Faculty of Mechatronics and Mechanical Engineering

Courses available in English since 2017/2018

Winter semester

No.	Course title	Lecture	Class	Lab	Project	ECTS
1	*Metrology*	*15*	*15*	*15*		*4*
2	*Hydraulic and Pneumatic Drives and Control*			*15*		*2*
3	*Experimental Mechanics*	*6*		*24*		*3*
4	*PLC Controllers and Digital Regulators*			*30*		*3*
5	*Databases in Production Systems*	*15*		*30*		*4*
6	*Strength of Materials*	*30*				*3*
7	*Engineering Mechanics*	*30*				*3*
8	*Safety and Protection Equipment*	*15*		*15*		*3*
9	*Manufacturing Technologies I*			*45*		*3*
10	*Global Logistics*	*15*			*15*	*2*
11	*Fundamentals of Thermal Engineering*	*15*	*15*	*15*		*5*
12	*Contemporary Production Technologies in Transportation Devices*	*30*		*15*		*4*

Summer semester

No.	Course title	Lecture	Class	Lab	Project	ECTS
13	*Metal Science*			*15*		*2*
14	*SCADA/HMI Industrial Data Visualisation and Backup Systems*			*30*		*3*
15	*Modelling and Simulation of Process Dynamics*	*30*		*15*		*4*
16	*Factors and effects of acoustical hazards*	*15*		*15*		*4*
17	*Methodology of operation of OHS services*	*30*				*3*
18	*Real time systems*	*15*		*30*		*4*
19	*Fundamentals of automation*			*15*		*2*
20	*Theory of machines*	*15*			*15*	*4*
21	*Fluid Mechanics*	*15*	*15*	*15*		*3*
22	*C Programming*			*30*		*3*

COURSES DESCRIPTION

1. Metrology

Course title in English	Metrology
Course form*	L, C, Lab
Hours required for whole semester	15L+15C+15Lab
ECTS	4
Department in charge of the course	Department of Manufacturing Engineering and Metrology
Supervisor	Dr. Krzysztof Stepien
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

: L – *lectures*, C – *classes*, Lab – *laboratory classes (laboratory practicals)*, P – *project/design

Objectives of the course:

The aim of the course is to familiarize students with methods and tools applied in length and angle measurements. Students should be able to apply basic measurement techniques in product quality control and to plan the range and methodology of tests and measurements; they should be able to prepare reports on tests containing measurement uncertainty analysis with the use of mathematical statistics methods.

The scope of the course

Lectures	The essence of metrology, division, and significance in various branches of science and technology; basic notions and definitions. Definition of value, values types; values systems; units of measurement; systems of measurement units. Measurement methods, measurement error, definitions, classification, general methods of calculation and the selected issues of the probability calculus. The selected problems of mathematical statistics which are applicable in metrology. The methods of calculating accidental errors in direct and indirect measurements; the methods of determining and eliminating systematic errors. Examples concerning the analysis and synthesis of accidental and systematic errors. Measuring instruments: division, construction, components, metrological and functional properties.
Classes	Basic principles of calculating tolerances and fits. Probability calculus: distribution parameters – calculating and interpretations. Error calculus; random errors in direct and in indirect measurements.
Laboratory classes	The construction, components, and principle of operation of measuring instruments. An analysis of random errors in direct measurements. An analysis of random errors in indirect measurements. Determining the accuracy class of measuring instruments. Comparative tests of metrological properties of measuring instruments. Modern measurements on geometrical structure concerning machine parts.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Class	A written test at the end of the semester, two homeworks to be done in teams.
Laboratory class	Written reports from the experimental work.

References

1. Humienny Z. et al. Geometrical Products Specifications – course for technical universities. WNT, Warszawa 2004
2. Jakubiec W., Malinowski J.: Metrologia wielkości geometrycznych. WNT Warszawa 2007, wydanie V
3. Adamczak S. Makieła W. Metrologia w budowie maszyn. Zadania z rozwiązaniami. WNT Warszawa 2007, wydanie II zmienione.
4. Adamczak S. Makieła W. Podstawy metrologii i inżynierii jakości dla mechaników. Ćwiczenia praktyczne. WNT Warszawa 2010, wydanie I
5. Adamczak S. Pomiary geometryczne powierzchni. Zarysy kształtu, falistość i chropowatość. WNT Warszawa 2008

2. Hydraulic and Pneumatic Drives and Control

Course title in English	Hydraulic and Pneumatic Drives and Control
Course form*	Lab
Hours required for whole semester	15Lab
ECTS	2
Department in charge of the course	Department of Mechatronic Systems
Supervisor	Dr. Piotr Woś
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is provide students with knowledge on basic physical phenomena connected with energy conversion, the law of conservation of energy, the principle of conservation of mass, and the principle of conservation of momentum in hydraulic and pneumatic systems. Another objective includes teaching the structure and principle of operation concerning basic elements and control systems of hydraulic and pneumatic systems. Finally, the objective of the course is also to give practical information on construction, designing and controlling hydraulic and pneumatic drives, aiming at their application in machines as well as devices for production automation.

The scope of the course

Introductory classes: familiarising students with the elements and hydraulic and pneumatic diagrams. Discussing the principles of safe exploitation of hydraulic and pneumatic drives.
The methods of controlling the velocity of pneumatic drives. Throttle-non-return and rapid exhaust valves.
The structure of pneumatic logic systems (Boolean logic) as well as pneumatic sensors.
The structure of control systems of pneumatic drives – designing and making pneumatic control systems.
The structure of control systems of hydraulic drives – throttle and parallel control.
The structure of control systems of hydraulic drives – capacity control.
Efficiency and power loss measurements in hydraulic and pneumatic systems.

Methods of assessing of teaching results

Checking a student's preparation to laboratory classes. Assessing the ability of selecting the elements and building control systems of hydraulic and pneumatic drives at a laboratory workstand. Assessing a student's activity during teamwork.

References

1. Dindorf R. pod red.: Hydraulika i Pneumatyka. Podręcznik Akademicki. Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2003.
2. Dindorf R.: Modelowanie i symulacja nieliniowych elementów i układów regulacji napędów płynowych. Monografia nr 44. Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2004.
3. Dindorf R.: Napędy płynowe. Podstawy teoretyczne i metody obliczania napędów hydrostatycznych i pneumatycznych. Podręcznik akademicki. Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2009.
4. Dindorf R. Elastyczne aktuatory pneumatyczne. Monografia. Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2013.

3. Experimental Mechanics

Course title in English	Experimental Mechanics
Course form*	L, Lab
Hours required for whole semester	6L+24Lab
ECTS	3
Department in charge of the course	Department of Machine Design
Supervisor	Prof. Andrzej Neimitz, Assoc. Prof. Jarosław Gałkiewicz
Course level	Masters's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

Presentation of structural integrity assessment methods for elements containing crack-like defects. Stress fields near a crack tip in linear-elastic and in elastic-plastic materials, stress intensity factor, J-integral.
Guidelines for true strain- stress curve plotting; methods of evaluation of fracture toughness, critical value of stress intensity factor K_{IC}, critical value of J-integral - J_{IC}, crack tip opening displacement δ_{TC}. Guidelines for S-N curves.

The scope of the course

Lectures	Isotropic linear elastic material, non-linear elastic material, elastic-plastic material. Constitutive relations, strain and stress tensor. Tensile test, yield strength, ultimate tensile strength; true strain-true stress curve plotting , strain hardening (work hardening), strain energy. The stress distribution in front of a crack tip in linear elastic material. Williams formulas, the stress intensity factor (SIF). Critical value of SIF, KIC, fracture criterion. Energy-balance approach to fracture, strain energy release rate. Strain and stress field in front of a crack tip in non-linear elastic or elastic-plastic material. HRR solution. J-integral. Energy-balance approach to fracture in elastic-plastic materials. Critical J-integral - JIC, fracture criterion. Strain distribution near a crack tip, crack tip opening displacement CTOD, critical value of a crack tip opening displacement.
Laboratory classes	Modern tensile test machines, the principles and programming Organization of measurements, calibration of the sensors and the measuring channels Evaluation of material properties in tensile test. Fracture toughness of elastic material, evaluation of stress intensity factor critical value, KIC Evaluation of brittle fracture assessment (MML method) and master-curve construction Fracture toughness of elastic-plastic material, Critical J-integral evaluation – JIC, the multiple specimen test technique Fracture toughness of elastic-plastic material, Critical J-integral evaluation – JIC, compliance method. Fracture toughness of elastic-plastic material, Critical J-integral evaluation – JIC, electrical potential drop method. Fracture toughness of elastic-plastic material, evaluation of critical value of crack tip opening displacement δTC Evaluation of fracture toughness of material during dynamic loading Fatigue of materials, guidelines for S-N curve plotting and fatigue strength assessment

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Laboratory classes	Tests during laboratory classes, reports from the experiments.

