Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biosensory**
Name in English: **Biosensors**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **ETP006368**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				15
Number of hours of total student workload (CNPS)	30				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses					
Number of ECTS points	1				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in basic biology, biochemistry, chemical physics and physics.
2. In capable to analyze simple electrical circuits, determination of thermodynamical parameters of biological and chemical systems.

SUBJECT OBJECTIVES

C1. Presentation of methodological principles of measurements in biological systems with the emphasis on molecular specificity.
C2. Presentation of consistent description of measuring scheme based on biosensor.
C3. Presentation of selected examples of applications of biosensors in medical diagnostics.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - As a result of the course student should be able to understand specifications of marketed biosensors.
PEK_W02 - Student should be able to differentiate biosensors form the point of view of working principle and necessary requirements for the sample.
PEK_W03 - Student should posses knowledge on technical aspects of functioning for all main groups of biosensors.

II. Relating to skills:

PEK_U01 - Student should be able to evaluate the usefulness of biosensor for a particular application based on its specification
PEK_U02 - Student should be able to cheque the state of the biosensor using build in test and appropriate tests.

III. Relating to social competences:

PEK_K01 - Student should be aware the importance of the technical state of the medical instrument for the proper diagnosis and therapy.
PEK_K02 - Student should be able to communicate with the technical and medical staff regarding the selection of the optimal biosensor based measurement.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction - information coding in biological systems	2
Lec2	The relevance of weak interactions in biology and medicine.	1
Lec3	Parametrization of biological systems and molecular basis of specificity.	1
Lec4	Classification and specification of biosensors.	1
Lec5	Basic principle of electrochemical biosensors.	1
Lec6	Redox potential and voltaperometry	1
Lec7	Amperometric measurements illustrated by glucometer and other enzymatic biosensors	1
Lec8	Selected examples of optical transducers and their applications in medical diagnostics.	4
Lec9	The structure and applications of gene- and protein- chips.	2
Lec10	Molecular imaging - selected examples.	1
		Total hours: 15
Form of classes – Seminar		Number of hours
Sem1	Description of commercially available biosensors for personal use.	4
Sem2	Discussion regarding biosensors for genomic and proteomic analysis.	4
Sem3	Description of integrated diagnostic biosensors-based systems.	4
Sem4	Application of molecular labelling in traditional diagnostic imaging techniques	3
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03, PEK_U01; PEK_U02; PEK_U03	Written presentation
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_W03, PEK_U01; PEK_U02; PEK_U03	Oral presentation
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
Material provided by the lecturer

SECONDARY LITERATURE
Textbooks in physicochemistry, biochemistry, electrochemistry and physiology.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biosensors
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03, PEK_U01; PEK_U02; PEK_U03	K2IB_W17	C1, C2, C3	Lec1-Lec10	N1
PEK_W01, PEK_W02, PEK_W03, PEK_U01; PEK_U02; PEK_U03	K2IB_K01, K2IB_U04	C1, C2, C3	Sem1-Sem4	N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biospektroskopia**
Name in English: **Biospectroscopy**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **FTP007331**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. credited physics and chemistry courses

SUBJECT OBJECTIVES

C1. Getting basic knowledge: spectroscopic techniques, use of chemical imaging in biology and medicine, ability to read spectra and quantitative determination of parameters.
C2. Ability to design experiments using spectroscopic methods.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Know and understand the basic laws which are based on spectroscopic techniques.
PEK_W02 - Has a basic knowledge of the structure and operation of various spectrophotometers.

II. Relating to skills:

PEK_U01 - can analyze the spectrum of used materials
PEK_U02 - Can use spectroscopic methods to identify materials
PEK_U03 - Being able to plan an experiment using spectrophotometric methods

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The introduction of credit conditions, the basic laws of chemistry, which is based on molecular spectroscopy.	2
Lec2	Basic laws and concepts used in molecular spectroscopy.	2
Lec3	kinds of spectroscopy and the information it provides about the molecules in different spectral ranges.	2
Lec4	Analysis of the spectra at different ranges, determination of the spectral parameters and interpretation of spectra.	4
Lec5	Applicationsof spectroscopy in various areas with particular emphasis on biological and medical sciences.	4
Lec6	Construction of spectrophotometers, radiation sources, permeable materials, recording techniques.	2
Lec7	Principles of chemical imaging.	2
Lec8	Construction of microscopes: fluorescent, Raman, FT-IR, NIR.	2
Lec9	Biomedical application of chemical imaging.	2
Lec10	Pharmaceutical application of chemical imaging.	2
Lec11	Application of chemical imaging in the polymer technology.	2
Lec12	Poster session for a class: Each student prepares a poster presentation of their choice spectroscopy applications in medicine.	4
		Total hours: 30

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02,PEK_U01, PEK_U02, PEK_U03	Presentation of the poster
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Biospektroskopia, red. J. Twardowski, PWN, Warszawa 1989.
Spektroskopia Ramana i w podczerwieni w biologii, J. Twardowski, P. A. Bacher, PWN, Warszawa 1988.

SECONDARY LITERATURE

Biomedical Application of Spectroscopy, red. R. J. Clark i R. E. Hester
Raman, Infrared and Near Infrared Chemical Imaging, red: Slobodan Sasic, Yukihiro Ozaki,
John Wiley & Sons, 2011

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biospectroscopy
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02,U01, PEK_U02, PEK_U03	K2IB_W13	C1, C2	Lec1-Lect12	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK KURSÓW HUMANISTYCZNYCH**
Name in English: **Block of humanistic courses**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **HMH100035BK**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		30
		Total hours: 30

TEACHING TOOLS USED

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of humanistic courses
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02	K2IB_W21, K2IB_W27	wg kart opracowanych przez SNH		wg kart opracowanych przez SNH

SUBJECT SUPERVISOR

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Systemy informatyczne w medycynie**
Name in English: **Medical Information Systems**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBE001002**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. No prerequisites are required.

SUBJECT OBJECTIVES

C1. Presentation of the basic issues concerning the use of information systems in medical applications
C2. To acquaint students with the methods of information processing in medical information systems.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Studen knows the methods of information processing in medical imaging.
PEK_W02 - Studen knows the basic structure of health systems, their advantages and disadvantages.
PEK_W03 - Student has knowledge about algorithms decision support systems in medicine.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic concepts of medical informatics (medical information, models, systems).	2
Lec2	Information systems in medicine (objectives, requirements, tasks, examples).	2
Lec3	Specialised databases in medicine.	2
Lec4	Medical records	2
Lec5	Classification systems, methods of coding of medical information.	3
Lec6	The acquisition of medical data.	2
Lec7		4
Lec8	Algorithms for analysis and interpretation of bio-signals.	3
Lec9	Computer systems for medical decision support.	3
Lec10	Intelligence sysyems in medicine	3
Lec11	Structures of medical information systems.	2
Lec12	The selected modules of information systems in medicine.	2
		Total hours: 30

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

F1	PEK_W01 – W03	test, oral answers
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Coiera Enrico, Guide to Medical Informatics, the Internet and Telemedicine, Arnold Edi., 1997.
Kompendium Informatyki Medycznej, [red] P. Szczepaniak, M. Kurzyński, R. Zajdel, Alfa Medica Press, 2002.
Nałęcz M.[red], Problemy Biocybernetyki i Inżynierii Biomedycznej, tom V Informatyka Medyczna, WKiŁ, Warszawa 2000.

SECONDARY LITERATURE

Wymagania Funkcjonalno-Użytkowe Oprogramowania Aplikacyjnego dla ZOZ. (Ruch Chorych, Apteka, Rachunek Kosztów Leczenia), wyd. MZiOS, Biuro Przekształceń Systemowych w Ochronie Zdrowia, Warszawa 1996.
Zasoby sieci Internet.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Medical Information Systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K2IB_W03, K2IB_W04	C1, C2	Lec1-Lec12	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biomateriały**
Name in English: **Biomaterials**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041002**
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				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has a basic knowledge of general chemistry and physical chemistry. He knows the basics of chemistry related to the structure and properties of chemical compounds.
2. Student has a well-established knowledge of basic phenomena and the laws of physics and the physical properties of matter.
3. Student knows the basics of material science and technology of materials.

SUBJECT OBJECTIVES

C1. Student get knowledge different groups of modern engineering materials used in medicine.
C2. Getting understand the importance of the role of biomaterial in the body's response.
C3. Acquiring knowledge of the selection of biomaterials that meet certain requirements in terms of medical and technical.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has ordered knowledge of the classification requirements of biomaterials and biomaterials. Characterized by the biological, structural and mechanical properties of biomaterials used for specific clinical applications. Has knowledge of the various stages of the integration of biomaterial - tissue.

PEK_W02 - Student has knowledge of the methods of manufacture of individual groups of biomaterials that determine their properties. He knows the concept of biocompatibility. He has knowledge about how to modify the surface of the implant.

PEK_W03 - Student has knowledge of the methods of sterilization of implant materials. He knows the legal conditions for the placing on the market of a new biomaterial.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to biomaterials, the definition and classification of biomaterials. Requirements for biomaterials.	2
Lec2	Interfacial phenomena: the biomaterial-biological environment (adsorption of proteins, cell adhesion, inflammation, regeneration).	3
Lec3	Corrosion. Metals and alloys used in medicine, Co-Cr-Mo alloys, Ti alloys. Shape memory materials.	3
Lec4	Biopolymers: biostable, resorbable and natural polymers.	2
Lec5	Bioceramics. The bioactivity of ceramic materials.	2
Lec6	Composites as biomimetic materials, graded materials. Carbon materials in medicine.	2
Lec7	Nanocomposites. Biocompatibility of nanoparticles and their application in medicine.	2
Lec8	Selected issues concerning the design of biomaterials, surface functionalization.	2
Lec9	Surface modification of biomaterials, surface layers.	2
Lec10	Infections and medical sterilization. Biomaterials used for surgical instruments.	2
Lec11	European standards and regulations on animal research. The organization and monitoring of clinical trials.	2
Lec12	Osteosynthesis. Biomaterials for orthopedic and cardiac surgery.	2
Lec13	The polymeric drug carrier polymers in the process of the controlled release of drugs.	2
Lec14	Prospects for the development of biomaterials, tissue engineering.	2
		Total hours: 30

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
[1] Błażewicz S., Stoch L. „Biomateriały, t.4; Biocybernetyka i inżynieria Biomedyczna 2000” pod red. Macieja Nałęcza,
[2] Marciniak J. „Biomateriały” Gliwice 2002,
[3] Łaskawiec J., Michalik R. „Zagadnienia teoretyczne i aplikacyjne w implantach”, Gliwice 2002
[4] Jaegermann Z., Ślósarczyk A., „Gęsta i porowata bioceramika korundowa w zastosowaniach medycznych „ AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne 2007.

