, Cl7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Wyposażenie statków powietrznych**
Name in English	Equipment of aircrafts
Main field of study	Mechanical Engineering and Machine Building
Specialization	Engineering of Aviation
Level and form of studies	1st level, full-time
Kind of subject	optional-specialization
Subject code	MSN 1420
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		
For group of courses mark (X) final course					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes	0		2		
including number of ECTS points for direct teacher-student contact (BK) classes	1		1,5		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in the field of aerial and electrical equipment, avionics and control of flying vessels, piston aircraft engines.

SUBJECT OBJECTIVES

C1 – Introduction to the aircraft control system.
C2 – Presentation of the cockpit power system.
C3 – Getting to know the high altitude rescue equipment.
C4 – Presentation of the airplane fuel system.
C5 – Introduction to hydraulic system of the aircraft.
C6 – Introduction to pneumatic system of the aircraft
C7 – Introduction to the special systems of the aircraft.
C8 – Introduction to the start and landing systems.
C9 – Development of skills of aircraft equipment characterization.
C10 – Gathering an ability for handling an aircraft equipment.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

following the course, the student should be able to:
PEK_W01 – characterize the aircraft's control system.
PEK_W02 – discuss the design of control system components.
PEK_W03 – explain the operation of the automatic control system.
PEK_W04 – characterize the cockpit power system.
PEK_W05 – describe the cockpit power system.
PEK_W06 – explain the construction and operation of high altitude rescue equipment.
PEK_W07 – characterize the airplane fuel system.
PEK_W08 – describe the airplane fuel system.
PEK_W09 – characterize hydraulic system of the aircraft.
PEK_W10 – explain operation of the hydraulic actuators.
PEK_W11 – characterize aircraft's pneumatic system.
PEK_W12 – describe the actuators of the pneumatic system.
PEK_W13 – characterize special systems.
PEK_W14 – explain operation of the start and landing systems.
PEK_W15 – explain operation of the aircraft's equipment.

relating to skills:

following the course, the student should be able to:
PEK_U01 – control devices of aircraft's equipment.
PEK_U02 – assess the performance of the selected aircraft equipment.
PEK_U03 – prepare a report of the tests carried out on equipment.
PEK_U04 – use the technical documentation of aggregates and equipment.
PEK_U05 – use tools and aviation equipment in accordance with the rules and regulations of safety.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	Characteristics of the aircraft's control systems.	2
Lec2	The design of elements of the control systems.	2
Lec3	Automatic control systems.	2
Lec4	Characteristics of the cockpit power system.	2
Lec5	Operation of the cockpit power system.	2
Lec6	High altitude rescue equipment.	2
Lec7	Characteristics of the airplane fuel system	2
Lec8	Operation of the fuel system.	2
Lec9	Characteristics of the hydraulic system.	2
Lec10	Actuators of the hydraulic system.	2
Lec11	Characteristics of the pneumatic system.	2
Lec12	Actuators of the pneumatic system.	2
Lec13	Special systems.	2
Lec14	Start and landing systems.	2
Lec15	Final test.	2
	Total hours	**30**

Form of classes - laboratory		Number of hours
Lab1	Test of aeronautical electrical thermometers.	4
Lab2	Test of aeronautical gauges.	4
Lab3	Test of pressure indicator of speed and height.	4
Lab4	Test of differential synchro connector.	4
Lab5	Test of aeronautical turbine flowmeters.	4
Lab6	Test of aeronautical electromechanisms.	6

Lab7	Test of aeronautical tachometers.	4
	Total hours	**30**

TEACHING TOOLS USED
N1. Lecture: • traditional lecture using multimedia presentation, • individual work - self-study and preparation to pass the course. N2. Seminar: • individual work - preparing the presentation and outline on a specific topic, • presentation of a paper using a multimedia presentation, • listening to papers presented in class. N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W15	Written and oral test

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
F2	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
F3	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
F4	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
F5	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
F6	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
F7	PEK_U01÷ PEK_U05	Short written tests, laboratory exercises and reports.
C=(F1+F2+F3+F4+F5+F6+F7)/7		Assessment condition is that all forming evaluations are positive.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Bachtin M., Lipski J.: Wyposażenie wysokościowe samolotów i statków kosmicznych. WKŁ, Warszawa1988.
[2] Cheda W., Malski M.: Techniczny poradnik lotniczy – Płatowce. WKŁ, Warszawa 1981.
[3] Cymerkiewicz R.: Budowa samolotów. WKŁ, Warszawa 1982.
[4] Pizoń Andrzej.: Elektrohydrauliczne analogowe i cyfrowe układy automatyki. Wydawnictwa Naukowo-Techniczne, Warszawa 1995.
[5] Praca Zbiorowa.: Wstęp do konstrukcji śmigłowców. WKŁ, Warszawa 1995.