References

1. Neimitz. Mechanika pękania, Wydawnictwo naukowe PWN, Warszawa, 1998.
2. Neimitz, I. Dzioba, M. Graba, J. Okrajni. Ocena wytrzymałości trwałości i bezpieczeństwa pracy elementów konstrukcyjnych zawierających defekty, Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2008.
3. J. Gałkiewicz, Z. Lis, R. Molasy, A. Neimitz. Mechanika doświadczalna Wydawnictwo Politechniki Świętokrzyskiej, Skrypt nr 349, Kielce 1999.
4. ASTM E1737-96. Standard Test Method for J-Integral Characterization of Fracture Toughness.
5. 5 5. ASTM E1820-09. Standard Test Method for Measurement of Fracture Toughness. Annual book of ASTM standards, vol. 03.01, 2011, pp1070-1118.

6. FINTET Fitness for Service (FFS) Procedure – Final Draft, 2006.

4. PLC Controllers and Digital Regulators

Course title in English	PLC Controllers and Digital Regulators
Course form*	Lab
Hours required for whole semester	30Lab
ECTS	3
Department in charge of the course	The Department of Automation and Robotics
Supervisor	Dr. Hubert Wiśniewski
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – lectures, C – classes, Lab – laboratories (laboratory practicals), P – project/design

Objectives of the course:

The aim of the course is to acquaint students with knowledge of the architecture of PLC controllers as well as knowledge and abilities of programming PLC controllers (including development of PID controllers). Another aim includes obtaining knowledge and skills which enable students to select a controller for given tasks of device and industrial devices regulation and control.

The scope of the course

Basic elements of a ladder language – transmitter/relay contacts and coils. The realisation of logic functions in a ladder language. Reference with binary organisation (logic product, logic sum, negation, switching-off alternative – XOR; logic product negation – NAND Sheffer function; logic sum negation – the Peirce function).
Counters, clocks, arithmetic and relations in a ladder language. References with word organisation.
Water circulation system in a swimming pool. A program controlling an object model.
Production line – filling bottles with lemonade. A program controlling an object model.
Automatic washing machine. A program controlling an object model.
A lift. A program controlling an object model.
Modelling digital controllers with the use of Simulink package. A program controlling an object model.
Introduction to Proficy Machine Edition software – handling basic application functions.
Preparing and configuring PLC controllers in Proficy Machine Edition application.
Basic blocks of a ladder language in Proficy Machine Edition application.
Advanced blocks of a ladder language in Proficy Machine Edition application.
Controlling traffic light operation – Proficy Machine Edition application.
Object control (heating and cooling with the co-operation of a digital controller).
Application controlling an inverter-motor execution system.

Methods of assessing of teaching results

A final laboratory test at the end of the semester. Reports from the experiments.

References

1. Sałat R. i inni. Wstep do programowania sterowników PLC. Wydawnictwa Komunikacji i Łączności, Warszawa, 2010.
2. Kwaśniewski J. Sterowniki PLC w praktyce inżynierskiej. Wydawnictwo BTC, Legionowo 2008
3. Kwaśniewski J. Programowalny sterownik SIMATIC S7-300 w praktyce inżynierskiej. Wydawnictwo BTC, Legionowo 2009
4. Świder J. i inni. Sterowanie i automatyzacja procesów technologicznych i układów mechatronicznych. Wydawnictwo Politechniki Gliwickiej, Gliwice 2012
5. Kasprzyk J.: Programowanie sterowników przemysłowych, Wydawnictwa Naukowo-Techniczne, Warszawa, 2006.
6. Pietrusewicz K. Dworak P. :Programowalne sterowniki automatyki PAC, Wydawnictwo Nacom, Poznań, 2007
7. Dzierżek K. Programowanie sterowników GE Fanuc w przykładach i zadaniach. Wydawnictwo Politechniki Białostockiej, Białystok 2007
8. Boel-Plater Bogdan Układy wykorzystujące sterowniki PLC. Projektowanie algorytmów sterowania. Wydawnictwo Naukowe PWN SA Warszawa 2008
9. Jakuszewski R. Programowanie systemów SCADA. Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice, 2006.
10. Kamiński K. Programowanie w STEP 7 MicroWin., 2006
11. Sławomir Kacprzak. Programowanie terowników PLC zgodnie z normą IEC61131-3 w praktyce. Wydawnictwo BTC, Legionowo 2011.
12. Stanisław Flaga. Programowanie sterowników PLC w języku drabinkowym. Wydawnictwo ResNet, Skawina, 2006.
13. Ryszard Jakuszewski. Programowanie systemów SCADA. Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice, 2006.

14. Documentation of GE Fanuc Companzz.
15. Biuletyny Automatyki firmy Astor www.astor.com.pl

5. *Databases in Production Systems*

Course title in English	Databases in Production Systems
Course form*	L, Lab
Hours required for whole semester	30L+15Lab
ECTS	4
Department in charge of the course	The Department of Automation and Robotics
Supervisor	Dr. Jarosław Zwierzchowski
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – lectures, C – classes, Lab – laboratories (laboratory practicals), P – project/design

Objectives of the course:

The aim of the course is to teach students to build database models and databases. Particular attention has been drawn to designing and implementing relational databases. A student will also be familiarised with industrial applications of databases: in CAD/CAM systems, in technological design systems concerning production preparation, in control systems, integrated automated manufacturing systems. A student understands the design methodology concerning relational databases. A student can create queries for a single and multiple queries; a student can also create and manage SQL procedures.

The scope of the course

Lectures	Basic notions: a database, Database Management System (DBMS), data logic models (relational, object, object-relational, semi-structured – XML base), the elements of a database system and the associated standards, and a database system life cycle. The analysis of information indispensable in designing databases: the characteristic of object area and its environment, user identification, data specification (indispensable in describing objects from the point of view of information stored in a database – attributes). Designing databases. Modelling data with the use of entity relationships and UML diagrams. Standardisation checking the conditions of data correctness and data integration. The transformation of data model to the diagram of a relational database. Creating (implementing) databases with the use of creators and the SQL language. Data processing recorded in a base with the use of queries and simple procedures of the SQL language as well as query creators. Designing a user interface for simple database console applications. Data safety. Databases in a distributed environment: databases in a customer-server applications, network Internet applications, and data warehouses. Application models. Technologies applied in distributed environments. Databases in engineering systems: CAD/CAM systems, systems supporting technical production preparation, control systems, and integrated management systems.
Laboratory classes	Installing the SQL Microsoft package. Describing the functionality of a database management program. Introduction to relational databases. Designing databases – a logic project. Designing databases – a physical project and database relations. Designing databases – implementing a base in the SQL Microsoft environment and relational diagrams. SQL queries to one array – filtering verses with the use of key words, e.g. SELECT, FROM, WHERE, DISTINCT, BETWEEN, and LIKE. SQL queries to one array with the use of key words, e.g. IN, ORDER BY, DESC, TOP, %, OR, AND, NOT, etc. Queries to multiple arrays – simple and complex subqueries, joining arrays with the use of the Inner/Outer Join On operator. Queries to many arrays – expressions and operators, algorithmic functions, chain, date, and time functions. Queries to multiple arrays – work with value groups, aggregate functions, key words, COUNT, GROUP BY, HAVING, SUM, AVG, MIN, MAX, etc. Updating the existing data – INSERT, UPDATE, and DELETE queries. Introduction to compound procedures. Compound procedures (Create/Alter Procedure), operators, and parameters passed to procedures. Implementing databases designed by students, SQL queries to these bases. A revision.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester

Laboratory classes	A final laboratory test at the end of the semester

References

1. Garcia-Molina H.,Ullman J.D.,Widom J.: Systemy baz danych. Pełny wyklad, Wydawnictwo Naukowo-Techniczne ,Warszawa 2006.
2. Darie Z., Ruvalcaba Z. ASP. NET 2.0, Wydawnictwo Helion, Gliwice 2007.
3. Joe Mayo. C#3.0 dla NET 3.5. Księga eksperta. Wydawnictwo Helion, Gliwice 2010.
4. Zawadzki M. SQL Server 2005, Wydawnictwo Mikom, Warszawa 2006.
5. Banachowski. L.,Stencel K. i inni Relacyjne bazy danych. Wykłady i ćwiczenia. Wydawnictwo Polsko-Japońskiej Wyższej Szkoły Technik Komputerowych, Warszawa 2009.
6. Banachowski. L.,Stencel K. i ini Systemy baz danych. Wykłady i ćwiczenia. Wydawnictwo Polsko-Japońskiej Wyższej Szkoły Technik Komputerowych, Warszawa 2004.
7. Jewtuszenko O., Trochimczuk R. Relacyjne bazy danych. Ćwiczenia praktyczne. Wydawnictwo Politechniki Białostockiej, Białystok 2005.
8. Majczak A. SQL przykłady praktyczne. Wydawnictwo MIKOM, Warszawa 2002.
9. Królikowski Z. Hurtownie danych. Logiczne i fizyczne struktury danych Wydawnictwo Politechniki Poznańskiej, Poznań 2007.
10. .Johnson E, Jones J. Modelowanie danych w SQL Serwer 2005 i 2008, Wydawnictwo Helion 2009
11. Biblioteka MSDM Microsoft, http://msdn.microsoft.com/en-us/library

6. *Strength of Materials*

Course title in English	Strength of Materials
Course form*	L
Hours required for whole semester	30L
ECTS	3
Department in charge of the course	Department of Mechanics
Supervisors	Prof. Leszek Radziszewski and dr. Anna Wróbel-Knysak
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to provide knowledge on basic values describing deformed bodies (stress, displacement, and deformation) as well as basic problems connected with construction behaviour and safety (simple material strength cases, tensile strength hypotheses, buckling, etc.)