SECONDARY LITERATURE
[5] Dąbrowski J.R., „Spiekane biomateriały na bazie stopu Co-Cr-Mo” Oficyna Wydawnicza Politechniki Warszawskiej 2004,
[6] Kurzydłowski K., Lewandowska S., Nanomateriały inżynierskie konstrukcyjne i funkcjonalne, Wydawnictwo Naukowe PWN,
[7] Dee K.C., „Tissue-Biomaterial Interaction”, Wiley – Liss 2003
[8] Inżynieria Biomateriałów

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biomaterials
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

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

PEK_W01	K2IB_W01, K2IB_W06	C1	Lec1-Lec7, Lec14	N1, N2, N3
PEK_W02	K2IB_W01, K2IB_W02	C1, C2	Lec3-Lec9	N1, N2, N3
PEK_W03	K2IB_W01	C3	Lec10-Lec13	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Technologia implantów**
Name in English: **Technology of implants**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041007**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		2
Lec14		2
Lec15		2
		Total hours: 30

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation
N3. case study

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Technology of implants
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K2IB_W02	C1, C2, C3		N1-N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie**
Name in English: **Management**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041008**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He can interpret profit and loss account of the company.
2. It has a basic knowledge of management
3. It has a basic knowledge of the organization of production

SUBJECT OBJECTIVES

C1. The course aims to familiarize students with the theoretical and practical approach to management.
C2. To acquaint students with the issues of strategic management and organization life cycle.
C3. To acquaint students with sources of resistance, methods of breaking and methods of motivating employees to work.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - Formulate strategy for the organization
PEK_W02 - He has knowledge of strategic management
PEK_W03 - He can define the source of resistance in the organization and distinguish methods of motivating employees

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Management - the basic concepts. The parameters of external influence on the organization. The evolution of management theory	2
Lec2	Organizational structures. The mission of the organization	2
Lec3	Problems of modern management	2
Lec4	Strategic management, strategic management models. Porter's model, BCG matrix.	3
Lec5	The life cycle of the organization and its innovation. Changes innovative. Conflict and methods of overcoming resistance.	2
Lec6	Negotiations, its phases, tactics and strategies	2
Lec7	Motivating. The methods to motivate	2
		Total hours: 15

TEACHING TOOLS USED

N1. problem lecture
N2. report preparation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K2IB_W08	C1, C2, C3		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Metody badań biomateriałów**
Name in English: **Methods of Biomaterials Testing**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041011**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows the basics of material science and technology of materials.
2. Student has knowledge about classification of biomaterials, he is able to characterize the biological properties, structural and mechanical properties of biomaterials used for specific clinical applications.
3. Student has a basic knowledge of mechanics and strength of materials.

SUBJECT OBJECTIVES

C1. Get to know the trends in the development of modern methods of measurement of biomaterials, conducted at different scales: macro / micro / nano.
C2. Student get knowledge and skills in conducting experimental studies aimed at determining the physical and mechanical properties of biomaterials.
C3. Acquisition of knowledge and skills in the field of research of chemical and structural properties of biomaterials, especially in terms of their functions and the required traits.
C4. Acquisition of basic knowledge about testing the biological activity of medical devices.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has knowledge of investigations of physical, mechanical, chemical and biological properties of biomaterials.

PEK_W02 - Student has a basic knowledge of experimental studies of degradation of implant materials.

PEK_W03 - Student has a basic knowledge of the possibilities to use cell lines in toxicity studies of biomaterials.

II. Relating to skills:

PEK_U01 - Student is able to analyze the relationship between the physical, chemical and structural properties of biomaterials and their functions.

PEK_U02 - Student is able to perform simple measurement apparatus designed to study the chemical, physical and structural properties of biomaterials.

PEK_U03 - Student can choose the appropriate techniques and measurement procedures, depending on the type of test and the type of biomaterial.

III. Relating to social competences:

PEK_K01 - Student is able to interpret the results of the experiments.

PEK_K02 - Student is aware of the need for interdisciplinary research in medical devices placed on the market.

PEK_K03 - Student can work on tasks independently and in groups.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Methods of experimental studies: introduction, classification, testing standards.	2
Lec2	Experimental studies on different organization levels at the micro, macro, meso and nano scales.	2
Lec3	Test methods for physical and structural properties of tissues and biomaterials.	3
Lec4	Test methods for mechanical properties: destructive test methods, static and dynamic mechanical tests.	2
Lec5	Test methods for mechanical properties: hardness and impact resistance measurements.	2
Lec6	Test methods for mechanical properties: methods of non-destructive testing, ultrasonic methods.	2
Lec7	Methods of test surfaces of biomaterials: methods of medical imaging.	2
Lec8	Test methods for biomaterial surfaces: X-ray, optical microscopy, TEM, SEM and AFM.	2
Lec9	Test methods for biomaterial surfaces: roughness and contact angle measurement.	2
Lec10	Test methods for biomaterial surfaces: test for resistance to wear.	3
Lec11	Methods for determining the chemical composition of biomaterials: elemental analysis, FT-IR spectroscopy, Raman spectroscopy, NMR spectroscopy. Liquid and gas chromatography.	2
Lec12	Histological and histochemical measurement methods.	2
Lec13	Studies in vivo and in vitro biomaterials: cytotoxicity and thrombocompatibility	2
Lec14	Qualitative assessment of the final products.	1

Lec15	Final test	1
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Introduction to laboratory safety training. Determination of mechanical properties of biological tissues.	2
Lab2	Determination of mechanical characteristics of tissues and biomaterials, in dynamic measurements.	2
Lab3	Test methods for biomaterial surfaces: microscopic methods.	2
Lab4	Test methods for biomaterial surfaces: profiler, contact angle, surface roughness.	2
Lab5	Corrosion testing of metallic biomaterials.	2
Lab6	Hardness test of biomaterials: the measurement of microhardness and scratchtests.	2
Lab7	Biotribological tests:: Measurement of wear resistance of metals and plastics.	2
Lab8	Degradation of biomaterials in simulated biological environment.	2
Lab9	Measurement of the mechanical properties using ultrasonic methods.	2
Lab10	Techniques for producing coatings: sol-gel method.	2
Lab11	Test methods for structural properties: microcomputed tomography	2
Lab12	Cytotoxicity biomaterials measurements I.	2
Lab13	Cytotoxicity biomaterials measurements II.	2
Lab14	Thrombocompatibility of biomaterials measurements.	2
Lab15	Characteristics of bacteria and biofilm on the surface of biomaterials.	2
		Total hours: 30

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	Evaluation of preparation and implementation of laboratory tasks, verbal response, optional - a written report of the laboratory tasks.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Błażewicz S., Stoch L. (2003); Biocybernetyka i Inżynieria Biomedyczna 2000. Tom 4. Biomateriały, pod red. Macieja Nałęcza, Exit, Warszawa

[2] Jaźwiński S. (1988); Instrumentalne metody badań materiałów, Wydawnictwa Politechniki Warszawskiej, Warszawa

[3] Szczepaniak, W. (2008); Metody instrumentalne w analizie chemicznej, PWN, Warszawa

[4] Michler, G.H. (2008); Electron microscopy of polymers, Springer

[5] Bala, H. (2003) Wstęp do chemii materiałów, WNT, Warszawa

SECONDARY LITERATURE

[6] Cygański, A. (2009); Metody spektroskopowe w chemii analitycznej, WNT, Warszawa

[7] Łaskawiec J., Michalik R. (2002); Zagadnienia teoretyczne i aplikacyjne w implantach, Gliwice

[8] Rabek, J.F. (2009); Współczesna wiedza o polimerach, PWN, Warszawa

[9] Niezgodziński, M.E., Niezgodziński, T. (2010); Wytrzymałość materiałów, PWN, Warszawa

[10] Kurzydłowski, K., Lewandowska, M. (2010); Nanomateriały inżynierskie konstrukcyjne i funkcjonalne, PWN, Warszawa

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Methods of Biomaterials Testing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W01, K2IB_W06	C1-C4	Lec1-Lec14	N1, N3, N5
PEK_W02	K2IB_W01, K2IB_W07	C1-C3	Lec1, Lec2, Lec10	N1, N3, N5

PEK_W03	K2IB_W01, K2IB_W09	C1, C4	Lec1, Lec2, Lec13	N1, N3, N5
PEK_U01	K2IB_U09, K2IB_U11	C2, C3	Lab1-Lab15	N2, N4, N5
PEK_U02	K2IB_U11, K2IB_U13, K2IB_U14	C2, C3	Lab1-Lab15	N2, N4, N5
PEK_U03	K2IB_U14	C1-C4	Lab1-Lab15	N2, N4, N5
PEK_K01	K2IB_K08	C1-C4	Lab1-Lab15	N2, N4, N5
PEK_K02	K2IB_K01, K2IB_K02	C1, C4	Lab1-Lab15	N2, N4, N5
PEK_K03	K2IB_K04, K2IB_K07	C2, C3	Lab1-Lab15	N2, N4, N5

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biotribologia**
Name in English: **Biotribology**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041016**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		2
Lec14		2
Lec15		2
		Total hours: 30

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2.
N3. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biotribology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W07	C1		N1, N2, N3
PEK_W02	K2IB_W07	C2		N1, N2, N3
PEK_W03	K2IB_W01, K2IB_W02, K2IB_W07, K2IB_W10	C3		N1, N2, N3

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**
Name in English: **Diploma Thesis Seminar**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041018**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1		2
Sem2		5
Sem3		2
Sem4		5
Sem5		1
		Total hours: 15

TEACHING TOOLS USED

N1. problem discussion
N2. project presentation
N3. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_W02, PEK_U01, PEK_U02, PEK_U03, PEK_K01	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Diploma Thesis Seminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 PEK_W02	K2IB_W19, K2IB_W21, K2IB_W22	C1, C2, C3		N1, N2, N3
PEK_U01 PEK_U02 PEK_U03	K2IB_U04, K2IB_U09, K2IB_U15, K2IB_U16, K2IB_U19	C1, C2		N1, N2, N3
PEK_K01	K2IB_K02, K2IB_K03	C3		N1

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biomechanika inżynierska**
Name in English: **Biomedical Engineering**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041020**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		2
Lec14		2
Lec15		2
		Total hours: 30

TEACHING TOOLS USED
N1. informative lecture N2. multimedia presentation

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biomedical Engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02	K2IB_W10, K2IB_W22	C1 - C3		N1, N2

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Języki programowania**
Name in English: **Programming languages**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041022**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It is assumed that prior to learning of this course the student has to prepare in the following areas: systems of counting, simple algorithms, the basic elements of programming in C language and basic knowledge of the design and operation of computers.

SUBJECT OBJECTIVES

C1. Familiarize students with the basic techniques of structured programming.
C2. Familiarize students with the methods of computer data representation.
C3. Prepared for independent software development and implementation of simple algorithms.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - As a result of the course the student has a basic knowledge of structural programming and object-oriented.

PEK_W02 - As a result of the course the student has a basic knowledge of the type of variables, defining functions, classes, and transfer them to your selection, overloading operators.

PEK_W03 - As a result of the course the student has a basic knowledge of the creation of conditional statements, loops programming, operations on indicators and creating objects.

II. Relating to skills:

PEK_U01 - Can write any program in C / C++.

PEK_U02 - Can create dynamic data structures.

PEK_U03 - Can implement the developed algorithm.

III. Relating to social competences:

PEK_K01 - Can work on tasks independently and in groups.