SECONDARY LITERATURE:

[1] Cichosz E.: Rozwój samolotów naddźwiękowych. WKŁ, Warszawa 1980.
[2] Cichosz E.: Konstrukcja i praca płatowca. WAT, Warszawa 1968.
[3] Godzimirski J.: Technologia produkcji płatowców. WAT, Warszawa 2000.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Wyposażenie statków powietrznych
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION **Engineering of Aviation**

Przedmiotowy efekt kształcenia	Odniesienie przedmiotowego efektu do efektów kształcenia zdefiniowanych dla kierunku studiów i specjalności	Cele przedmiotu	Treści programowe	Numer narzędzia dydaktycznego
PEK_W01	S1ILO_W09	C1	Lec1	N1; N3
PEK_W02		C1	Lec2	
PEK_W03		C1	Lec3	
PEK_W04		C2	Lec4	
PEK_W05		C2	Lec5	
PEK_W06		C3	Lec6	
PEK_W07		C4	Lec7	
PEK_W08		C4	Lec8	
PEK_W09		C5	Lec9	
PEK_W10		C5	Lec10	
PEK_W11		C6	Lec11	
PEK_W12		C6	Lec12	
PEK_W13		C7	Lec13	
PEK_W14		C8	Lec14	
PEK_W15		C9	Lec15	
PEK_U01	S1ILO_U11	C10	Lab1÷Lab7	N2; N3
PEK_U02		C10	Lab1÷Lab7	
PEK_U03		C10	Lab1÷Lab7	
PEK_U04		C10	Lab1÷Lab7	
PEK_U05		C10	Lab1÷Lab7	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Wytrzymałość materiałów**
Name in English	Strength of materials
Main field of study	Mechanical Engineering and Machine Building
Specialization	Thermal Engineering
Level and form of studies	1st level, full-time
Kind of subject	optional-specialization
Subject code	MSN 1460
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	30	30		
Form of crediting	Examination	crediting with grade	crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	3	1	1		
including number of ECTS points for practical (P) classes	0	1	1		
including number of ECTS points for direct teacher-student contact (BK) classes	1.5	0.75	0.75		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Basic knowledge, skills and competences relating to mathematics – differential and integral calculus, mechanics – statics, dynamics; the fundamentals of materials strength.

SUBJECT OBJECTIVES

C1. Solving technical problems on the basis of the laws of mechanics,
C2. Making strength analyses of structural components for complex load cases,
C3. Imparting basic knowledge about the rheology and fatigue of materials,
C4. Learning experimental methods of determining the strength properties of materials and selected mechanical quantities,
C5. Acquiring and strengthening social competences covering emotional intelligence consisting in the ability to collaborate in a student team in order to effectively solve problems. Responsibility, honesty and reliability, the observance of the customs prevailing in the academic community and in society.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge

The student:

PEK_W01 – can define the behaviour of a deformable body in complex load cases, knows the notion of strain and the basic strain hypotheses;
PEK_W02 – knows the basic energy theorems and the structure analysis methods based on them;
PEK_W02 – has systematized knowledge concerning the strength analysis of plates, slabs and thick-walled tubes;
PEK_W04 – has basic knowledge about the rheology and fatigue of construction materials.

relating to skills

The student can:

PEK_U01 – carry out an analysis of the state of stress and strain, and strength dimensioning for complex load cases;
PEK_U02 – use the basic energy theorems to solve material strength problems;
PEK_U03 – assess the safety of the behaviour of a structure under fatigue loads;
PEK_U04 – carry out tests of the basic strength properties of construction materials, measure displacements and strains and interpret the obtained results.

relating to social competences

The student:

PEK_K01 – shows openness to searching for information and subjecting it to critical analysis;
PEK_K02 – shows objectivity in the evaluation of arguments, the rational explanation and substantiation of her/his own point of view, using knowledge from the field of materials strength;
PEK_K03 – observes the customs and principles prevailing in the academic community.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec1	The buckling of compressed bars, elastic buckling – Euler's formula, the influence of the way of fixing the ends of a bar on the critical force; slenderness, reduced buckling length, the limiting slenderness ratio, inelastic buckling.	2
Lec2	The composite strength of a bar – strain hypotheses.	2
Lec3	The general energy theorem, linearly elastic systems, Clapeyron's theorem, Maxwell's theorem, Betti's theorem, Castigiliano's theorem, the Menambrea-Castigiliano theorem.	2
Lec4	Statically determinate bar structures, generalized displacements and generalized forces, examples of displacement calculations, statically indeterminate bar structures, examples of reaction calculations.	2
Lec5	The Maxwell-Mohr method, the canonical equations of the forces method.	2
Lec6	The strength of rotating plates.	2
Lec7	The strength of thick-walled tubes.	2
Lec8	Plates. The determination of the stress and strain distribution in a plate. The basic equation of the theory of plates.	2
Lec9	Material fatigue – basic notions.	2
Lec10	The fundamentals of fatigue calculations in the unlimited fatigue strength range.	2
Lec11	The basics of fatigue calculations in the limited fatigue strength range.	2
Lec12	Low-cycle fatigue – examples of calculations.	2
Lec13	Creep and relaxation – basic notions.	2
Lec14	Strength calculations for creep.	2
Lec15	Thermal fatigue.	2
	Total hours	**30**

Form of classes - class		Number of hours
Cl 1	The composite strength of a bar, the application of the strain hypotheses.	2
Cl 2	Statically determinate bar systems – examples, the use of Castigliano's theorem.	2
Cl 3	Statically indeterminate bar systems – examples, the use of the Menambrea-Castigiliano theorem.	2
Cl 4	The use of the Maxwell-Mohr method.	2
Cl 5	The strength of thick-walled tubes and rotating plates.	2
Cl 6	Fatigue calculations.	3
Cl 7	Written test.	2
	Total hours	**15**
Form of classes - laboratory		**Number of hours**
Lab1	Introduction.	2
Lab2	The tensile test carried out on metals and plastics.	2
Lab3	Strain measurements using the electric resistance strain gauge technique.	2
Lab4	Fatigue strength tests.	2
Lab5	Strength tests in compound stress states – torsion with bending.	2
Lab6	Buckling – the experimental determination of the critical force for a slender bar, the compression test.	2
Lab7	Straight and skew bending, the recapitulation and crediting of the laboratory classes.	3
	Total hours	**15**

TEACHING TOOLS USED
N1. The traditional lecture with the use of audio-visual aids. N2. Calculation exercises – the discussion of problem solutions. N3. The laboratory experiment. N4. Producing a report. N5. Tutorials. N6. Self-study – preparation for laboratory classes. N7. Self-study – preparation for the examination.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01÷PEK_W04 PEK_K01÷PEK_K03	Written and oral examination

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- class

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01÷PEK_U03 PEK_K01÷PEK_K03	Oral answers, written tests
F2		Major test
C = 0.2 F1 + 0.8 F2		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- laboratory

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U04 PEK_K01÷PEK_K03	Short test – entrance test
F2		Report from a laboratory class
C = 0,5 F1 + 0,5 F2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE :
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[132] Jakubowicz A., Orłoś Z.: *Wytrzymałość materiałów*, WNT, Warszawa, 1984
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[136] Rajfert T., Rżysko J.: *Zbiór zadań ze statyki i wytrzymałości materiałów*, PWN, Warszawa, 1976
[137] *Laboratorium wytrzymałości materiałów*, Pr. pod red. Z. Rechula i J. Ziaji, O. W. PWr., W-w, 2001
SECONDARY LITERATURE:
[61] Kocańda S., Szala J.: *Podstawy obliczeń zmęczeniowych*, PWN, Warszawa, 1985
[62] Żuchowski R.: *Zmęczenie cieplne metali i elementów konstrukcji*, Prace Naukowe IMiMT Politechniki Wrocławskiej, Wydawnictwo PWr, Wrocław, 1981
[63] Wolny S., Siemieniec A.: *Wytrzymałość materiałów, Część II – Wybrane zagadnienia wytrzymałości materiałów*, Uczelniane Wydawnictwa Naukowo-Techniczne, Kraków, 2004
[64] Brzoska Z.: *Wytrzymałość materiałów*, PWN, Warszawa, 1979
[65] Niezgodziński M.E. Niezgodziński T.: *Wzory, wykresy i tablice wytrzymałościowe*, WNT, Warszawa, 2009