The scope of the course

The fundamentals of materials strength, the tasks, assumption, and subject simplification. Material models and the classification of construction models. A stress vector and the stress condition in a point.
The analysis of a flat stress state – transformation, determining main directions, and Mohr's wheel. Displacement vector. Distortion condition in a point – relative elongations, shape deformations, geometric relationships, mainstreams.
Basic physical relationships, the diagram of stretching soft and high-carbon steel. Hook's law in one-way shear state. Generalised Hook's law.
The geometry of a rod cross-section – centres of gravity, axial, and polar section inertia moment. Main central inertia axes of a cross-section.
Internal forces in a rod and the classification of material strength cases. Stretching – the analysis of displacements, deformations, and stresses; material strength condition.
The cases of statically undeterminable stretching, stresses induced by assembly errors, and thermal stresses. Shearing, clear shearing, and technological shearing.
Rod torsion with circular section, the analysis of deformations and stresses, maximum stresses and shaft torsion angle, material strength condition.
Bending, the diagrams of shearing forces and bending moments, the description of deformations concerning a bent support; the analysis of stresses in a bent rod; material strength condition.
Tangent stresses during bending. Deflection lines of supports and a differential equation of the deflection line.
Deformation energy – the energy of capacity and shape deformation. Material strength hypotheses – the Huber-Mises-Hencky hypothesis, the hypothesis of the largest static stresses.
Practical utilisation of material strength hypotheses to analyse complex rod strength cases.
Rod buckling – Euler's formula, smoothness and boundary smoothness, spring-elastic buckling.
Deformation energy of rod constructions, Betti's theorem, determining displacement in rod structures with the Maxwell-Mohr method.
The elements of thin plate theory: assumptions and basic relationships.
Stress concentration. Material fatigue.

Methods of assessing of teaching results

A written test at the end of the semester

References

1. Niezgodziński M. E., Niezgodziński T.: *Wytrzymałość materiałów*. Warszawa, PWN 2002
2. Gierulski W., Miksa M., Radowicz A.: *Mechanika techniczna.* Politechnika Świętokrzyska, Skrypt 291, Kielce 1996
3. Jakubowicz A., Orłoś Z.: *Wytrzymałość materiałów*. Warszawa, WNT 1984 (lub inne wydania)
4. Brzoska Z.: *Wytrzymałość materiałów*. Warszawa, PWN 1974
5. Konarzewski Z.: *Podstawy technicznej mechaniki ciała stałego*. Warszawa, WNT 1985

7. *Engineering Mechanics*

Course title in English	Engineering Mechanics
Course form*	L
Hours required for whole semester	30L
ECTS	3
Department in charge of the course	Department of Mechanics
Supervisor	Prof. Leszek Radziszewski and dr. Anna Wróbel-Knysak
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to provide students with knowledge on: understanding basic phenomena connected with the interaction of solid bodies; expressing these expressions with the use of forces; the ability of mathematical presentation of the equilibrium state of a simple mechanical system; understanding the phenomenon of the point and solid motion; understanding the causes of motion; the ability of mathematical description as regards the motion of a material point and a rigid solid.

The scope of the course

Basic concepts concerning mechanics. A rigid body, construction, bonds, force, and systems of forces. The axioms of mechanics. The third law of dynamics.
The first law of dynamics. Equilibrium of a middle system of forces. A plane and spherical system of forces. A couple of forces.
The moment of a system of forces.
The moment of a force against a pole and against an axis. Reducing a plane arbitrary system of forces.
The equilibrium of a plane arbitrary system of forces. Supports, determining the reaction of bonds. Complex systems.
The reduction and equilibrium of a spherical arbitrary system of forces.
The phenomenon of friction. The force of friction. The friction of bands. Band brake. The resistance of friction.
The centre of mass of a rigid body. Inertia moment of a rigid body against the axis. Steiner's theorem.
The kinematics of a point. The equations of motion, velocity, and acceleration of a point.
The kinematics of a rigid body. Translatory and rotational motion. Gears.
Plane motion of a rigid body. Temporary centre of rotation.
The dynamics of a material point. Second law of dynamics. The rotation of a point under the influence of a time-dependent force, the forces of viscous resistance, and the forces of dry friction.
The dynamics of a body in a rotational motion. The dynamics of complex systems. A cable winch. A gear.
The dynamics of a body moving with a plane motion.
The work of a force. Power. Device efficiency.
Potential and kinetic energy. The principle of equilibrium as regards kinetic energy and work. The principle of conservation of mechanical energy.

Methods of assessing of teaching results

A written test at the end of the semester

References

1. J. Leyko: Mechanika ogólna t. I i II . PWN 2001.
2. Z.Engel, J. Giergiel : Mechanika ogólna cz. I i II. Wyd. AGH 2006.
3. J. Leyko, Szmelter : Zbiór zadań z mechaniki ogólnej. PWN 1998.
4. J. Osiecki, Z. Koruba : Mechanika elementarna. Skrypt PŚk nr 417
5. J. Giergiel, Uhl : Zbiór zadań z mechaniki ogólnej. PWN 1998.
6. Misiak : Mechanika ogólna cz. I, II i III. PWN 2003..

8. *Safety and Protection Equipment*

Course title in English	Safety and Protection Equipment
Course form*	L, Lab
Hours required for whole semester	15L+15Lab
ECTS	3
Department in charge of the course	Department of Mechanics
Supervisor	Prof. Leszek Radziszewski and dr. Anna Wróbel-Knysak
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to provide knowledge and skills on basic factors which pose hazard for an employee's health as well as basic problems connected with maintaining OHS conditions.

The scope of the course

Lectures	Basic definitions of protective and safety equipment. Basic requirements for the personal protection measures. The procedures of assessing conformity and the methods of assessing the means of individual protection. Exemptions from the PEE directive. Links to other directives concerning the measures of personal protection. Basic principles concerning health and safety. Harmonized standards. Materials applied for producing the measure of personal protection. Analysing mechanical properties of polymers, fibres, and ceramic materials. Analysing mechanical properties of composites. Analysing protective properties of bullet- and knife-proof. Analysing protective properties of helmets. Protective properties as regards outer clothing and gloves. Analysing protective clothes of noise muffs. Analysing protective properties of glasses.
Laboratory classes	Static tensile test of composite materials. Determining stresses in the bent composite support with the tensometric method. Determining mechanical properties of polyester plastics. Determining resistance to static punch of composite fabrics. Determining resistance to dynamic punch of composite fabrics. Testing protective properties of antivibration gloves. Testing protective properties of glasses.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Laboratory classes	Written tests during laboratory classes

References

9. *Manufacturing Technologies I*

Course title in English	Manufacturing Technologies I
Course form*	Lab
Hours required for whole semester	45Lab
ECTS	3
Department in charge of the course	Department of Applied Computer Science and Armament Engineering
Supervisor	Dr. Renata Mola, dr. Tomasz Miłek and dr. Piotr Thomas
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to familiarise students with forging, binding, and metal forming technologies which are applied in industry together with practical learning of the selected manufacturing technologies.

The scope of the course

OHS principles binding in the Forging Laboratory. Forging equipment and forging models.
Moulding and core sands.
The methods of testing moulding sands: sieve analysis, testing binding agent content.
Testing technological properties of moulding sands.
Moulding with the use of a core model, making a core.
OHS principles binding in the Welding Laboratory. Gas welding and thermal cutting.
Welding and hand flame-plating with coated electrodes.
Arc welding in protective gas covers.
Automatic submerged arc welding.
Selecting the parameters of metal resistance welding.
Testing the selected phenomena which accompany soldering.
Non-destructive tests of welded joints.
OHS principles binding in the Metal Forming Laboratory. Deep drawing and redrawing cylindrical drawpieces.
Blanking (also with the use of shears).
The methods of bending sheet metal: arching, flanging, and reeling.
Rod drawing.
Longitudinal rolling of sheet metal.
Forward and backward extrusion of full profiles.