PEK_K02 - Can think and act creatively.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The introduction of the basic concepts of: algorithm and methods of its presentation, examples of algorithms.	2
Lec2	Introduction to the C language. Data types. Working on data types.	2
Lec3	Operators: arguments, priority. Control statements and loops.	2
Lec4	Working whit indicators, tables and functions. Definitions of functions, a function prototype, a function call.	2
Lec5	The value returned by the function. Recursion.	2
Lec6	The standard input and output operations for C (stdio.h).	2
Lec7	Structure, union and bit fields: the declarations and implementation. The parameters of the main function.	2
Lec8	Introduction to object-oriented programming: C++ language.	2
Lec9	The concept of class. Action on objects, member functions: declaring and defining. This indicator. The static component class.	2
Lec10	Encapsulation , the difference between the structure and class in C++.	2
Lec11	Overriding the names of variables and functions. Overloading function names. Default arguments in function. Introduction to the constructor.	2
Lec12	The constructor. The destructor. Dynamic memory allocation.	2
Lec13	Constructor initialization list. Copy constructor.	2
Lec14	Friend Functions. Friending classes.	2
Lec15	Overloading operators: number of arguments, the operator as a standard feature, as a function of the component.	2
		Total hours: 30

Form of classes – Laboratory		Number of hours
Lab1		1
Lab2		2
Lab3		2
Lab4		2
Lab5		2
Lab6		2
Lab7		2
Lab8		2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Initiation classes. Getting familiar with the programming work environment.	1
Proj2	Creation and implementation of a simple algorithm. The use of control statements and loops.	2
Proj3	Declaring and defining a function.	2
Proj4	Creating arrays, structures and unions. Dynamic Allocation.	2
Proj5	Working on indicators and tables.	2
Proj6	Logical and arithmetic (bit) operations .	2
Proj7	The project your own	2
Proj8	The project your own	2
		Total hours: 15

TEACHING TOOLS USED
N1. informative lecture N2. multimedia presentation N3. report preparation

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	report
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Gręboszz Jerzy,Phymfony C++, Oficyna Kallimach, Kraków 1993,
[2] Stroustrup Bjarne, C++ language, WNT, Warszawa 1994.

SECONDARY LITERATURE

[1] Gręboszz J.: C++ passion. Oficyna Kallimach, 1997.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Programming languages
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W03, K2IB_W04, K2IB_W25, K2IB_W26	C1	Lec1, Lec2, Lec8, Lec10	N1, N2
PEK_W02	K2IB_W03, K2IB_W04, K2IB_W25, K2IB_W26	C2	Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec9, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2
PEK_W03	K2IB_W03, K2IB_W04, K2IB_W22, K2IB_W25, K2IB_W26	C2	Lec3, Lec4, Lec12	N1, N2
PEK_U01	K2IB_U01, K2IB_U02, K2IB_U22	C3	Pr1, Pr2, Pr3, Pr4, Pr5 Pr6, Pr7, Pr8	N3
PEK_U02	K2IB_U02, K2IB_U22	C2	Pr4	N3
PEK_U03	K2IB_U01, K2IB_U22	C3	Pr7, Pr8	N3
PEK_K01	K2IB_K04	C2 ,C3	Pr1, Pr2, Pr3, Pr4, Pr5 Pr6, Pr7, Pr8	N3
PEK_K02	K2IB_K05, K2IB_K07, K2IB_K08	C1, C2, C3	Pr1, Pr2, Pr3, Pr4, Pr5 Pr6, Pr7, Pr8	N3

SUBJECT SUPERVISOR

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SUBJECT CARD

Name in Polish: **Planowanie eksperymentu**
Name in English: **Experiment planning**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041024**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematical analysis and linear algebra
2. Knowledge of statistics, including: descriptive statistics, statistical inference, correlation and regression methods, and time series analysis

SUBJECT OBJECTIVES

C1. Introducing students to the different methods and techniques of planning experiments
C2. Collect and organize results of experiments and analyze this information to reach a conclusion
C3. Application of experiments, inter alia, to optimize the performance and quality of products and services in the field of biomedical engineering
C4. Presentation of principles, objectives, milestones and basic concepts related to the planning of experiments
C5. Importance indication of experiments planning to improve quality in biomedical engineering

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student indicates the principles, objectives and planning stages of experiments
PEK_W02 - Student defines the basic concepts of experiment design
PEK_W03 - Student explains the basic statistical model, which is used in planning of experiments, known as the general linear model

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	General principles of experiment planning. Historical overview	2
Lec2	Definition and basic assumptions of general linear model	2
Lec3	Models of analysis of variance (ANOVA) and regression analysis	2
Lec4	Classic plans of experiments: completely randomized experimental plan, two-factor experimental design	2
Lec5	Classic plans of experiments: plans of randomized and incomplete blocks	2
Lec6	Classic plans of experiments: Latin and Graeco-Latin square, Youden square	2
Lec7	Factorial experiments plans: full and fractional factorial experiments	4
Lec8	Factorial experiments plans: centrally formulated plans for factorial experiments	2
Lec9	Factorial experiments plans: plans for saturated experiments on three levels	2
Lec10	Factorial experiments plans: factorial experiments plans with different numbers of levels of factors, Taguchi orthogonal arrays	2
Lec11	Search of optimization conditions: Box-Wilson method, the method EVOP, examples of applications	2
Lec12	Search of optimization conditions: examples of Taguchi methods applications in biomedical engineering	2
Lec13	Optimal design of experiments: real and discrete experiment plans, optimality criteria and optimal plans	2
Lec14	Carry out a test to check the knowledge and skills of students for this course	2
		Total hours: 30

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01-W03	Final test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Rafajłowicz E., Optymalizacja eksperymentu z zastosowaniami w monitorowaniu jakości produkcji, Oficyna Wydawnicza PWr, Wrocław 2005, link: http://www.dbc.wroc.pl/Content/1509/rafajlowicz.pdf
2. Korzyński M., Metodyka eksperymentu. Planowanie, realizacja i statystyczne opracowanie wyników eksperymentów technologicznych, Wyd. WNT, Warszawa2006
3. Planowanie doświadczeń (DOE), Electronic Statistics Textbook, Statsoft, link: http://www.statsoft.pl/textbook/stathome_stat.html
4. Mańczak K., Technika planowania eksperymentu, Wyd. WNT, Warszawa 1976
5. 8. Wawrzynek J., Planowanie eksperymentów zorientowane na doskonalenie jakości produktu, Wyd. UE, Wrocław 2009

SECONDARY LITERATURE

1. Jędrychowski W., Zasady planowania i prowadzenia badań naukowych w medycynie, Wyd. UJ, Kraków 2004
2. Majchrzak E., Mochnacki B.: Metody numeryczne. Podstawy teoretyczne, aspekty praktyczne i algorytmy, Wydawnictwo Politechniki Śląskiej, wyd. IV, Gliwice 2004
3. Szmelter J., Metody komputerowe w mechanice, Wyd. PWN, Warszawa 1980
4. Draper, N. R., H. Smith, Analiza Regresji Stosowana, Wyd. PWN, Warszawa 1973
5. Wanat K., Algorytmy numeryczne, Wyd. Dir, Gliwice 1993
6. Rafajłowicz, E., Algorytmy Planowania Eksperymentu z Implementacjami w Środowisku MATHEMATICA, Akademicka Oficyna Wydawnicza PLJ, Warszawa 1996
7. Detyna B., Detyna J., Jakość usług medycznych. Ocena statystyczna, podstawy metodyczne, Wyd. DIFIN, Warszawa 2011

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Experiment planning
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K2IB_W04, K2IB_W20	C1, C2, C3, C4, C5	Lec1-Lec14	N1, N2

SUBJECT SUPERVISOR

dr hab. inż. Jerzy Detyna tel.: 320-38-45 email: jerzy.detyna@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechanika pękania**
Name in English: **Fracture Mechanics**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041026**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Mechanics, Strength of Materials.

SUBJECT OBJECTIVES

C1. Knowledge of linear models of fracture mechanics.
C2. Stress intensity factor K & J integer as fundamental parameters of fracture mechanics.
C3. Energy methods in description of fatigue crack propagation.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knowledge of linear models of fracture mechanics.

PEK_W02 - Knowledge of methods dealing with application of stress intensity factor K & J integer as fundamental parameters of fracture mechanics.

II. Relating to skills:

PEK_U01 - He can calculate fundamental parameters of fracture mechanics.

PEK_U02 - He can use stress intensity factor K & J integer to evaluation of crack propagation.

III. Relating to social competences:

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

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

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

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Theoretical Strength of Materials.	1
Lec2	Griffith's theory.	1
Lec3	Irwin's theory.	1
Lec4	Panasiuk-Dugdale’s model.	1
Lec5	Linear models of fracture mechanics.	1
Lec6	Brittle & ductile fracture.	1
Lec7	Parameters of fracture toughness.	1
Lec8	The J - integer.	1
Lec9	Treshold stress intensity factor K.	1
Lec10	Energy description of fatigue fracture.	2
Lec11	Analysis of kinetic fatigue failure diagrams (KFFD).	2
Lec12	Diimensional Analysis models in Fracture Mechanics.	1
Lec13	Final test.	1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

N2. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Neimitz A., Mechanika pękania, PWN Warszawa 1998,
2. Kocańda St., Zmęczeniowe pękanie metali, WNT Warszawa, wyd. 3, 1985,
3. Boroński D., Metody badań odkształceń i naprężeń w zmęczeniu materiałów i konstrukcji, Wyd. Inst. Tech. Ekspl. - PIB , Radom 2007,
4. Szata M., Opis rozwoju zmęczeniowego pękania w ujęciu energetycznym, OW PWr, Wrocław 2002.

SECONDARY LITERATURE

1. Bochenek A., Elementy mechaniki pękania, Wyd. Politechniki Częstochowskiej, Częstochowa 1998,
2. Gasiak G., Trwałość materiałów konstrukcyjnych przy obciążeniach cyklicznych z udziałem wartości średniej obciążenia, OW PO Opole 2002.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fracture Mechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W22	C1, C3	Lec1 to Lec13	N1, N2
PEK_W02	K2IB_W22	C2	Lec1 to Lec13	N1, N2

SUBJECT SUPERVISOR

Prof. dr hab. inż. Mieczysław Szata tel.: 71-320-31-38 email: mieczyslaw.szata@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Sprzęt i metody rehabilitacji**
Name in English: **Medical Equipment and Methods for Rehabilitation**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041029**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has an ordered knowledge of the anatomy and physiology of the human locomotor system.
2. Student has an ordered knowledge of biomechanical engineering.
3. Student has a basic knowledge of rehabilitation engineering.

SUBJECT OBJECTIVES

C1. Getting knowledge of existing devices used in rehabilitation.
C2. Arrange knowledge of the existing methods of physical medicine.
C3. Arrange knowledge of applied rehabilitation for various disease.
C4. Learning basic first aid.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student can define rules for medical rehabilitation in patients with various disabilities.
PEK_W02 - Student can characterize and describe the physical medicine therapies.
PEK_W03 - Student has a basic knowledge of first aid.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Methods for evaluation of physical capacity in healthy subjects and patients.	2
Lec2	Medical devices used in rehabilitation.	2
Lec3	New therapeutic methods of physical medicine.	4
Lec4	Kinesitherapy in oncology and internal diseases.	2
Lec5	Diagnostics and Treatment of Postural Disorders.	2
Lec6	Basic medical emergency.	2
Lec7	Test.	1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. informative lecture
N3. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Dega W., Milanowski K., Rehabilitacja medyczna. PZWL, Warszawa 2001 (in Polish).
Nałęcz M. (Red.), Biocybernetyka i inżynieria biomedyczna 2000, t.5 Biomechanika i inżynieria rehabilitacyjna. Akademicka Oficyna Wydawnicza EXIT, Warszawa 2003 (in Polish).
Kiwerski J., Rehabilitacja medyczna, Wydawnictwo PZWL, Warszawa 2005 (in Polish).
Ronikier A., Diagnostyka funkcjonalna w fizjoterapii, Wydawnictwo Lekarskie PZWL, Warszawa 2012 (in Polish).

SECONDARY LITERATURE

Kasperczyk T., Wady postawy ciała diagnostyka i leczenie, KASPER, Kraków 2004 (in Polish).
Brotzman S.B., Wilk K.E., Rehabilitacja ortopedyczna, Elsevier Urban & Partner, Wrocław 2009.
Lennon S., Stokes M., red. Kwolek A., Fizjoterapia w rehabilitacji neurologicznej, Elsevier Urban&Partner, Wrocław 2009 (in Polish) .
Woźniewski M., Kornafel J., Rehabilitacja w onkologii, Elsevier Urban&Partner, Wrocław 2010 (in Polish).
Donatelli R., red. Gnat R., Rehabilitacja w sporcie, Elsevier Urban&Partner, Wrocław 2011 (in Polish).
Czasopisma: Ortopedia Traumatologia Rehabilitacja, Rehabilitacja Medyczna, Praktyczna fizjoterapia i rehabilitacja .