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Wytrzymałość materiałów
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building
AND SPECIALIZATION Thermal Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	S1INC_W01	C1, C2	Lec1÷Lec2	N1, N5, N7
PEK_W02		C1	Lec3÷Lec5	N1, N5, N7
PEK_W03		C1, C2	Lec6÷Lec8	N1, N5, N7
PEK_W04		C1, C2, C3	Lec9÷Lec15	N1, N5, N7
PEK_U01	S1INC_U01	C2	Cl 1, Cl 5	N2, N5
PEK_U02		C1	Cl 2÷ Cl 4	N2, N5
PEK_U03		C1, C3	Cl 6	N2, N5
PEK_U04		C4	Lab1÷Lab7	N3÷N6
PEK_K01 PEK_K02 PEK-K03	K1MBM_K02 K1MBM_K04	C5	Lec1÷Lec15 Cl 1÷Cl 7 Lab1÷Lab7	N5÷N7

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name in Polish	**Zarządzanie środowiskiem**
Name in English	Environmental Management
Main field of study	Mechanical Engineering and Machine Building
Level and form of studies	1st level, full-time
Kind of subject	obligatory
Subject code	MSN1500
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				
For group of courses mark (X) final course					
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	1,5				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Basic knowledge in the field of ecology and chemistry.

SUBJECT OBJECTIVES

The main objectives of the course are to:

C1 – Provide knowledge relating to legal, organizational and social determinants of environmental protection.
C2 – Acquaint students with the basic economic concepts of financial management in taking actions affecting the environment.
C3 – Acquaint students with technical and economic models in the field of investment in environmental protection.
C4 – Discuss the problems associated with the use and transformation of natural resources.
C5 – Acquaint students with distribution and acquisition of European and national funds for environmental protection as well as international environmental management systems.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – Should have a knowledge concerning natural resource efficiency and waste management.

PEK_W02 – Should have a knowledge of the sources, methods and legal aspects of environmental project funding.

PEK_W03 – Should have a knowledge to make decisions related to legal, organizational and financial aspects of environmental management at the enterprise level and the basic units of local government.

PEK_W04 – Should have a knowledge concerning legal and economic conditions of Poland in respect to EU countries.

PEK_W05 – Should have a knowledge of the major problems associated with environmental management.

relating to social competences:

PEK_K01 – Should have a competence to represent organizations and social ecology movements.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	The economics of natural resources use.	2
Lec2	Environmental valuation.	2
Lec3	Methods of environmental valuation.	2
Lec4	Economic calculations of environmental projects.	2
Lec5	Modeling the economic impact of environmental policy.	2
Lec6	Instruments for environmental policy in the EU.	2
Lec7	International coordination of environmental policy.	2
Lec8	Sources of environmental project funding in Poland	2
Lec9	Surface protection and waste management - legal status.	2
Lec10	Water protection – legal status.	2
Lec11	Air protection – legal status.	2
Lec12	Integrated permits.	2
Lec13	European Environmental Management System – EMS	2
Lec14	International environmental management system - ISO 14000	2
Lec15	Lecture summary, conclusions.	2
	Total hours	**30**

TEACHING TOOLS USED
N1. Problematic-informative lecture, multimedia presentation.
N2. Student's own work – literature review.
N3. Consultation.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT- lecture

Evaluation (F– forming (during semester), C– concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
C	PEK_W01 - PEK_W03 PEK_K01	Colloquium.

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE : [1] Folmer H., Gabel L., Opschoor H.: Ekonomika środowiska i zasobów naturalnych", Wyd. Krupski i S-ka, Warszawa 1996 [2] Poskrobko B., Zarządzanie Środowiskiem, PWE, Warszawa 2006, [3] Nierzwiński W., Zarządzanie Środowiskowe, PWE Warszawa 2005, [4] Zarządzanie Środowiskiem, Praca zbiorowa, PWE 2007, ISBN 978-83-208-1713-3, 2, [5] Nowak Z., Zarządzanie Środowiskiem, Praca zbiorowa, wyd. Politechnika Śląska, Polski Ruch CP, 2011. SECONDARY LITERATURE: [1] Wos A.: Ekonomika odnawialnych zasobów naturalnych, PWE, Warszawa 1995 [2] Wippenny J.T.: Wartość środowiska. Metody wyceny ekonomicznej, PWE, Warszawa 1995 [3] Prawo ochrony środowiska Wspólnoty Europejskiej, Wyd. Ministerstwo Ochrony Środowiska i Zasobów Naturalnych, Warszawa 1995, suplementy 1997 [4] Czasopisma „Problemy Ekologii" [5] Obowiązujące akty prawne: Ustawa „Prawo ochrony środowiska", Dz. U. Nr 63, poz.627, Ustawa o odpadach, Prawo wodne, Ustawa o prawie geologicznym i górniczym, Prawo energetyczne