Methods of assessing of teaching results

Written test during laboratory classes. Written reports from the laboratory classes. Final test at the end of the semester.

References

1. Perzyk M. i inni: Odlewnictwo. WNT, Warszawa 2004.
2. Falęcki Z.: Podstawy formowania z modeli odlewniczych. Wydawnictwa AGH, Kraków, 1994.
3. Bińczyk F.: Konstrukcyjne stopy odlewnicze, WPŚ, Gliwice 2003.
4. Rączka J., Tabor A.: Odlewnictwo, Skrypt Politechnika Krakowska, Kraków 1997.
5. Ferenc K., Ferenc J.: Konstrukcje spawane. Projektowanie połączeń. WNT, Warszawa 2000.
6. Klimpel A.: Spawanie, zgrzewanie i cięcie metali. Technologie. WNT, Warszawa 1999.
7. Jakubiec M., Lesiński K., Czajkowski H.: Technologia konstrukcji spawanych. WNT, Warszawa 1983.
8. Erbel J i inni.: Encyklopedia technik wytwarzania stosowanych w przemyśle maszynowym. Tom I, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001.
9. Sińczak J. i inni: Procesy przeróbki plastycznej. Wydawnictwo naukowe AKAPIT, Kraków 2003.
10. Kapiński S.: Kształtowanie elementów nadwozi samochodów. WKŁ, Warszawa 1996.
11. Richert J.: Innowacyjne metody przeróbki plastycznej. Wydawnictwa AGH 2010.
12. Rudol F.: Ćwiczenia laboratoryjne z odlewnictwa. Skrypt PŚk., Kielce, 1988.
13. Sińczak J. i inni: Procesy przeróbki plastycznej – ćwiczenia laboratoryjne. Podstawy teoretyczne i wykonawstwo ćwiczeń AKAPIT, Kraków 2001.
14. Mazurkiewicz A., Kocur L.: Obróbka plastyczna - laboratorium. Wydawnictwo Politechniki Radomskiej. Radom 2001.

10. *Global Logistics*

Course title in English	Global Logistics
Course form*	L, P
Hours required for whole semester	15L+15P
ECTS	2
Department in charge of the course	Laser Processing Research Centre
Supervisor	Assoc. Prof. Wojciech Żórawski
Course level	Masters's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The objective of the course is to familiarize students with state-of-the-art on problems relating to global logistics. Components of global processes and systems will be discussed, logistics-based relations of enterprises on global market will be presented and an analysis of fundamental logistics-based processes dependent on means of transport will be conducted. Functions of logistics-based management in global market will be described as well as inter-organizational forms and principles of logistics-based management in this field.

The scope of the course

Lectures	International Supply Chain Management International Logistics Infrastructure Methods of Entry into Foreign Markets International Contracts International Ocean Transportation International Air Transportation International Land and Multimodal Transportation
Project	Entry into Foreign Markets Types of International Contracts Project of Ocean Transportation Project of Air Transportation Project of Multimodal Transportation

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Project	Projects developed by students as home assignments.

References

1. Pierre David, Richard Steward: International Logistics. Thomson 2008.
2. Alan Rushton, Steve Walker: International Logistics and Supply Chain Outsourcing. Kogan Page Limited 2009.
3. Gołembska Elżbieta, Szymczak Maciej: Logistyka międzynarodowa. Wydawca: PWE, 2004,ISBN: 8320815207.
4. Gołembska Elżbieta LOGISTYKA MIĘDZYNARODOWA W GOSPODARCE ŚWIATOWEJ. Wyd. DIFIN, 2010, ISBN: 9788376413280.
5. Neider Janusz: Transport międzynarodowy. PWE 2008.
6. Nowoczesne Rozwiązania w Logistyce. Opracowanie zbiorowe. Oficyna Wydawnictwo, 2009.

11. *Fundamentals of Thermal Engineering*

Course title in English	Fundamentals of Thermal Engineering
Course form*	L, C, Lab
Hours required for whole semester	15L+15C+15Lab
ECTS	5
Department in charge of the course	Department of Mechanics
Supervisors	Assoc. Prof. Robert Pastuszko, dr. Hubert Kaniowski
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	YES

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to provide students with knowledge on basic physical phenomena applied in thermodynamics and heat transfer; other aims include: the ability of balancing closed and open thermodynamic systems; solving technical problems on the basis of the laws of thermodynamics.

The scope of the course

Lectures	Basic notions and definitions: energy, a thermodynamic system, thermodynamic parameters, the concept of the state of system and thermodynamic equilibrium. Unit values applied in thermodynamics. Internal energy. The zeroth law of thermodynamics. Work and heat as methods of energy transfer between systems. The first law of thermodynamics for closed (with controlled mass) and open systems (with controlled capacity/volume). The procedures of balancing energy, examples of energy analysis. The equation of state for an ideal gas, specific heat at constant pressure and capacity/volume for an ideal gas. Characteristic ideal gas transformations, polytropic transitions. The equation of state of a real gas. The second law of thermodynamics: equilibrium axiom, the properties of entropy, reversible and irreversible transitions, entropy as a function of state. Gibb's equation. Clapeyron's equation and other differential relationships. The application of the second law of thermodynamics for energy conversion systems. Examples of thermodynamic cycles: Carnot's cycle and engine cycles. Cycle efficiency. Fans and compressors. Cooling cycles, compressing and sorption refrigerators. Heat pumps. Unconventional energy sources. The following concepts: simple substance, phase, and mixture. Water vapour transitions: saturation curves, humid and overheated vapour, critical parameters, a triple point, the properties of gas mixtures, and two-phase mixtures. Humid air and its transitions. The Molier diagram for humid air. Basic information on heat transfer (conduction, transfer, radiation, and transmission). Proximity numbers and criteria equations in heat transfer. Basic information on the combustion processes.
Classes	Thermodynamic parameters (temperature, pressure, and proper capacity/volume), physical features of fluids: mass, density, capacity/volume, and units applied in thermodynamics. Basic energy balances. The equations of state of an ideal gas. The first law of thermodynamics: internal energy and enthalpy. Work at volume change in a gravitational field, in accelerated and rotational motion. The application of the first law of thermodynamics for closed systems. Gas transitions: ideal and real. The first law of thermodynamics for open systems: the law of conservation of energy, flow machines: a nozzle, a turbine. Carnot's cycle, refrigerator, a heat pump. Sample tasks on heat transfer: a flat wall, convection.
Laboratory classes	Introduction. The requirements as regards obtaining a credit. Familiarising students with OHS and fire-protection regulations in the Laboratory of Thermodynamics. The principles of preparing experimental data. Temperature measurement. Temperature measuring instruments. Practical analysis of the method of installing thermometers in installations. Testing heat pipes. Pressure measurement. Calibrating spring manometers. The relationship between the physical state and temperature as well as pressure. Determining temperature distribution with the use of thermovision camera. A sun collector.

	Combustion heat measurement and determining combustion value of solid/gaseous fuels.

Methods of assessing of teaching results

Lectures	A written an open-answer test at the end of the semester
Classes	Written tests during classes. A final test at the end of the semester
Laboratory classes	Written tests during laboratories. Written reports from the laboratories.

References

1. Yunis A. Cengel, Michael A. Boles: Thermodynamics: An Engineering Approach, New York : McGraw-Hill Publishing Company, 1989
2. Howell, John R. : Fundamentals of engineering thermodynamics, New York McGraw-Hill Book Company, cop. 1987
3. Michael J. Moran, Howard N. Shapiro : Fundamentals of engineering thermodynamics, Chichester : John Wiley & Sons, 1998
4. Staniszewski B.: Termodynamika, PWN, Warszawa 1986
5. Wiśniewski S.: Termodynamika Techniczna . Wydawnictwa Naukowo-Techniczne, 1999
6. Gdula S. J. :Przenoszenie ciepła : praca zbiorowa. PWN, Warszawa, 1980
7. Bayazitoglu, Y. Ozisik, Necati M.: Elements of Heat Transfer . McGraw-Hill Book Company, New York, 1988

12. *Contemporary Production Technologies in Transportation Devices*

Course title in English	Contemporary Production Technologies in Transportation Devices
Course form*	L, Lab
Hours required for whole semester	30L+15Lab
ECTS	4
Department in charge of the course	Laser Processing Research Centre
Supervisor	Dr. Piotr Sęk
Course level	Bachelor's degree
Implementation period in the academic year	Winter semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The course is focused on theoretical fundamentals and possible applications of modern manufacturing technologies concerning transport devices. Physical fundamentals of the above-mentioned technologies (together with their characteristics) will be discussed during the lectures. The following issues will be discussed as well: the range and constraints of a particular technology, the obtained material properties after machining and the construction of devices which realise a given technology. In addition, the applications of given technologies (together with the examples of technological documentation) will be presented. Particular attention will be drawn to technologies which utilise concentrated energy flux, i.e. Electro Discharge Machining (EDM), Wire Electrical Discharge Machining (WDEM), Electro Chemical Machining (ECM), Electro Spark Alloying (ESA), Water-Jet, plasma cutting and welding, laser cutting and welding.