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Medical Equipment and Methods for Rehabilitation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03,	K2IB_W10	C1, C2, C3, C4		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Sterowanie podzespołami robotów i manipulatorów medycznych**
Name in English: **Control components of medical robots and manipulators**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041030**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It is assumed that prior to learning of this course the student has to be prepared for: ARM microcontroller programming in C/C++, basic knowledge of electronics, has an established knowledge in motor control, sensors programming.

SUBJECT OBJECTIVES

C1. Familiarize students with the basic principles of the development of control systems.
C2. Familiarize students with the basics of creating electronic circuits.
C3. Mastery of how to create printed circuit boards.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - Can develop a logic diagram of the control system.
PEK_U02 - Can develop and make printed circuit board in the EAGLE software.

III. Relating to social competences:

PEK_K01 - Can work on tasks independently and in group.
PEK_K02 - Can think and act creatively.

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Introduction to the project of the control system of a mobile or walking robot.	2
Proj2	Choose your robot and determining the amount of controlled motors.	2
Proj3	Determine the type of the motor.	2
Proj4	Develop a logical diagram of the control system.	2
Proj5	Develop a logical diagram of the control system.	2
Proj6	Introduction and using the EAGLE software to create an electronic circuit diagram and PCB.	2
Proj7	Introduction and using the EAGLE software to create an electronic circuit diagram and PCB.	2
Proj8	Development of the circuit diagram in the EAGLE	2
Proj9	Development of the circuit diagram in the EAGLE	2
Proj10	Development of the circuit board in the EAGLE	2
Proj11	Development of the circuit board in the EAGLE	2
Proj12	Implementation of the circuit board.	2
Proj13	Installation and testing of electronic components of the control system.	2
Proj14	Development and implementation of a simple control algorithm for a robot.	2
Proj15	Development and implementation of a simple control algorithm for a robot.	2
		Total hours: 30

TEACHING TOOLS USED

N1. project presentation
N2. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. ‘Mechanical automation devices’ - B. Chorowski, M. Wereszko.
2. 'Fundamentals of robotics. The theory and components of manipulators and robots’ – collective work.
3. ‘Theory of mechanisms and manipulators. Fundamentals and Application Examples in practice’ A. Morecki, J. Knapczyk, K. Kędzior

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Control components of medical robots and manipulators
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01	K2IB_U01, K2IB_U02	C1, C2	Prj1, Prj2, Prj3, Prj4, Prj5, Prj14, Prj15	N2
PEK_U02	K2IB_U01, K2IB_U02	C3	Prj6, Prj7, Prj8, Prj9, Prj10, Prj11, Prj12,Prj13	N1, N2
PEK_K01	K2IB_K04	C1, C2, C3	Prj1, Prj2, Prj3, Prj4, Prj5, Prj6, Prj7, Prj8, Prj9, Prj10, Prj11, Prj12, Prj13, Prj14, Prj15	N1, N2
PEK_K02	K2IB_K05, K2IB_K07, K2IB_K08	C3, C3	Prj3, Prj4, Prj5, Prj6, Prj7, Prj8, Prj9, Prj10, Prj11, Prj12, Prj13, Prj14, Prj15	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Fraktale**
Name in English: **Fractals**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041031**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		2
Lec14		2
Lec15		2
		Total hours: 30

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides
N2. multimedia presentation
N3. tutorials
N4.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Fractals
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01-PEK_W03	K2IB_W06	C1 - C3		N1- N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mikrobiologia**
Name in English: **Microbiology**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041032**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge of materials measurement methods carried out at different scales: macro / micro / nano.
2. Student has a basic knowledge of the biological activity of medical devices
3. Student has a basic knowledge of cell biology.

SUBJECT OBJECTIVES

C1. Getting a basic knowledge about the micro-environment, with particular emphasis on human physiological microflora
C2. Getting a knowledge about the microbiological techniques used in studies of microorganisms.
C3. Student get knowledge of the disinfection and sterilization techniques, necessary for experimental studies of biological material

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student get a basic knowledge of the biodiversity of microorganisms and their biochemical and physiological properties and functions in nature. He getting know the physiological flora of the human body.
PEK_W02 - Student get know how to deal aseptic and antiseptic limiting nosocomial infections.
PEK_W03 - Student has a basic knowledge of methods and techniques for the study of microorganisms.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Systematics of environment al pathogens.	2
Lec2	Characteristics of pathogens in natural environments, the impact of environmental factors on microorganisms.	2
Lec3	Pathogenicity and virulence of microorganisms. Characteristics of micro-organisms that cause disease in humans.	3
Lec4	Immunoprophylaxis of infectious diseases.	2
Lec5	Features and functions of the human physiological microflora.	2
Lec6	Description of the mechanisms of infectious diseases.	2
Lec7	Microbial drug sensitivity and drug resistance. Determination of susceptibility of microorganisms, susceptibility testing, mykogram.	2
Lec8	Targeted and empiric therapies of diseases.	2
Lec9	Growth, reproduction and basic genetics of microorganisms. Mutations and mutagens.	2
Lec10	Chemotherapeutic agents.	2
Lec11	Bacterial drug resistance mechanisms	2
Lec12	The risks of disease in Poland and abroad.	2
Lec13	Download and upload materials for microbiological examination.	2
Lec14	Hospital-acquired infections. Sterilization of medical and disinfectants.	2
Lec15	Final test	1
		Total hours: 30

TEACHING TOOLS USED

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

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Virella G: Mikrobiologia i choroby zakaźne, Wydawnictwo Medyczne Urban&Partner, Wrocław, 2000
[2] Zaręba. M, Borowski. J: Mikrobiologia Lekarska, PZWL. W-wa 1999

SECONDARY LITERATURE

[3] Janowiec M.: Mikrobiologia i serologia, PZWL, W-wa, 1988
[4] Singleton P. Bakterie w biologii, biotechnologii i medycynie. Wydawnictwo Naukowe PWN, W-wa 2000

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Microbiology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W14	C1, C2	Lec1-Lec12, Lec15	N1-N3
PEK_W02	K2IB_W01, K2IB_W14	C3	Lec6, Lec12, Lec14, Lec15	N1-N3
PEK_W03	K2IB_W14	C2	Lec8, Lec13, Lec15	N1-N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Bioprzepływy**
Name in English:
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041033**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			30		
Number of hours of total student workload (CNPS)			90		
Form of crediting			Crediting with grade		
Group of courses					
Number of ECTS points			3		
including number of ECTS points for practical (P) classes			3		
including number of ECTS points for direct teacher-student contact (BK) classes			2.1		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
Lab6		2
Lab7		2
Lab8		2
Lab9		2
Lab10		2
Lab11		2
Lab12		2
Lab13		2
Lab14		2
Lab15		2
		Total hours: 30

TEACHING TOOLS USED

N1. report preparation
N2. tutorials
N3. problem discussion

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U	K2IB_U01, K2IB_U02, K2IB_U03, K2IB_U05, K2IB_U18	C2, C3		N1, N2, N3
PEK_K	K2IB_K01, K2IB_K04, K2IB_K05, K2IB_K08	C2, C3		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Bioprzepływy**
Name in English: **Biofluids**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041034**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		1
Lec8		1
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		1
Lec14		2
Lec15		2
Lec16		2
Lec17		1
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
Lab6		2
Lab7		2
Lab8		2
Lab9		2
Lab10		2
Lab11		2
Lab12		2
Lab13		2
Lab14		2
Lab15		2
		Total hours: 30

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Biofluids
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K2IB_W01, K2IB_W12	C1, C2		N1, N2, N3

SUBJECT SUPERVISOR

dr inż. Maciej Zawiślak email: Maciej.Zawislak@pwr.edu.pl

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Projektowanie układów wspomagających lokomocję człowieka**
Name in English: **Design of the human locomotion supporting system**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041035**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				45	
Number of hours of total student workload (CNPS)				90	
Form of crediting				Crediting with grade	
Group of courses					
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				2.1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows the basics of the mechanical structures designing, the construction of control systems of machines and devices, as well as the biomechanics of human motion system.
2. Student has mastered the ability to represent machine components and assemblies by freehand drawing and AutoCad system.
3. Student has ability to work systematically, gradually realizing work tasks.

SUBJECT OBJECTIVES

C1. Learning to the complex devices designing of the human locomotion supporting systems.
C2. Preparation for work in a team.
C3. Increase knowledge of devices design basics particularly for biomedical engineering devices.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - Student can design a complex device for supporting of physically disabled person locomotion, designing the necessary parts and assemblies, as well as expertly selecting finished systems and assemblies.
PEK_U02 - Student can interact with other participants in the process of design and construction, serving a variety of roles in a team.
PEK_U03 - Student can prepare technical documentation and evaluate innovativeness of designed solutions based on the analysis of existing machines and devices.

III. Relating to social competences:

PEK_K01 - Student can identify and take into account in its action priorities for implementation tasks undertaken.
PEK_K02 - Student can identify and take into account in its action priorities for implementation of the taken task.
PEK_K03 - Student is able to present results of his work using modern techniques of presentation.

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Introduction - general formulation of the problem to be solved (in the field of physically disabled person locomotion supportingt - such as providing an autonomy upright for paraplegic persons, enabling participation in marathons, etc.), information on the principles of the realisation and evaluation of the project; homework # 1: Prepare a short description of the selected method (techniques) exploring the concept of solving the problem design and analysis of existing solutions.	3
Proj2	A brief discussion of the various techniques of the solution concepts searching, selection one of them for application bythe project team, formulation of the brief foredesignst and criteria for solutions evaluation; conduct a session to generate ideas solve the problem, the choice of conception to realization; homework 2: Structuring of the design process - proposition of the algorithm describing the design process developing.	3
Proj3	Analysis of the prepared algorithms, establishing checkpoints of the design process. Extract the teams performing various tasks (eg, biomechanical analysis, the design powertrain, etc.) homework 3: Detailed analysis of the task - to develop proposals of designing and evaluation criteria for solving a given task.	3
Proj4	Generating the solution concepts of the individual tasks (eg brainstorming sessions) and select conception to realization; homework 4: develop proposals schedule of individual tasks and a list of the informations necessary for the task, which should be provided by the other teams.	3
Proj5	Set a schedule of the project, selection of the tasks coordinator, presentation of the solutions concepts for particular tasks. Homework 5: working in teams.	3
Proj6	Working in teams, exchange of informations, consultations, presentation of the biomechanical analysis results and diagrams depicting the proposed specific solutions.	3
Proj7	Continued work in teams, a presentation of the proposed solutions and basic calculations (including FEM).	3

Proj8	Continued work in teams, a presentation of the proposed solutions and basic calculations (including FEM).	3
Proj9	Presentation of the stage of completion in teams - evaluation of the teams.	3
Proj10	Continuation of works in teams, verification of the solutions in terms of their integration possibility.	3
Proj11	Continued work in teams, analyze the choice of materials and manufacturing technology of the components and assemblies (designed within the project).	3
Proj12	Continued work in teams, analysis of designed devic production costse, presentation of the results of the teams.	3
Proj13	Continuation of the results presentation of the teams,set up a team responsible for the final report preparation. Verification of the each task documentation.	3
Proj14	Continued verification of the tasks documentation. Discussion on development opportunities of the designed device, the scope of prototype examination, another solutions choose.	3
Proj15	Presentation of the project, the evaluation of the innovativeness, project evaluation.	3
		Total hours: 45

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. problem discussion
N3. project presentation
N4. report preparation
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_K01	participation in problem discussions; evaluation of the homeworks (Z); F1=(Z1 +....+Z4)/4
F2	PEK_U01, PEK_U03, PEK_K02	evaluation of preparation and computational part of the project, good rating is needed (min. 3.0).
F3	PEK_U02, PEK_K03	project presentation, good rating is needed (min. 3.0).
P = 1/10*F1+3/5*F2+3/10*F3		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Dietrych M. (red.), Podstawy konstrukcji maszyn, PWN, Warszawa, 1989.
[2] Prochowski L., Mechanika ruchu, WKiŁ, Warszawa, 2005.
[3] Pawlicki G., Podstawy inżynierii medycznej, Wyd. PW, Warszawa, 1997.
[4] Będziński R., i in., Biomechanika i inżynieria rehabilitacyjna, Tom 5, Biocybernetyka i Inżynieria Biomedyczna, pod red. Nałęcza M., Polska Akademia Nauk, Warszawa, 2004.