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

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study/ specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W17	C1, C4	Lec 1, Lec 2, Lec 4; Lec 6 – Lec 8	N1÷N3
PEK_W02		C2, C5	Lec 2, Lec 3, Lec 6, Lec 7	
PEK_W03		C2, C3	Lec 11- Lec 15	
PEK_W04		C5	Lec 5, Lec 6	
PEK_W05		C1-C5	Lec 1- Lec15	
PEK_K01	K1MBM_K02	C1-C5	Lec 1- Lec15	

FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

1. Name in Polish **Ochrona własności intelektualnej i przemysłowej**

Name in English Intellectual and Industrial Property Protection
Main field of study: **Mechanical Engineering and Machine Building Power Engineering**.
Level and form of studies: **1st level, full-time**
Kind of subject: **obligatory**
Subject code **PRZ1152W**
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				
For group of courses mark (X) final course					
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				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. No prerequisites

SUBJECT OBJECTIVES

C1 Gaining basic knowledge on the kinds and systems of intellectual property protection, its use and commercialization.
C2 Understanding the role and procedures of intellectual property protection, including industrial property (inventions, designs and marks) as well as copyrights (artistic, scientific, literary works, computer programs and databases).
C3 Understanding the legal and economic aspects of intellectual property protection and its use in modern organizations in different fields of industry
C4 Getting to know different patent (and other IPR) information sources, as well as methods of their use for knowledge protection in innovation processes.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEK_W01Student knows and understands the basic concepts and regulations concerning the IPR protection and commercialization.
PEK_W02 Student has basic knowledge of different types of protectable knowledge and legal systems and procedures of IPR protection in PL, EU, and in the world.
PEK_W03 Student understands the role and value of intellectual property, knows the procedural costs of knowledge protection as well as potential benefits derived from it.
Student is also aware of risks connected with IPR infringement cases.

PEK_W04 Student has general knowledge of available patent information sources and its use for knowledge protection in innovation processes.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec 1	Introduction. The concept and role of intellectual property protection for modern organizations and in everyday life. Intellectual and industrial property protection ideas, systems and methods.	2
Lec 2	Industrial property law – types of protected knowledge, the concept of invention and patent, patentability requirements, patent procedures(PL,EU,WO)	6
Lec 3	Trademarks and service marks– definition and protection procedures and requirements. Geographical indications protection systems	2
Lec 4	Utility Models, Designs and know-how – definitions and protection methods and procedures	2
Lec 5	The use of available patent information databases – examples and methods of searches of protected items of intellectual property.	2
Lec 6	Copyrights and related rights – creative and scientific works protection, software and database protection, subject, object and time of protection	6
Lec 7	Intellectual property infringement cases, limits of protection rights, pros and cons of different systems of knowledge protection, the use of protected knowledge – examples and case studies	4
Lec 8	The use and commercialization of intellectual property, licences and other agreements in knowledge transfer	4
Lec 9	Test	2
	Total hours	30

TEACHING TOOLS USED
N1. Lecture with multimedia presentations N2. Internet patent information databases searches N3. Office hours.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 –W04	test
F2	PEK_W01 –W04	Activity
P = 0,8*F1 + 0,2*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

2. Red. Kotarba W., **Ochrona wiedzy a kapitał intelektualny organizacji**. PWE Warszawa 2006.

3. Red. Kostański P., **Prawo własności przemysłowej, Komentarz**, C.H.Beck, Warszawa 2010

4. J. Barta, M. Czajkowska-Dąbrowska, Z.Ćwiąkalski, R. Markiewicz, E.Traple, **Prawo autorskie i prawa pokrewne**. Komentarz. Zakamycze 2008.

SECONDARY LITERATURE:

1. Ustawa z dnia 30 czerwca 2000r. Prawo własności przemysłowej. Dz. U. Nr 49 z 2001r., poz. 508.
2. Ustawa z dnia 4 lutego 1994 r. o prawie autorskim i prawach pokrewnych. Dz. U. Nr 80 z 2000r., poz. 904.
3. Ustawa z dnia 16 kwietnia 1993r. o zwalczaniu nieuczciwej konkurencji. Dz. U. Nr 47, poz. 211, z 1996r. Nr 106, poz. 496, z 1997r. Nr 88, poz. 554, z 1998r. Nr 106, poz. 668.
4. Internet sites: www.uprp.pl, www.epo.org, www.wipo.org, uspto.org, OHIM, etc.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Ochrona własności intelektualnej i przemysłowej
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Mechanical Engineering and Machine Building (MBM) / Power Engineering (ENG)

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1MBM_W16 or K1ENG_W13	C1- C4	Lec1-Lec8	N1, N2, N3
PEK_W02				
PEK_W03				
PEK_W04				