The scope of the course

Lectures	Physical fundamentals of machining utilising concentrated energy flux. Plasma and its utlisation in technology. Plasma cutting and welding. Laser cutting and welding. Laser surface machining. Electro Discharge Machining (EDM) Wire Electrical Discharge Machining (WDEM) Electro Spark Alloying (ESA) Electro Chemical Machining (ECM) Water-Jet cutting technology. Threats and OHS training while working with devices for machining utilising concentrated energy flux. Preparing technological documentation for a given technology.
Laboratory classes	Analysing the microstructure of laser-hardened carbon steel. Surface porosity measurement after Water-Jet cutting. Determining technological indicators during WEDM machining. The impact of laser cutting parameters on surface quality. Programming electroerosive machining tools. Assessing the impact of plasma welding parameters on mechanical properties of a weld. Programming laser and plasma machining tool.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Laboratory classes	A final laboratory test at the end of the semester. Written reports from the laboratories.

References

1. Adam Ruszaj - Niekonwencjonalne metody wytwarzania elementów maszyn i narzędzi - Wydawnictwo Instytutu Obróbki Skrawaniem - Kraków 1999
2. Tadeusz Burakowski, Tadeusz Wierzchoń - Inżynieria powierzchni metali - WNT - Warszawa 1998
3. Jan Kusiński - Lasery i ich zastosowanie w inżynierii materiałowej. Wydawnictwo Naukowe „Akapit", Kraków 2000
4. Adam Miernikiewicz - Doświadczalno-teoretyczne podstawy obróbki elektroerozyjnej (EDM). Politechnika Krakowska - Rozprawy - nr 274 - Kraków 2000.
5. Michał Malinowski - Lasery światłowodowe - Wydawnictwo Politechniki Warszawskiej - Warszawa 2003
6. Andrzej Klimpel - Spawanie, zgrzewanie i cięcie metali - WNT - Warszawa 1999
7. Mieczysław Siwczyk - Obróbka elektroerozyjna Tom I i Tom II - Wydawnictwo FNTMS - Kraków 2001
8. Praca zbiorowa pod redakcją Lucjana Dąbrowskiego – Obróbka skrawaniem, ścierna i erozyjna – Wydawnictwo Politechniki Warszawskiej – Warszawa – 2001
9. Piotr Borkowski - Teoretyczne i doświadczalne podstawy hydrostrumieniowej obróbki powierzchni - Wydawnictwo

Politechniki Koszalińskiej - Koszalin 2004

13. *Metal Science*

Course title in English	Metal Science
Course form*	L
Hours required for whole semester	15Lab
ECTS	2
Department in charge of the course	Department of Applied Computer Science and Armament Engineering
Supervisor	Assoc. Prof. Marek Konieczny
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to familiarise students with the structure, properties, and application of metals (together with their alloys) in technology.

The scope of the course

The characteristics of metals.
Examining mechanical properties – tension test
Badanie własności mechanicznych – pomiary twardości i udarności
Metallographic practical chemistry.
The crystallisation of metals and alloys.
Hardening metals through plastic deformation. Recrystallisation.
The structure and properties of casts and shaped products through plastic deformation.

Methods of assessing of teaching results

Written reports from the laboratory classes.

References

1. Przybyłowicz K.: Metaloznawstwo, WNT, Warszawa 2003
2. Przybyłowicz K.: Metaloznawstwo teoretyczne, WNT, Warszawa 2001
3. Blicharski M. : Wstęp do inżynierii materiałowej WNT, Warszawa 2001
4. Ashby M.F., Jones D. R.H.: Materiały inżynierskie, WNT, Warszawa 1995
5. Staub F., Adamczyk J., Cieślakowa Ł., Gubała J., Maciejny A.: Metaloznawstwo, Śląskie Wydawnictwo Techniczne, Katowice 1994.
6. Askeland D.R.: The Science and Engineering of Materials, Wadsworth, Belmont 1984.

14. *SCADA/HMI Industrial Data Visualisation and Backup Systems*

Course title in English	SCADA/HMI Industrial Data Visualisation and Backup Systems
Course form*	Lab
Hours required for whole semester	30Lab
ECTS	3
Department in charge of the course	Department of Automation and Robotics
Supervisor	Dr. Hubert Wiśniewski
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to familiarize students with the fundamentals of systems for data visualisation, control, and storage in industrial systems. The methods of building human-machine interface will be discussed as well.

The scope of the course

Preparing the Proficmy Machine Edition environment to work. Configuring system parameters.
Designing and the implementation of SCADA system architecture with the use of at least two PLC controllers.
Operational panel which controls basic process data monitoring functions.
The realisation of advanced functions connected with the visualisation and monitoring industrial processes (functions based in the VBScript or ViewScript).
The implementation of control-measuring functions with the use SoftPLC module in GE Fanuc operational panels.
Logging process data of the currently assigned industrial process.
Handling alarms connected with the monitored industrial process.
Traffic management centre.
Liquid cooling system.
A remote panel – inverter control as a remote system.
A remote panel – servodrive control with the PI regulation.
Automated feeding system.
Stationary inverter control system.
Redundancy system with the event logging system.
A diagnostic system – utilising PLC diagnostic functions.

Methods of assessing of teaching results

Written tests during laboratory classes

References

1. Technical documents by Astor concerning Proficy Machine Edition and InTouch environment.
2. Technical documents by Astor concerning Communications between PLC controllers.
3. Astor manual concerning programming of PLC controllers by GE.
4. Ryszard Jakuszewski „Podstawy programowania systemów SCADA Wydawnictwo Skalmierski 2009
5. Ryszard Jakuszewsk Programowanie systemów SCADA Proficy HMI/SCADA - iFIX 4.0 Wydawnictwo Skalmierski 2008
6. Ryszard Jakuszewsk Zagadnienia zaawansowane programowania systemów SCADA - iFIX 4.0 Wydawnictwo Skalmierski 2009

15. *Modelling and Simulation of Process Dynamics*

Course title in English	Modelling and Simulation of Process Dynamics
Course form*	L, Lab
Hours required for whole semester	30L+15Lab
ECTS	4
Department in charge of the course	Department of Automation and Robotics
Supervisor	Prof. Radim Farana, Assoc. Prof. Leszek Cedro
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to provide students with knowledge on: the laws and principles which concern building models, the structure of mathematical models, the analysis of problems and skills as regards building simulation models, the structure of computer models and their visualisation, and modelling as well as computer simulation of mechanical and electronic systems.

The scope of the course

Lectures	Basic notions concerning the theory of systems. Similarity, modelling, identification, simulation, and model types. Analysis, synthesis, the 'black box' problem. Mathematical models. Causal condition. Single-dimensional and multi-dimensional mathematical model of dynamic systems. Linear mathematical models. The Laplace transform. Linear differential equations, operational and spectra transmittances, impulse and step responses, linear models of state variables. Control and observation form of single-dimensional models of state variables. The relationships between specific mathematical models. Static characteristics of linear dynamic systems and determining them. Matrix transmittance and multi-dimensional linear models of state variables. Basic connections (series, parallel, feedback) of single- and multi- dimensional linear dynamic systems. The classification of linear dynamic elements. Basic proportional elements – properties. Non-inertia proportional elements (also with first-order and second-order inertia), delaying element, and phase shifter. Basic differential elements – properties. Non-inertia and first-order inertia elements. Integral elements – properties. Non-inertia integral elements (and with first-order inertia). The principles of creating mathematical models. The equations of forces, moments, masses, and energy equilibrium. Second-order Lagrange equations – their application. Creating mathematical models of mechanical systems with translatory and rotational motion. Mathematical models of simple robots. Creating mathematical models of electric systems. Voltage analogy between mechanical and electrical systems. Mathematical models of four-terminal passive networks, operational amplifiers of a DC motor. Creating mathematical models of hydraulic and pneumatic models.
Laboratory classes	Introduction to MATLAB language. Modelling linear models in MATLAB. Solving differential equations in MATLAB. Simple elementary models. Simulation in MATLAB. Introduction to SIMULINK. Simulating simple dynamic models in SIMULINK. Simulating complex dynamic models. Obtaining a credit.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Laboratory classes	Homework assignment (a project)