SECONDARY LITERATURE

[1] Pahl G., Beitz W., Nauka konstruowania, WNT, Warszawa, 1984
[2] Mazanek E.(red.), Przykłady obliczeń z podstaw konstrukcji maszyn, WNT, Warszawa, 2008.
[3] Bober T., Zawadzki J., Biomechanika układu ruchu człowieka, Wyd. BK, Wrocław, 2001.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Design of the human locomotion supporting system
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01 - PEK_U03	K2IB_U03, K2IB_U07, K2IB_U08	C1, C2, C3	Proj1 - Proj14	N1 - N5
PEK_K01 - PEK_K03	K2IB_K07	C2	Proj1 - Proj14	N1 - N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechatronika w medycynie**
Name in English: **Mechatronics in medicine**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041036**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		2
Lec9		2
Lec10		2
Lec11		2
Lec12		2
Lec13		2
Lec14		2
Lec15		2
		Total hours: 30

TEACHING TOOLS USED
N1. informative lecture N2. multimedia presentation

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechatronics in medicine
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W10	C1, C2		N1, N2
PEK_W02, PEK_W03	K2IB_W05, K2IB_W10, K2IB_W22	C1, C2		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Statystyka dla bioinżynierów**
Name in English: **Statistics for Biomedical Engineers**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041037**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has basic knowledge of mathematical statistics, probability theory, error analysis and experiment planning necessary to describe and analyze the data obtained in the study
2. Student has skills in interpretation, presentation and documentation of experiments, analysis and monitoring of processes and tasks of a project
3. Student able to use computer tools, including specialized applications, graphics programs, PC systems

SUBJECT OBJECTIVES

C1. Introduction to the methods of statistical analysis in practical applications, with particular emphasis on biomedical engineering
C2. Acquainting with computer algorithms using statistical analysis software such as Statistica
C3. Presentation of the needs and specific requirements of industry and science in the field of statistical data analysis and experiment planning, including clinical studies

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has ordered, broader and deeper knowledge of the techniques of statistical inference, including the parametric and non-parametric tests, regression analysis (simple, multiple, stepwise, non-linear and logistic), variance (univariate and multivariate), canonical analysis, discriminant, and factorial analysis clustering, and survival analysis.

PEK_W02 - Student has ordered knowledge of the theoretical assumptions of statistical data analysis implementation to PC software like Statistica

PEK_W03 - Student has a basic knowledge of experimental design including statistical data analysis

II. Relating to skills:

PEK_U01 - Student is able to analyze experimental data

PEK_U02 - Student is able to verify the statistical hypothesis

PEK_U03 - Student is able to draw conclusions on the basis of the statistical tests results

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic concepts Introduction to data processing	2
Lec2	Descriptive Statistics Measures of location, variability, asymmetry and concentration	2
Lec3	Statistical distributions Random variables and their distributions	2
Lec4	Statistical Inference - Hypothesis Testing Parametric statistical tests 1	2
Lec5	Statistical Inference - Hypothesis Testing Parametric statistical tests 2	2
Lec6	Statistical Inference - Hypothesis Testing Non-parametric statistical tests 1	2
Lec7	Statistical Inference - Hypothesis Testing Non-parametric statistical tests 2	2
Lec8	Statistical Inference - Hypothesis Testing Contingency tables and the sensitivity and specificity, and ROC curve - diagnostic tools	2
Lec9	Statistical Inference - Hypothesis Testing Testing multiple comparisons post-hoc	2
Lec10	The study relationships between variables - correlation	2
Lec11	The study relationships between variables - regression	2
Lec12	Methods for exact nonparametric inference in the case of abnormal distribution of the experimental data	2
Lec13	Analysis of canonical discriminant and cluster analysis	2
Lec14	Analysis of survival	2

Lec15	Elements of experimental design	2
		Total hours: 30
Form of classes – Classes		Number of hours
Cl1		2
Cl2		2
Cl3		2
Cl4		2
Cl5		2
Cl6		1
		Total hours: 11
Form of classes – Project		Number of hours
Proj1	Introduction to statistical issues. Grouping statistical material. Statistical distributions.	2
Proj2	Statistical Inference - Hypothesis Testing Parametric statistical tests	2
Proj3	Statistical Inference - Hypothesis Testing Non-parametric statistical tests	2
Proj4	Statistical Inference - Hypothesis Testing Testing multiple comparisons post-hoc	2
Proj5	Statistical Inference - Hypothesis Testing Tests for categorical/ qualitative variables	2
Proj6	The study relationships between variables - correlation and regression	2
Proj7	Analysis of canonical discriminant and cluster analysis	2
Proj8	Elements of experimental design	1
		Total hours: 15

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation
N3. problem lecture
N4. problem exercises
N5. calculation exercises

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

F1	PEK_W01, PEK_W02, PEK_W03	Test
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03	Solution of the problem exercises
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] A. Stanisz, Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom 1. Statystyki podstawowe. Kraków, 2006.
[2] A. Stanisz, Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom 2. Kraków, 2006.
[3] A. Stanisz, Przystępny kurs statystyki z zastosowaniem STATISTICA PL na przykładach z medycyny. Tom 3. Kraków, 2006.
[4] J. Koronacki J., J. Mielniczuk, Statystyka dla studentów kierunków technicznych i przyrodniczych. WNT, Warszawa, 2001.
[5] J. Greń, Statystyka matematyczna – modele i zadania. PWN Warszawa , 1978.

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Statistics for Biomedical Engineers
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W20	C1	Lec1, Lec2, Lec3, Lec4, Lec5, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14	N1, N2, N3
PEK_W02	K2IB_W21	C2	Lec5, Lec7	N1, N2, N3

PEK_W03	K2IB_W21	C1, C3	Lec15	N1, N2 N3
PEK_U01-PEK_U03	K2IB_U10	C1-C3	Lab	N2,N4,N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Metody numeryczne w biomechanice**
Name in English: **Numerical methods in biomechanics**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041038**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		30		
Number of hours of total student workload (CNPS)	30		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	1		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		4
Lec5		4
Lec6		1
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		4
Lab3		6
Lab4		8
Lab5		10
		Total hours: 30

TEACHING TOOLS USED

N1. multimedia presentation
N2. problem exercises
N3. problem lecture
N4. report preparation
N5. tutorials

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	
F2	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	
P = 0,7*F1+0,3*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Numerical methods in biomechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K2IB_W03, K2IB_W06	C1		N1, N3, N5
PEK_U01, PEK_U02, PEK_U03	K2IB_U02, K2IB_U03, K2IB_U06, K2IB_U14	C2		N1, N2, N4, N5
PEK_K01, PEK_K02, PEK_K03	K2IB_K01, K2IB_K03, K2IB_K04, K2IB_K07	C3		N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Zarządzanie logistyczne w medycynie**
Name in English: **Medical Logistics Management**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041039**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	60				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student should have a basic knowledge of basic economics and marketing.
2. Student should have a base in the field of mathematical analysis.

SUBJECT OBJECTIVES

C1. Introduction to basics of logistics management in various areas of medicine: hospital wards, emergency medical services, pharmacy, blood banks.
C2. Get knowledge of the basics of warehouse management, inventory management and the organization of the flow of materials on the example of the hospital and pharmacy.
C3. Presentation of the documents and laws regulating the conduct in specific areas of medicine.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student get a basic knowledge of logistics and logistics management in the hospital. Has knowledge of the functioning of health care providers.

PEK_W02 - Student has a knowledge of the organization and management of the supply chain of medical products. He knows the regulations on medical devices.

PEK_W03 - Get knowledge of the organization and management of the various operators involved with the hospital: pharmacy, emergency medical services, blood banks.

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to logistics and logistics management in the enterprise: the scope of the enterprise, logistics processes, engineering, logistics (packaging, storage technologies, techniques, internal and external transport).	2
Lec2	Logistics processes in medicine. Hospital Logistics: the scope of the operation, the organization of a network of hospitals in a large city, the management of emergency medical services, distribution of food, medicine and other supplies needed in hospital wards	2
Lec3	Distribution and logistics in the pharmaceutical industry. Medical device - definition, functions, classification, standardization and regulatory framework for medical devices. Logistics distribution of medicines, logistic labels in the labeling of drugs, labeling unit.	2
Lec4	Logistics in emergency care, ambulance, emergency road fast. Medical management of mass casualty events.	2
Lec5	Logistics in transplantation: the coordination of organ transplants. The management and logistics of blood banking.	2
Lec6	Financial aspects of inventory management, reimbursement, maintenance, and emergency medical service. Types of inventory, objectives and tasks of inventory management. Hospital Formulary.	2
Lec7	Management of medical waste, waste classification. Legislation governing the handling of medical waste.	2
Lec8	Final test	1
		Total hours: 15

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Abt S., Zarządzanie logistyczne w przedsiębiorstwie, PWE, Warszawa 1998.
[2] Nowakowski T. (red): Systemy logistyczne.Tom II. Wyd. Difin. Warszawa 2011
[3] Balter J.F., Zbroja T., Zarządzanie logistyczne w przedsiębiorstwie, Oficyna Wydawnicza CL Consulting i Logistyka, Wrocław 2003.

SECONDARY LITERATURE

[4] Coyle J.J., Bardi E.J., Langley Jr C.J., Zarządzanie logistyczne, PWE,
Warszawa 2002.
[5] Zając P: Elektroniczna wymiana danych w systemach logistycznych. Seria Navigator nr 19, Of. Wyd. Pol. Wr. Wrocław 2010
[6] Czasopismo LOGISTYKA

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Medical Logistics Management
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W03, K2IB_W08	C1	Lec1, Lec2, Lec8	N1, N2, N3
PEK_W02	K2IB_W08, K2IB_W21	C2, C3	Lec3, Lec6, Lec8	N1, N2, N3
PEK_W03	K2IB_W08	C1, C3	Lec4-Lec6, Lec7, Lec8	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Podstawy robotyki**
Name in English: **Introduction to robotics**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041040**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)			15		
Number of hours of total student workload (CNPS)			60		
Form of crediting			Crediting with grade		
Group of courses					
Number of ECTS points			2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes			1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of mechanics and design of mechanical systems
2. Basic knowledge of analog and digital electronic circuits and sensors
3. Basic microcontroller programming and algorithms implementation skills

SUBJECT OBJECTIVES

C1. Presentation of selected technical solutions used in automation and robotics as an example of educational robot kit
C2. The use of the acquired knowledge of mechanics, electronics and programming to make a simple mobile robot
C3. Developing skills of algorithm invention and implementation

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

PEK_U01 - can invent and implement simple algorithms for the motion control of mobile robot
PEK_U02 - is able to analyze and use data from sensors and cameras to control robot movement
PEK_U03 - can use digital servomotors

III. Relating to social competences:

PEK_K01 - is able to think and act creatively
PEK_K02 - is able to work on tasks independently and in groups

PROGRAMME CONTENT

Form of classes – Laboratory		Number of hours
Lab1	Introduction to robotics. The use graphical environment for humanoid robot motion control	2
Lab2	Motion control of digital servo	2
Lab3	The use of sensors in robotics	2
Lab4	The use of vision systems in robotics	2
Lab5	The basic algorithms for motion control of mobile robots	2
Lab6	Design and assembly of the simple mobile robot -creating own project	2
Lab7	Development and implementation of motion control algorithms for a designed robot sensors- creating own project	3
		Total hours: 15

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Wojciech Klimasara, Zbigniew Pilat (2013), Podstawy automatyki i robotyki. Podręcznik, WSiP

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Introduction to robotics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01	K2IB_U01, K2IB_U02, K2IB_U03, K2IB_U05, K2IB_U22	C3	Lab 1, Lab5, Lab 7	N1,N2
PEK_U02	K2IB_U01, K2IB_U02, K2IB_U03, K2IB_U05	C2	Lab3, Lab4,Lab7	N1,N2,N3
PEK_K01	K2IB_K05	C1, C2,C3	Lab1, Lab2,Lab3, Lab4,Lab5,Lab6,Lab7	N1,N2,N3
PEK_K02	K2IB_K08	C1, C2,C3	Lab1, Lab2,Lab3, Lab4,Lab5,Lab6,Lab7	N1,N2,N3
PEK U03	K2IB_U01, K2IB_U02, K2IB_U03, K2IB_U05	C1, C2	Lab1, Lab2, Lab6	N1,N2,N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Mechanobiologia**
Name in English: **Mechanobiology**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041041**
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	Crediting with grade	
Group of courses					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basics of biomedical engineering
2. Mechanics and strength of materials

SUBJECT OBJECTIVES

C1. Describe the role of mechanical stimuli as a factor in regulating biological processes in a living organism.
C2. Discussion of selected biomechanical models of biological processes in the living organism.
C3. The acquisition of the practical use of mechnobiological models for the analysis of processes formation, differentiation and tissue remodeling.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - has knowledge about the effects of the mechanical stimuli impact on the tissue in the living organism.

PEK_W02 - has knowledge of currently used biomechanical models of biological processes in the living organism

II. Relating to skills:

PEK_U01 - able to apply the mathematical model of the biomechanical process to analysis of issues related to the tissues remodeling as a function of the load application.

PEK_U02 - can individually analyze the results of numerical simulations (FEM) of biological processes in tissues.

III. Relating to social competences:

PEK_K01 - is aware of the role of the engineer in their efforts to improve the quality of life of contemporary society.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Mechanobiologia, historical overview. Discussion of the mechanical parameters are treated as stimuli affecting the biological responses of cells and tissues.	2
Lec2	Tissue mechanical characteristics, their comparison depending on the load type (static or dynamic).	2
Lec3	Mesenchymal stem cells (MSC) and their role in tissue adaptation processes.	2
Lec4	Effect of mechanical factors on the biological processes that occur in the tissues, tissue sensitivity to mechanical stimuli.	2
Lec5	The formation and development of bone tissue.	2
Lec6	Bone tissue modeling and remodeling, the interaction between tissues and implants.	2
Lec7	Bone remodeling model by Carter	2
Lec8	Bone remodeling model by Huiskes and Prendergrast.	2
Lec9	Models of tissues proliferation and differentiation in the fracture gap.	2
Lec10	Mechanobiology of leg elongation process, part 1.	2
Lec11	Mechanobiology of leg elongation process, part 2.	2
Lec12	Blood vessel wall mechanobiology, healthy and pathological lesions (aneurysm, atherosclerosis).	2
Lec13	Biomechanical aspects of cooperation between the stent and a blood vessel.	2
Lec14	Bioreactors in tissue engineering, the role of tissue bioreactors, design of bioreactors, bioreactors for clinical applications	2
Lec15	Scafolds design and manufacture, scafolds biocompatibility.	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	The impact of external concentrated forces on bone remodeling by the Carter algorithm.	6

Lab2	Remodeling of the trabecular and cancellous bone structure - Tsubota algorithm.	6
Lab3	Tissue remodeling around the implant as a result of interaction between the implant and tissue.	6
Lab4	Modeling and analysis of the pressure wave as a effect on the state of strain and the stress in the blood vessel wall.	6
Lab5	Effect of bone fragments displacement on differentiation and tissue remodeling processes on the bone fractures gap.	6
		Total hours: 30
Form of classes – Project		Number of hours
Proj1		6
Proj2		6
Proj3		6
Proj4		6
		Total hours: 24

TEACHING TOOLS USED
N1. multimedia presentation N2. problem exercises N3. report preparation

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

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_K01	mark of the project Proj1
F2	PEK_U01, PEK_U02, PEK_K01	mark of the project Proj2
F3	PEK_U01, PEK_U02, PEK_K01	mark of the project Proj3
F4	PEK_U01, PEK_U02, PEK_K01	mark of the project Proj4
F5	PEK_U01, PEK_U02, PEK_K01	mark of the project Proj5
P = (F1+F2+F3+F4+F5)/5		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Będziński R. (ed.), Engineering Technology, Vol. XII Biomechanics. Institute of Fundamental Technological Research, Warsaw 2011 (in Polish)
Van C. Mow, Huiskes R.: Basic Orthopaedic Biomechanics and Mechano-Biology. Lippincott Williams & Wilkins, Philadelphia, 2005

SECONDARY LITERATURE

journals: Journal of Biomechanics, Clinical Biomechanics, Acta of Bioengineering and Biomechanics

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mechanobiology
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W09, K2IB_W14	C1	Le1-Le6, Le12, Le13, Le15	N1, N2
PEK_W02	K2IB_W06, K2IB_W09	C2	Le7-Le11, Le14	N1, N2
PEK_U01	K2IB_U01, K2IB_U02	C3	Lab.	N2, N3
PEK_U02	K2IB_U03, K2IB_U04, K2IB_U06	C3	Lab.	N2, N3
PEK_K01	K2IB_K01, K2IB_K02, K2IB_K08	C1, C2, C3	Lab.	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Proseminarium dyplomowe**
Name in English: **Thesis proseminar**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041042**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Background & general knowledge about realised Master’s thesis area.

SUBJECT OBJECTIVES

C1. Knowledge of proper technical and scientific Master Thesis preparation.
C2. Review of current knowledge, aim and scope for diploma thesis preparation.
C3. Selection the individual own diploma thesis.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - He can prepare & present the research problem using text, charts & tables.

II. Relating to skills:
PEK_U01 - Rules of proper technical and scientific paper preparation.

III. Relating to social competences:
PEK_K01 - He can search information and is able to critical review it.

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1	Information about diploma work and diploma exam - requirements. Selection the individual own diploma thesis. Review of current knowledge, aim and scope of individual diploma thesis – students presentations. Reports from progress in realization of students work – students presentation.	30
		Total hours: 30

TEACHING TOOLS USED

N1. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01, PEK_U01, PEK_K01	Evaluation of project preparation.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1.Publications from the scope of the thesis carried out
2.Baranowski B.; Metody twórczego rozwiązywania problemów inżynierskich. Wielkopolska Korporacja Techniczna NOT, Poznań 1999
3. Regulations Governing Higher Education Studies at Wroclaw University of Technology
4. G. Gambarelli, Z. Łucki: Jak przygotować pracę dyplomową lub doktorską. Wyd. Universitas, Kraków 1996, wyd. II.
5. R. Zanderowski: Praca magisterska, licencjat: krótki przewodnik po metodologii pisania i obrony pracy dyplomowej. Wyd. Fachowe CeDeWu PL, Warszawa 2009.

SECONDARY LITERATURE

1.Wiszniewski A.; Sztuka pisania. Videograf II, Katowice 2003
2. B. Kurzępa, E. Kurzępa: Ochrona własności intelektualnej: zarys problematyki. Wyd. Towarzystwo Naukowe Organizacji i Kierownictwa "Dom Organizatora", Toruń 2010.
3. A. Lenar: Profesjonalna prezentacja multimedialna. Wyd. Helion, Gliwice 2010.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Thesis proseminar
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W22	C1	Se1	N1
PEK_U01	K2IB_U01	C2	Se1	N1
PEK_K01	K2IB_K02	C3	Se1	N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Praca przejściowa, projekt technologiczny**
Name in English: **Intermediate project, technology development**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041043**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				45	
Number of hours of total student workload (CNPS)				90	
Form of crediting				Crediting with grade	
Group of courses					
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				2.1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1		3
Proj2		3
Proj3		6
Proj4		3
Proj5		3
Proj6		6
Proj7		3
Proj8		3
Proj9		9
Proj10		3
Proj11		3
		Total hours: 45

TEACHING TOOLS USED

N1. self study - preparation for project class
N2. project presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Intermediate project, technology development
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01, PEK_U02, PEK_U03, PEK_K01	K2IB_K07, K2IB_U02, K2IB_U03, K2IB_U04, K2IB_U17, K2IB_U25, K2IB_U26	C1-C3		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Bionika**
Name in English: **Bionics**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **obligatory**
Subject code: **IBM041044**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		1
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		2
		Total hours: 15

TEACHING TOOLS USED
N1. informative lecture N2. self study - preparation for project class N3. project presentation N4. tutorials

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

P = F1

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02 PEK_K01, PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Bionics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W16, K2IB_W22	C2, C3		N1
PEK_W02	K2IB_W16, K2IB_W22	C1, C2		N1
PEK_U01, PEK_U02	K2IB_U02, K2IB_U03	C1, C2		N2, N3, N4
PEK_K01, PEK_K02	K2IB_K02, K2IB_K08	C1, C2, C3		N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Elementy biomechaniki sportu**
Name in English: **Problems of the sports biomechanics**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041045**
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		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	1		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge of the fundamental theorems of mechanics (statics, kinematics, dynamics).
2. Student has elementary knowledge of the human anatomy.
3. Student has the ability to define the structure of complex systems.

SUBJECT OBJECTIVES

C1. Mastering knowledge of the basic laws of mechanics applications for the biomechanical analysis of human movement during a variety of sport's activity.
C2. Developing of the ability to apply student's knowledge to the analysis and description of the observed phenomena.
C3. Improving of the knowledge of biomechanics.
C4. Mastering of the ability to analyze motion and forces acting on the man who makes sport exercises with selected methods and measurement techniques.
C5. Mastering of the ability of numerical modeling and simulation of human musculoskeletal system.
C6. Developing the ability to work in a team.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has ordered knowledge of the biomechanics of sport and can to propose a biomechanical model of the man who makes the established motion profile, taking into account external influences.

PEK_W02 - Student can indicate the method of the basic geometric and mass parametrs calculation of the human body.

PEK_W03 - Student can explain the relationship between sports results and biomechanical parameters of man.

II. Relating to skills:

PEK_U01 - Student can experimentally determine the biomechanical parameters of human movement (in particular related to its sports activities), planning and implementing experiment and handling the obtained measurement data.

PEK_U02 - Student can to interpret human movement performing sports exercises in terms of biomechanics (mechanics + anatomy and physiology elements).