References

1. Víteček A., Cedro L., Farana R., Modelowanie Matematyczne Podstawy, Podręcznik akademicki ,Wydawnictwo PŚk 2010,

PL ISBN 978-83-88906-28-2
2. Błasiak M., Cedro L., Chrząszcz B.: Rozwiązywanie wybranych zadań z mechaniki analitycznej z użyciem metod numerycznych. Wydawnictwo Politechniki Świętokrzyskiej, Skrypt nr 422, Kielce, 2006
3. Chłędowski M.: Wykłady z automatyki dla mechaników. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów, 2003, ISBN 83-7199-255-6
4. Dindorf R.: Modelowanie i symulacja nieliniowych elementów i układów regulacji napędów płynowych. Monografie, studia, rozprawy Nr 44. Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2004, PL ISSN 0239-4979
5. Peszyński K., Siemieniako F.: Sterowanie procesów, podstawy i przykłady. Wydawnictwa Uczelniane Akademii Techniczno-Rolniczej, Bydgoszcz, 2002, ISBN 83-87274-64-X
6. Spong M. W., Vidyasagar M.: Dynamika i sterowanie robotów. Wydawnictwa Naukowo-Techniczne, Warszawa,1997, ISBN 83-204-2198-5 (tłumaczenie z angielskiego, John Wiley & Sons, 1989)
7. Stefański T.: Teoria sterowania. Tom I. Układy liniowe. Skrypt nr 367. Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2002, PL ISSN 0239-6386
8. Tarnowski W.: Modelowanie systemów. Wydawnictwo Uczelniane Politechniki Koszalińskiej, Koszalin, 2004, ISBN 83-7365-052-0

16. *Factors and effects of acoustical hazards*

Course title in English	Factors and effects of acoustical hazards
Course form*	L, Lab
Hours required for whole semester	15+15Lab
ECTS	4
Department in charge of the course	Department of Mechanics
Supervisor	Prof. Leszek Radziszewski, dr Anna Wróbel-Knysak
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to provide students with knowledge and skills on acoustic factors which are hazardous for the health of an employee; basic issues connected with retaining safety measures as well as vibro-acoustic protection.

The scope of the course

Lectures	The fundamentals of acoustics. The types of acoustic disturbances. The propagation of acoustic waves. Analysis in time and frequency domain. The physiology of the hearing apparatus. The process of hearing. Sound perception theories. The selected issues on construction acoustics. Acoustic parameters of construction objects. The impact of noise and vibrations on a human body. Legal regulations as regards protecting the environment against noise and vibrations in Poland and in the EU. Vibroacoustic hazards in the working environment. The parameters and the methods of limiting hazardous impact on the environment. The methods, sensors, and measuring instruments to monitor vibrations and noise. A test. Acoustic maps and noise barriers. Sound-proof elevations.
Laboratory classes	Calibrating instruments for acoustic measurements. Measurement for a didactic building (building B, Kielce University of Technology) during a break and during classes. Measuring acoustic parameters of a small and large classroom. Measuring acoustic parameters of the auditorium. Measuring acoustic insulation of construction walls. Measuring noise intensity generated by technological devices. Measuring noise intensity generated by a mechanical vehicle. Measuring the impact of a road noise barrier on acoustic fields.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Laboratory classes	Written tests during laboratory classes. Reports from laboratory classes.

References

A. Lecture
1.Engel Z., Ochrona środowiska przed drganiami i hałasem, PWN
Warszawa, 2001.
2. Rozporządzenie Ministra Środowiska z dnia 2 października 2007 r., w sprawie wymagań w zakresie prowadzenia pomiarów poziomów w środowisku substancji lub energii przez zarządzającego drogą, linią kolejową, linią tramwajową, portem. (D.U. nr 192, 2007, poz.
1392).
3. Rozporządzenie Ministra Środowiska z dnia 14 czerwca 2007 r. w sprawie dopuszczalnych poziomów hałasu w środowisku. Dz.U. nr 120 poz. 826.
3. Fugiel D., Szacowanie niepewności pomiarów hałasu, 2002, rozdz. I, II.1 i II.2 http://www.ntlmk.com/D_Fugiel_art1.pdf
http://www.physics2000.com/PDF/Text/
4. Ch 16 FOURIER ANALYSIS,%20 NORMAL MODES AND SOUND.pdf
5. Deutsch D., Hearing music in ensembles, Physics Today February
2010, 40-45
6 . Makarewicz R., Dźwięk w środowisku. Ośrodek Wydawnictw Naukowych, Poznań 1994

7. Makarewicz R., Dzwieki i fale, Wydawnictwo Naukowe UAM, 2009
8. Boeker E., Rienk van Grondelle, Fizyka Środowiska, Wydawnictwa PWN, Warszawa 2002.
9. http://www.engineeringtoolbox.com/nc-noise-criterion-d 725.html
24
10. Harazin B. Ocena i interpretacja wyników pomiarów drgan mechanicznych. na stanowiskach pracy. Bezpieczeństwo Pracy 1996; 1: 19–22
11. Engel Z., Piechowicz ., Pleban d., Stryczniewicz L. Minimalizacja przemysłowych zagrożeń wibroakustycznych – Poradnik. CIOP-PIB, Warszawa, 2005.
12. Engel Z., Piechowicz ., Pleban d., Stryczniewicz L.. Hale przemysłowe, maszyny i urzadzenia-wybrane problemy wibroakustyczne. CIOP-PIB, Warszawa, 2009

B. Laboratory classes
1. User Manual - Sonopan SON 50 – www.sonopan.com.pl

17. *Methodology of operation of OHS services*

Course title in English	Methodology of operation of OHS services
Course form*	L
Hours required for whole semester	30L
ECTS	3
Department in charge of the course	Department of Mechanics
Supervisor	Dr. Anna Wróbel-Knysak
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – lectures, C – classes, Lab – laboratories (laboratory practicals), P – project/design

Objectives of the course:

The objective of the course is to familiarize students with fundamental OHS principles, working stand hazards and methods of protection from potential hazards. Another objective is to provide students with basic terms and rules of ergonomics. The objective of the course is also to teach students the range of rights and responsibilities of employees of OHS service.

The scope of the course

The essence of OHS services. Rules for constitution, qualification requirements and dependencies of OHS service
Rules for an inspection of working conditions by OHS service, regarding working stands of pregnant and breast feeding women, adolescents, disabled employees, etc.
Principles for informing an employer about potential occupation hazards including recommendations aiming at removing the hazards.
Rules for creating periodical reports on an analysis of OHS conditions, containing technical and organizational proposals for avoiding hazards and for improving working conditions.
Rules for participation in modernization and development of working places, participation in an evaluation of documentation relating to modernization and development of working places, including rules for approval new or re-built whole buildings or their parts.
Rules for development of recommendations concerning OHS requirements in current or new production processes. Rules for presenting recommendations relating to preserving principles of ergonomics in a working stand.
Participation in creating and development of internal decrees, regulations and OHS instructions.
Participation in establishing circumstances and causes of accidents at work. Rules for formulation of recommendations resulting from the study on causes and circumstances of these accidents and from falling in occupational diseases. Rules for controlling implementation of these recommendations.
Principles of creating documentations relating to accidents at work, falling in occupational diseases, rules for storing documents.
Consulting application of rules and principles concerning OHS, particitpation in evaluation of occupational risk.
Consulting organizational structure and methods of work in stands exposed to hazardous or health harmful factors and rules for selection best means for protection of employees.
Cooperation with relevant organizational units of persons, in particular in organizing and
assuring high level of trainings in the field of OHS.
Cooperation with laboratories authorized to control and measure factors harmful to health, cooperation with laboratories conducting measurements of environmental conditions.
Participation in consulting problems of OHS and in activities of OHS committees, cooperation with doctors dealing with health care of employees.
Cooperation with work standards and safety inspectorates and with local units on initiating and developing various forms of popularization of problems concerning OHS.

Methods of assessing of teaching results

A written test at the end of the semester

References

1. B. Rączkowski ***BHP w praktyce*** ODDK Gdańsk 2007r
2. D. Koradecka ***Bezpieczeństwo Pracy i Ergonomia*** – CIOP Warszawa 1997
3. Kodeks pracy
4. S. Wieczorek ***Ergonomia*** – „Tarbonus" 2014
5. Rozporządzenie Rady Ministrów w sprawie służby bezpieczeństwa i higieny pracy
6. Rozporządzenie MIPS w sprawie ogólnych przepisów bezpieczeństwa i higieny pracy

18. *Real time systems*

Course title in English	Real time systems
Course form*	L, Lab
Hours required for whole semester	15L+30Lab
ECTS	4
Department in charge of the course	Department of Automation and Robotics
Supervisor	Dr. Michał Kekez
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – lectures, C – classes, Lab – laboratories (laboratory practicals), P – project/design

Objectives of the course:

The aim of the course is to present fundamentals of real time systems, real time operating systems, industrial networks, and distributed automatic control systems.