PEK_U03 - Student can formulate the numerical models of the human motion, and then use them to determine the parameters that characterize the physical activity of man.

III. Relating to social competences:

PEK_K01 - Student can think and act in a creative way, using his knowledge and understands the need for the continuous replenishment.

PEK_K02 - Student has ability to communicative presentation the results of their work using the relevant tools (report, drawing, diagram, multimedia presentation).

PEK_K03 - Student is able to work in a team.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction; human biomechanical model - basic definitions, geometric and mass parameters characterizing the human body, methods of their determination. Measurement methods in biomechanics of sport.	2
Lec2	Forces and torques (generated by the muscles and from the external loads). The static and kinetic balance. Motion coordination as a result of the control and regulation of human movement; its importance in sports.	2
Lec3	Biomechanical description of the walk, run, jump and athletic throw.	2
Lec4	Biomechanics of ball games (ball throw, kick, volleyball serve, serve court).	2
Lec5	Biomechanics of rowing (indoor and water).The influence of the medium resistance (in which the player and/or equipment is moving) on the achieved results.	2
Lec6	Biomechanics of water sports: swimming and diving, water as a medium in which the motiont is realised; buoyancy, resistance, propulsion and support forces. Bodies floatation and stability.	2
Lec7	Biomechanics of ski sports: cross-country skiing and downhill skiing, ski jumping. Forces: aerodynamic drag, gravity and friction; analysis of aerodynamic properties of silhouette skier.	2
Lec8	Final test.	1
		Total hours: 15

Form of classes – Laboratory		Number of hours
Lab1	Introduction to numerical simulation program (Adams) - the multibody method (UW).	2
Lab2	Presentation of the user's graphical interface for simulation using the UW.	2
Lab3	Study of human equilibrium using resistive mat.	2
Lab4	The rower rowing on ergometer kinematics analysis using cinematographic method.	2
Lab5	The rower rowing on ergometer kinematics analysis using Optotrak system.	2
Lab6	Analysis of the multibody human's model, for example. rower on rowing ergometer	2
Lab7	Optimization of the numerical model, comparing of the numerical calculations results and the experimental data (Lab5 and Lab6).	2
Lab8	Examination.	1
		Total hours: 15

TEACHING TOOLS USED

N1. problem lecture
N2. laboratory experiment
N3. calculation exercises
N4. report preparation
N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03	positive laboratory reports evaluation (S) from Lab3, Lab4 and Lab5; F1 = (S3 + S4 + S5)/3

F2	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	positive laboratory evaluation (S) from Lab1, Lab2, Lab6 and Lab7; F2=(S1+S2+S6+S7)/4
P = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Bober T., Zawadzki J., Biomechanika układu ruchu człowieka, Wyd. BK, Wrocław, 2001. [2] Ernst K., Fizyka sportu, PWN, Warszawa, 2012. [3] Grimshaw P., Lees A.,, Fowler N., Burden A., Krótkie wykłady - Biomechanika sportu, PWN, 2010.

SECONDARY LITERATURE

[1] Urbanik Cz., Zagadnienia biomechaniki sportu, Wyd. AWF Warszawa, 2003. [2] Żołądź J., Power output, mechanical efficiency and fatigue in human skeletal muscles, Wyd. AWF Kraków, 1999. [3] Czabański B., Elementy teorii pływania, Wyd. AWF Wrocław, Wrocław, 2003.
[4] Puleo J., Milroy P., Anatomia w bieganiu, Wyd. Muza S.A., Warszawa, 2012.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Problems of the sports biomechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02, PEK_W03	K2IB_W06	C1, C3	Lec1 - Lec7	N1, N5
PEK_U01, PEK_U02, PEK_U03	K2IB_U14	C2, C4, C5	Lab1 - Lab7	N2, N3, N4, N5
PEK_K01, PEK_K02, PEK_K03	K2IB_K04, K2IB_K08	C2, C6	Lab1 - Lab7	N1 - N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Biomechanika stomatologiczna**
Name in English: **Dental Biomechanics**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041046**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15		
Number of hours of total student workload (CNPS)	60		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	2		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge of biomaterials. He is able to characterize biological, structural and mechanical properties, of various biomaterials used in medicine.
2. Student has established knowledge of the biomechanical engineering issues.
3. Student has a basic knowledge of human organs from the point of view of physiology, mechanics and pathomechanics of human load-bearing structures.

SUBJECT OBJECTIVES

C1. Student get a knowledge of basic dental biomechanics issues: including the construction, function and biomechanics of the masticatory system.
C2. Student get a basic knowledge of the biomechanical analysis of dental treatment (including orthodontics), biomechanical aspects of cooperation with dental filling, bite correction, biomechanical principles for the construction of dentures and dental implants biomechanics.
C3. Mastering the practical principles of experimental research in the field of dental biomechanics.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student get a knowledge of the construction, operation and biomechanics of the masticatory system.
PEK_W02 - Get a basic knowlegde of dental treatments and technical resources used in this treatment.
PEK_W03 - Student has ordered knowledge of the applications of biomechanics in the analysis techniques and the effects of treatment of the human masticatory system.

II. Relating to skills:

PEK_U01 - Student is able to analyze the mechanical properties of selected tissues of masticatory system.
PEK_U02 - Student is able to analyze the characteristics of the implants, dentures and plates for fixation for fractures of the mandible.
PEK_U03 - Student is able to carry out the measurements using different methods to analyze orthodontic systems and the impact of fill material shrinkage strain on the state of the tooth.

III. Relating to social competences:

PEK_K01 - Student is able to interpret the results of the experiments.
PEK_K02 - Student can work on tasks independently and in groups.
PEK_K03 - Student is aware of the need for continuous training and learning.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Structure and function of masticatory system. Basic concepts and terminology in the field of dental biomechanics. Basic biomechanics of the masticatory apparatus. The most significant developments in dental biomechanics.	2
Lec2	Biomechanical characteristics of enamel, dentin, periodontal and spongy tissue of the jaw bone. The loads acting on individual teeth and jaw bones. Biomaterials used in dentistry.	2
Lec3	Biomechanics of temporomandibular joint.	2
Lec4	Basic and advanced input methods of dental fillings. Biomechanics of treatment with the contribution of root.	2
Lec5	The basic procedure for treatment in orthodontics.	2
Lec6	Basic and advanced design methods of dental implants. Evaluation of strength and functionality of prostheses and implants.	2
Lec7	The basic procedure for treatment with dentures.	2
Lec8	Basic and advanced design methods of dentures. Experimental and numerical methods for the analysis of the effects of dental treatment.	2
Lec9	Developmentals anomalies of stomatognathic system.	2
Lec10	The basic procedure for treatment with dental implants.	2
Lec11	Treatment of fracture and bone defect of stomatognathic system.	2
Lec12	Basics of construction of stabilizers of mandibular fractures.	2
Lec13	Visualization of computer aided diagnostic and treatment planning. Some aspects of jaw surgery.	2
Lec14	Esthetic stomatology.	2

Lec15	Final test	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Introduction to laboratory, safety training.	1
Lab2	Investigation of mechanical properties of selected tissues of masticatory system.	2
Lab3	Investigation of mechanical properties of stabilizers of mandibular fractures.	2
Lab4	Investigation of mechanical properties of dental implants.	2
Lab5	Experimental study of the mechanical properties of dental prostheses.	2
Lab6	Methods of analysis of orthodontic systems cooperated with the teeth.	2
Lab7	Analysis of strain state correlated with the impact of shrinkage of the material filling the tooth.	2
Lab8	Analysis of mechanical properties using the finite element method.	2
		Total hours: 15

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

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

F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	Evaluation of preparation and implementation of laboratory tasks, verbal response, optional - a written report of the laboratory tasks.
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. A.N. Natali, Dental biomechanics, Taylor and Francis, 2003
2. R. Nanda, Biomechanika i estetyka w ortodoncji, Czelej, 2009
3. T. Rakosi, T.M. Graber, G. Śmiech-Słomkowska, Leczenie ortodontyczne i ortopedyczne wad zębowo-twarzowych, Czelej, Łódź, 2011

SECONDARY LITERATURE

1. A. Komorowska, Materiały i techniki ortodontyczne, Warszawa 2009
2. Materiały ortodontyczne w ujęciu naukowym i klinicznym, Czelej, Lublin 2003
3. Journal of Dental Biomechanics

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Dental Biomechanics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W15	C1	Lec1, Lec2, Lec8	N1, N2
PEK_W02	K2IB_W01, K2IB_W15	C2	Lec3-Lec5, Lec8	N1-N4
PEK_W03	K2IB_W15, K2IB_W22	C1, C2	Lec5-Lec8	N1-N4
PEK_U01	K2IB_U13, K2IB_U14	C1, C3	Lab1, Lab2, Lab8	N3-N5
PEK_U02	K2IB_U03, K2IB_U14	C2, C3	Lab3-Lab6	N3-N5
PEK_U03	K2IB_U14	C2, C3	Lab7	N3-N5
PEK_K01	K2IB_K05	C3	Lab1-Lab8	N2-N5
PEK_K02	K2IB_K04, K2IB_K07	C3	Lab1-Lab8	N3, N4
PEK_K03	K2IB_K01, K2IB_K02	C1-C3	Lab1-Lab8	N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Analiza obrazów medycznych**
Name in English: **Medical image processing**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041047**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student knows the basics of structured programming in C / C++

SUBJECT OBJECTIVES

C1. Familiarizing with medical imaging methods and computer image analysis algorithms for filtering, segmentation and spatial modeling
C2. Introduction to the implementation of digital medical image analysis algorithms
C3. The introduction to the latest trends in the field of digital medical image analysis, decision support, virtual and augmented reality

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Student has structured knowledge of medical imaging methods, physical phenomena, the applicability of specific methods of imaging in terms of imaging possibilities and their invasiveness, and medical image file formats

PEK_W02 - Student has a basic knowledge of the methods of medical image filtering and segmentation of objects on medical images

PEK_W03 - Student has an elementary knowledge of new trends in the analysis of medical images, virtual and augmented reality.

II. Relating to skills:

PEK_U01 - Student can implement selected algorithms of filtering and image analysis (including quantitative analysis) and can solve the problems in the area of filtration and analysis stand-alone

PEK_U02 - Student can analyze medical data in DICOM format using packaged applications

PEK_U03 - Student can prepare a dossier with a discussion of the results of image analysis

III. Relating to social competences:

PEK_K01 - Student can work on tasks stand-alone and in a group

PEK_K02 - Student can think and act creatively

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Medical imaging methods (summary of information about the methods of CT, MRI, ultrasonography, endoscopy, PET, SPECT).	1
Lec2	Medical imaging methods (summary of information about the methods of CT, MRI, ultrasonography, endoscopy, PET, SPECT). Format of medical images.	2
Lec3	Computer analysis of digital images. Algorithms of image interpretation. Artifacts origin in medical images. Methods of noise filtration.	2
Lec4	Algorithm of object recognition on static medical images	2
Lec5	Algorithms for tissue structures recognition in images recorded in real time (video sequences)	2
Lec6	Spatial modelling of tissue structures	2
Lec7	Virtual and augmented reality. New trends in the analysis of medical images.	2
Lec8	New trends in the analysis of medical images. Examples of systems for medical decision support.	2
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1	Familiarizing with the basics of programming environment.	1
Lab2	Methods to load digital images in the following formats: BMP and DICOM.	2
Lab3	Methods of filtering of medical images	2
Lab4	Tissue structures recognition (e.g. bone tissue, tumor) on medical images	2

Lab5	Quantitative analysis of medical images	2
Lab6	Segmentation and spatial modelling of bone tissue using customized software	2
Lab7	Evaluation project / Visit to the laboratory of laparoscopic simulation	2
Lab8	Evaluation project	2
		Total hours: 15

TEACHING TOOLS USED

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	report of the exercises laboratory
F2	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	report
P = 0.5*F1+0.5*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Ryszard Tadeusiewicz, Mariusz Flasiński, Image recognition, National Scientific Publisher, Warsaw, 1991 (in Polish).
[2] Ryszard Tadeusiewicz, Przemysław Korohoda: Computer Analysis and image processing, Telecommunications Advancement Foundation Publisher, Kraków 1997 (in Polish).