The scope of the course

Lectures	Definition of a real time system. The areas of application of a real time system. Embedded systems. Time automatons. Structural analysis of real time systems – basic information. API system notion. The features of operating real time systems. POSIX 1003 standard. The names and short characteristics of the most common real time operating systems. QNX in relation to other systems. Equipment aspect. QNX architecture. System micronucleus and its functions: the advantages of its application, elementary set of mechanisms realised by a micronucleus. The program and process. Interrupts, process context, and a process descriptor. Canonic process states and a process states diagram. Threads; more important sources and thread attributes. A scheduler; a priority thread. System nucleus mode and the user mode. Preemptive and co-operative scheduling. Processes and threads in a real time system: asynchronous, synchronous, and second-plan. Scheduling: Round Robin, FIFO, sporadic, and other. System commands and API functions connected with process and threads priorities (together with scheduling strategy). Determining constraints for source use by the process. Sensor networks – basic information. Series transmission handling; API functions; system commands. Sample programs. MODBUS frames in ASCII or RTU modes. Time measurement in the system – hardware mechanisms and their use in the QNX system (appropriate API functions and data types); generating delays; process blocking for a specific period of time; sample programs. NI PCI-6251 card; access to input/output space registers; handling digital inputs and outputs; A/D converters handling; sample programs.
Laboratory classes	QNX system installation. Files and catalogues. Access rights. Basic commands of the QNX system; displaying information about processes; connecting mass memory. System work with significant processor load. Internal device sending data through a serial port to the QNX system – testing handling data transfer. Mini project 1 – building an application which works under control of the QNX system; controlling a determined internal device (depending on the data received by a serial port from an external device with given properties (also with the use of the MOBUS frame). Computer-based test 1. Extension of the mini project No 1 – connecting a graphical user interface. The application of C++ or LabView. The application of time automaton (or their networks) – a system of handling a protected level-crossing. The application of structural analysis of real time analysis – automated underground (a general and conceptual diagram, the specification of the control process with the use of state change diagram). Computer-based test 2. Handling applications in the QNX system for real time data acquisition from the NI PCI-6251 card; source code analysis. Mini project No 2 – extension of the application utilising NI PCI-6251 card (handling analogues or digital outputs). Obtaining a credit for laboratory classes.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester

Laboratory classes	Two computer-based tests, two mini-projects, reports from two assignments

References

1. Ułasiewicz J.: Systemy czasu rzeczywistego QNX6 Neutrino, btc, Warszawa 2007
2. NI PCI-6251 Manual, National Instruments 2009
3. Szmuc T.: Modele i metody inżynierii oprogramowania systemów czasu rzeczywistego, Uczelniane Wydawnictwa Naukowo Dydaktyczne AGH, Kraków 2001
4. Kwiecień A.(red), Gaj P.(red.): Współczesne problemy systemów czasu rzeczywistego, WNT, Warszawa 2004
5. Li Q., Yao C.: Real-Time Concepts for Embedded Systems, CMP Books, 2003
6. Plaza R.A., Wróbel E. J.: Systemy czasu rzeczywistego, WNT, Warszawa 1988
7. Sacha K.: Systemy czasu rzeczywistego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 1999
8. Sacha K.: QNX – system operacyjny, X – Serwis sp. z o.o., Warszawa 1995
9. Sacha K.: Laboratorium systemu QNX, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1995
10. Szmuc T., Szpyrka M.: Metody formalne w inżynierii oprogramowania systemów czasu rzeczywistego, WNT, Warszawa, 2010
11. Olderog E-R, Dierks H.: Real-Time Systems: Formal Specification and Automatic Verification, Cambridge University Press, 2008

19. *Fundamentals of automation*

Course title in English	Fundamentals of automation
Course form*	Lab
Hours required for whole semester	15Lab
ECTS	2
Department in charge of the course	Department of Automation and Robotics
Supervisor	Dr. Jakub Takosoglu
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the laboratory classes is practically familiarise students with the structure and operation of automatic control systems so that it facilitates the utilisation of knowledge obtained during the classes and audit practice on the subject. Laboratory classes are realised with the use of real-life automatic control systems in laboratory versions as well as through computer simulations (work in teams of two or three).

The scope of the course

Determining responses of basic elements (laboratory stands and simulation tests).
Determining static characteristics of measurement converters: linear and angular displacement (pressure and temperature as well).
The identification of the control object in the form of a hydraulic actuator controlled with a valve (or a thermal object).
Determining automatic control response of position control concerning a hydraulic or pneumatic actuator at a laboratory stand.
The synthesis of gas pressure control system with the use of a laboratory stand.
Simulation testing concerning a control object and the system of automatic control with this object.
Testing an on-off temperature control system (laboratory stands and simulation tests).

Methods of assessing of teaching results

Written tests during laboratory classes. Reports from the experimental work.

References

1. Żelazny M.: Podstawy automatyki. PWN Warszawa 1976.
2. Amborski K.: Teoria sterowania w ćwiczeniach. PWN Warszawa 1978.
3. Kaczorek T.: Teoria sterowania i systemów. PWN Warszawa 1996.
4. Stefański T.. Teoria sterowania t.1. Wyd. Politechniki Śk. Skrypt Nr 367. Kielce 2002.
5. Dindorf R., Dziechciarz S., Łaski P.: Laboratorium z podstaw automatyzacji i robotyki. Skrypt Politechniki Świętokrzyskiej nr 371, Kielce 2001.
6. Chłędowski M. Wykłady z automatyki dla mechaników. Wyd. Politechniki Rzeszowskiej 2003.

20. *Theory of machines*

Course title in English	Theory of machines
Course form*	L, P
Hours required for whole semester	15L+15P
ECTS	4
Department in charge of the course	Laser Processing Research Centre
Supervisor	Assoc. Prof. Wojciech Żórawski
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The objective of the course is to provide students with knowledge on general aspects of mechanical engineering relating to vocabulary, design, principles of operation of machines and its parameters. Within the framework of lectures evolutionary processes in technology are presented with a special regard to so-called genetics of construction.

The scope of the course

Lectures	Machines and civilization – classification of machines and theirs role in present world, load of machines, structural materials Water- machines, impeller and displacement pumps, water turbine and hydro-electric power plant – the principle of operations, parameters of work, fundamentals of design Machines applied in hydraulic systems (gear pumps, axial piston pumps, sliding-vane pumps, gerotor pumps), fluid drives, hydraulic and hydrokinetic torque converter, hydraulic manipulators and servo-motors, hydraulic accumulators From windmill to modern wind power plant – evolution of design, compressors and fans – classification, bases and parameters of operation, examples Internal-combustion engines – general classification, piston engines, power and efficiency of engines, feed systems and timing gear systems Jet-propulsion motor, jet engines, ramjet, turbo-jets – operation, examples of construction Machines for machining – classification, construction elements of lathes, drills and milling machines, examples of construction
Project	Project of Impeller Pump Project of Water Turbine Project of Wind Turbine Project of Internal Combustion Engine Project of Jet Engine

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Laboratory classes	Providing projects required by the lecturer.

References

1. Robert L. Norton, "Design of Machinery, An Introduction to the Synthesis and Analysis of Mechanisms and Machines", 3rd Edition, McGraw Hill - Higher Education, 2004,
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Component Design", 3rd Edition, John Wiley & Sons, 2000,
3. Handbook of Diesel Engines, Publisher: Springer, 2010
4. Ernst Mach: The Science Of Mechanics, Metcalf Press, 2007,
5. Aerospace Engineering Desk Reference, Publication : Elsevier LTD., 2009,
6. Prof. Dr.-Ing. Friedrich-Wilhelm Bach, Dr. Andreas Laarmann, Dipl.-Ing. Thomas Wenz: Modern Surface Technology, 2006 Wiley-VCH Verlag GmbH & Co. KGaA
7. K.E. Schneider, V. Belashenko, M. Dratwiński, S. Siegmann, A.Zagorski: Thermal Spraying for Power Generation Components WILLEY-VCH 2006
8. W. Włosinski: The joining of advanced materials. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1999.
9. R.E. Hummel: Understanding materials science : history, properties, applications .

21. *Fluid Mechanics*

Course title in English	Fluid Mechanics
Course form*	L, C, Lab
Hours required for whole semester	15L+15C+15Lab
ECTS	3
Department in charge of the course	Department of Mechanics
Supervisor	Assoc. Prof. Magdalena Piasecka, Assoc. Prof. Robert Pastuszko
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – *lectures*, C – *classes*, Lab – *laboratories (laboratory practicals)*, P – *project/design*

Objectives of the course:

The aim of the course is to familiarise students with physical phenomena connected with fluid statics, kinematics, and dynamics. Another aim is to acquaint students with the ability of analysing the flow system in open and closed pipes and solving technological problems on the basis of fluid mechanics laws.

The scope of the course

Lectures	Introduction to fluid mechanics. Real and ideal fluids. The properties of fluids. Forces interacting with fluids. Fluid statics. Basic equation of fluid statics. The equation of fluid equilibrium in a three-dimensional system. The height of fluid column as the measure of static pressure. Pressure measurement. Overpressure, negative pressure, and absolute pressure. Pascal's law. Manometers. Hydrostatic thrust on surfaces submerged in fluid. Stevin's paradox. Communicating vessels. Relative equilibrium in straight-line motion and in a rotating vessel. Archimedes' principle. The equilibrium of floating solids. Static equilibrium of compressible fluids. The kinematics of fluids – basic notions. The description of fluid motions. The equation of filament continuity. The classification of flows. Stationary flow. The dynamics of fluids – Euler's equation of motion. Bernoulli's equation. The applications of Bernoulli's equation. Fluid rate measurement with the use of pressure tubes. Bernoulli's equations for real fluids. Dynamic equations of viscous fluid (Navier-Stokes). Flows in closed pipes. The Hagen-Poiseuille law. Laminar and turbulent flows. Critical Reynold numbers. Linear and local losses. The similarities of flow phenomena The Coriolis coefficient. Pipes with a constant section – typical issues at calculating pipelines. Flows in open channels. The concept of a boundary layer. The flow around solid bodies by viscous fluids. An outline of gas dynamics.
Classes	Physical properties of fluids: mass and density. Physical properties of fluids: compressibility and expandability. Physical properties of fluids: viscosity. Hydrostatic pressure. Hydrostatic equilibrium. Mass and capacity flow. The equilibrium of filament continuity. Bernoulli's equation for an ideal fluid. Bernoulli's equation for a real fluid.
Laboratory classes	The measurement of static stresses in a fluid. Relative equilibrium of a liquid. Flow visualisation – Reynolds critical number. Determining the coefficient of linear losses in a closed pipe. Determining the coefficient of local losses at water flow in a pipe. Determining the characteristic of a fluid-flow machine.

Methods of assessing of teaching results

Lecture	A written test at the end of the semester
Classes	Written tests during the classes.
Laboratory classes	Written test during the classes. Reports from the experimental work.

References

1. Z. Orzechowski, J. Prywer, R. Zarzycki: Mechanika płynów w inżynierii środowiska, WNT, Warszawa 2001
2. R.Gryboś: Podstawy mechaniki płynów, PWN, Warszawa 1998
3. R.Puzyrewski, J.Sawicki: Podstawy mechaniki płynów i hydrauliki, PWN, Warszawa 1998
4. A.Tarnogrodzki: Wykłady i ćwiczenia z mechaniki cieczy i gazów, Wydawnictwa Politechniki Warszawskiej, Warszawa 1991
5. R.A. Duckworth: Mechanika płynów, WNT, Warszawa 1983
6. Y. Nakayama, R.F. Boucher: Introduction to Fluid Mechanics, Butterworth-Heinemann 2002
7. Burka E.S., Nałęcz T.J.: Mechanika płynów w przykładach, PWN, Warszawa 2002
8. Ratajczak R., Zwoliński W.: Zbiór zadań z hydromechaniki, PWN, Warszawa 1981
9. Gołębiewski C. i in.: Zbiór zadań z mechaniki płynów, PWN, Warszawa 1980
10. Orzechowski Z.: Ćwiczenia audytoryjne z mechaniki płynów, skrypty dla szkół wyższych, Politechnika Łódzka, Łódź 1993
11. Gryboś R., Pakuła G.: Zbiór zadań z mechaniki płynów, skrypt ucz. Politechniki Śląskiej nr 1609, Gliwice 1991
12. Bartosik: Laboratorium mechaniki płynów, skrypt nr 368, Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2001
13. M. Matlak, A. Szuster: Ćwiczenia laboratoryjne z mechaniki płynów, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2002
14. H.Szewczyk: Mechanika płynów. Ćwiczenia laboratoryjne, Wydawnictwo Politechniki Wrocławskiej, Wrocław 1989

22. *C Programming*

Course title in English	C Programming
Course form*	Lab
Hours required for whole semester	30Lab
ECTS	3
Department in charge of the course	Department of Automation and Robotics
Supervisor	Dr. Jarosław Zwierzchowski
Course level	Bachelor's degree
Implementation period in the academic year	Summer semester
The course ends in an exam (YES/NO)	NO

*: L – lectures, C – classes, Lab – laboratories (laboratory practicals), P – project/design

Objectives of the course:

The aim of the course is to familiarise students with the principles of programming in the C language. A student ought to be able to write and run programs in the C language as well as to know the application of the C language in developing software for tasks concerning control and process management layers as regards industrial practice.

The scope of the course

C programming environment; the organisation of a simple program; declaring variables, entering data, simple computations, writing results. An example: computing the roots of a square equation.
Procedural programming, the organisation of operations in the form of procedures and functions; passing parameters to functions and from functions to the program.
An example: computing the value of a polynomial for the assigned variable value; all actions in the form of separate procedures or functions (loading the degree and polynomial coefficients as data correctness control, loading the value of independent variable and a control print, computing polynomial value (two algorithms); result prints, the prints of program operation description together with the author's name.
Defining new types of variables (structures) and overloading operators, which facilitates operations on the entered types. Overloading functions or procedures performing old operations on new data types.
An example: entering complex numbers as a structure containing a real and imaginary part; entering operations interacting with complex numbers (+-*/).
Summary – a program for computing the roots of second- and third-order equations with reading data, control polynomial prints; calculating and printing all roots; a control print of a polynomial value for every computed root.
Individual tasks: computing the roots of fourth-order polynomials and the selected lower-order polynomials (multi-quadrant sixth- and eighth-order polynomials, i.e. $ax^8+bx^6+cx^4+ex^2+f=0$; fifth- to ninth-order symmetrical polynomials, i.e. $ax^9+bx^8+cx^7+dx^6+ex^5+ex^4+dx^3+cx^2+bx+a=0$). Utilising own libraries with the function of reading polynomial data; calculating the values and prints filled with one procedure realizing specific tasks.
Summary: the definition of the structure describing a polynomial; overloading operators interacting with polynomials, e.g. C=C+A; C+=A; C=Add(C,A); (A,C-polynomials)
Individual projects: band matrix print with specific element distribution in the band; operators, functions, and matrixes operating on polynomials. Computer memory dynamic reservation – single- and multidirectional lists; the analysis of determining and storing indicators. Utilising a sparse matrix for storing.
Exercises on operating lists – browsing, printing, filling the verses of a sparse matrix remembered as an element list. Operations on complete verses – copying a verse, adding to another verse.
Object-oriented programming – defining a polynomial as the object grouping data structures, functions, and operators interacting on these data – hermetisation.
Constructors – the structure of the object representing a verse of a sparse matrix stored in the form of a list. A constructor copying such object. Destructors. Object-oriented programming in Windows – graphics in the program box – simple graphical elements. Animations in a graphical box – a mobile clock hand.
A student's independent information search about system functions – MSDN library; specialist compilers and libraries to other systems and processors.

Methods of assessing of teaching results

A computer-based tests. Homework assignments.

References

1. Stroustrup Bjarne. Programowanie. Teoria i praktyka z wykorzystaniem C++. Wydawnictwo Helion, Gliwice 2010.
2. Bismor D. Programowanie systemów sterowania. Narzędzia i metody. Wydawnictwo Naukowo-Techniczne PWN, Warszawa 2010.
3. Gręboszc J. Symfonia C++ standard tom1 i tom2, Wydawnictwo Edition 2000, Kraków 2008.
4. Deitel H.M. Deitel P.J. C++ How to program Third Edition Wydawnictwo Prentice Hall, 2001
5. Baron B. Metody numeryczne w C++Builder, Wydawnictwo Helion, Gliwice 2004.
6. Porębski W. Język C++ Standard ISO w praktyce. Wydawnictwo Naukowo-Techniczne PWN, Warszawa 2008.

7. Bates J. Tompkins T. Poznaj Visual C++ Wydawnictwo Mikom, Warszawa 1999.