SECONDARY LITERATURE

[1] Jasjit S. Suri, David L. Wilson, Swamy Laxminarayan: Handbook of Biomedical Image Analysis. Kluwer Academic / Plenum Publishers, New York, Boston, Dordrecht, London, Moscow, 2005.
[2] Isaac Bankman: Handbook of Medical Imaging: Processing and Analysis Management (Biomedical Engineering), Academic Press; 1 edition (October 13, 2000)

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Medical image processing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W04, K2IB_W23	C1	Lec1, Lec2, Lec3	N1, N2
PEK_W02	K2IB_W03, K2IB_W04, K2IB_W22, K2IB_W24	C1, C2	Lec3, Lec4, Lec5, Lec6	N1, N2
PEK_W03	K2IB_W22	C3	Lec7, Lec8	N1, N2
PEK_U01	K2IB_U01, K2IB_U02, K2IB_U14, K2IB_U20, K2IB_U21, K2IB_U22	C1, C2	Lab1, Lab2, Lab3, Lab4, Lab5, Lab7, Lab8	N3, N4
PEK_U02	K2IB_U06, K2IB_U14	C2, C3	Lab6	N3, N4
PEK_U03	K2IB_U03, K2IB_U14	C1, C2, C3	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8	N3, N4
PEK_K01	K2IB_K02, K2IB_K04	C1, C2, C3	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8	N3, N4
PEK_K02	K2IB_K05, K2IB_K07, K2IB_K08	C1,C2, C3	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8	N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Sterowanie podzespołami robotów i manipulatorów**
Name in English: **Control components of robots and manipulators**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041048**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It is assumed that prior to learning of this course the student has to prepare in the following areas: writing concept of algorithms, programming in C / C + + and basic of electronics.

SUBJECT OBJECTIVES

C1. Familiarizing students with the control systems of robots and manipulators. Presentation of the software for robotic system simulation and control.
C2. Familiarizing students with the robot control system components, such as electric motors, temperature sensors, position, acceleration sensors and gyroscopes etc.
C3. Familiarizing students with the architecture of microprocessor and computer control systems and methods of implementation of control algorithms.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:
PEK_W01 - It has a basic knowledge of handling robot simulation software and implementation of basic control systems.
PEK_W02 - Has a basic knowledge of motor drive.
PEK_W03 - Has basic knowledge of programming and reading data of digital and analog sensors.

II. Relating to skills:
PEK_U01 - Can implement control algorithms for computer and microprocessor systems.
PEK_U02 - Can control a DC motor, unipolar and bipolar stepper motor.
PEK_U03 - Can program and use the digital temperature sensors, acceleration and gyroscope.

III. Relating to social competences:
PEK_K01 - Can work on tasks independently and in groups.
PEK_K02 - Can think and act creatively.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Components of robots and manipulators - Introduction	2
Lec2	Kinematic systems - basic terms	2
Lec3	Analysis of the kinematic systems	2
Lec4	Analysis of the kinematic systems - analytical methods	2
Lec5	Robots and manipulators - Introduction	2
Lec6	Robots and manipulators - methods of description and analysis	2
Lec7	Control systems - Introduction	2
Lec8	Regulation and control systems	2
Lec9	Actuators - construction and control	2
Lec10	Actuators - construction and control 2	2
Lec11	Gears and transmissions	2
Lec12	Sensory systems, data acquisition and visualization	3
Lec13	Communication protocols and interfaces	2
Lec14	The integration of robotic systems - selection of components	2
Lec15	Test	1
		Total hours: 30

Form of classes – Laboratory		Number of hours
Lab1	Introduction, presentation of the components used in robotics	1
Lab2	Introduction to simulation environment of spatial robotic systems	3
Lab3	Basics of modeling kinematic systems	2
Lab4	Implementation of spatial models of of manipulators	2
Lab5	Układy regulacji i sterowania - wprowadzenie	2

Lab6	The implementation of control systems and control	2
Lab7	Modelling of selected components of robotic systems - gears and transmissions	2
Lab8	Implementation and programming of image analysis systems	4
Lab9	Implementation of the algorithm of manipulator control	4
Lab10	The implementation of the control system of the drive unit	4
Lab11	Implementation and testing of the measuring system and distance sensors	4
		Total hours: 30

TEACHING TOOLS USED

N1. informative lecture
N2. multimedia presentation
N3.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

J. Augustyn, Designing of embedded systems on the family microcontrolers SAM7S with core ARM7TDMI , IGSMiE PAN, 2007, ISBN: 978-83-60195-55-0

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Control components of robots and manipulators
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2IB_W03, K2IB_W04, K2IB_W11	C1	Lec1, Lec2, Lec3, Lec4	N1, N2
PEK_W02	K2IB_W03, K2IB_W04, K2IB_W05, K2IB_W18	C2	Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12	N1, N2
PEK_W03	K2IB_W03, K2IB_W04	C2, C3	Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2
PEK_U01	K2IB_U01, K2IB_U02, K2IB_U12	C2, C3	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8, Lab9, Lab10, Lab11, Lab12, Lab13, Lab14, Lab15	N3
PEK_U02	K2IB_U01, K2IB_U02	C2, C3		N3
PEK_U03	K2IB_U01, K2IB_U02, K2IB_U10	C1, C2, C3	Lab12, Lab13, Lab14, Lab15	N3
PEK_K01	K2IB_K04	C1, C2, C3	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8, Lab9, Lab10, Lab11, Lab12, Lab13, Lab14, Lab15	N3
PEK_K02	K2IB_K05, K2IB_K07, K2IB_K08	C1, C2, C3	Lab1, Lab2, Lab3, Lab4, Lab5, Lab6, Lab7, Lab8, Lab9, Lab10, Lab11, Lab12, Lab13, Lab14, Lab15	N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Metody numeryczne w zagadnieniach optycznych**
Name in English: **Numerical methods in optical applications**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041049**
Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of foundations of solid mechanics and numerical methods of structure analysis. Experience in using any professional computer program for such analysis.

SUBJECT OBJECTIVES

C1. The knowledge of mechanics and optics of human eyeball, also of surgical correction of its optical power as well as of basic methods of IOP measurement.
C2. General knowledge regarding selection of theoretical and practical means appropriate for biomechanical tasks.
C3. Rational and critical attitude to published research.

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Knows the structure and operation of human eyeball optical system.
PEK_W02 - Knows basic methods of IOP measurement.
PEK_W03 - Knows: the basic problems of biomechanical model creation, how to solve nonlinear constructions.

II. Relating to skills:

PEK_U01 - Can verify possibility of numerical solution of basic types of biomechanical problems.
PEK_U02 - Can plan the strategy of solving simple biological constructions.

III. Relating to social competences:

PEK_K01 - Rationally presents and justifies his point of view, arguments relates to knowledge of mechanics.
PEK_K02 - Critically assesses “the newest” research results, especially based on experiments carried out using technologically advanced research and measurements tools.

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the lecture: its subject and scope, fundamental problems.	2
Lec2	Introduction to finite elements method (FEM) in the scope important for biomechanical research.	2
Lec3	Specific problems of FEM: finite element, shape function, linear solution, physical and geometrical nonlinearity.	2
Lec4	Optical system. Fundamentals of geometrical optics for two lenses: parameters of the system, analytical equation.	2
Lec5	Human eyeball optical system: accommodation, structure of cornea, lens, sclera.	2
Lec6	Experimental fundamentals of tonometry: GAT, DCT, ART.	2
Lec7	Biomechanical model of human eyeball and its applications in optics and in tonometry – survey, methods, results.	2
Lec8	Structure of numerical model of eyeball, solution parameters. Calculation of optical power of cornea-lens system.	2
Lec9	Numerical simulation of optical self-adjustment and of PRK and RK surgery.	2
Lec10	Goldmann applantion tonometry: comparison of theoretical predictions with experiments.	2
Lec11	Physical fundamentals of Imbert-Fick law. Numerical solution analysis.	2
Lec12	Material of human eyeball shells: identification of material parameters of cornea, sclera and limbus.	2
Lec13	Verification methods of numerical model. Test for PRK and GAT after PRK.	2
Lec14	Applanation tonometry – formal foundation obtained thanks to numerical model of eyeball, correction of reading accounting for corneal geometry.	2
Lec15	Potential possibilities of numerical model of eyeball. Exam requirements.	2
		Total hours: 30

TEACHING TOOLS USED

N1. Traditional lecture with the use of transparencies and slides.
N2. Problem discussion.
N3. Tutorials.
N4. Homework.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE
(Basic reading)

SECONDARY LITERATURE
(Additional reading)

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Numerical methods in optical applications
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01 do PEK_W03	K2IB_W06	C1,C2, C3	Lec1 to Lec15	N1- N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA I, II**
Name in English: **MASTER THESIS**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **IBM041051, IBM041052**
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)				540	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				18	
including number of ECTS points for practical (P) classes				18	
including number of ECTS points for direct teacher-student contact (BK) classes				20.0	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

TEACHING TOOLS USED

N1. case study
N2. self study - preparation for project class
N3. self study - self studies and preparation for examination
N4. tutorials

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Kozłowski R., Praktyczny sposób pisania prac dyplomowych, Wolters Kluwer, 2009
2. Kalita C., Zasady pisania licencjackich i magisterskich prac badawczych. Poradnik dla studentów, Wydawnictwo ARTE, 2011

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
MASTER THESIS
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01, PEK_W02	K2IB_W21, K2IB_W22	C1, C2, C3		N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K2IB_U01, K2IB_U04, K2IB_U16, K2IB_U18, K2IB_U19	C1, C2, C3		N1, N2, N3
PEK_K01, PEK_K02, PEK_K03	K2IB_K01, K2IB_K02, K2IB_K03, K2IB_K05, K2IB_K06	C3		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK JĘZYKI OBCE B2+, C1+**
Name in English: **Block of Foreign languages B2+ or C1+**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **JZL100709**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		15			
Number of hours of total student workload (CNPS)		30			
Form of crediting		Crediting with grade			
Group of courses					
Number of ECTS points		1			
including number of ECTS points for practical (P) classes		1			
including number of ECTS points for direct teacher-student contact (BK) classes		0.5			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Classes		Number of hours
Cl1		15
		Total hours: 15

TEACHING TOOLS USED

N1.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of Foreign languages B2+ or C1+
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01	K2IB_U05, K2IB_U23	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO
PEK_K01	K2IB_K01	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO

Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK JĘZYKI OBCE A1, A2, B1**
Name in English: **Block of Foreign languages A1 or A2 or B1**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **JZL100710**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		45			
Number of hours of total student workload (CNPS)		60			
Form of crediting		Crediting with grade			
Group of courses					
Number of ECTS points		2			
including number of ECTS points for practical (P) classes		2			
including number of ECTS points for direct teacher-student contact (BK) classes		1.5			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Classes		Number of hours
Cl1		45
		Total hours: 45

TEACHING TOOLS USED

N1.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of Foreign languages A1 or A2 or B1
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01	K2IB_U05, K2IB_U24	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO
PEK_K01	K2IB_K01	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **BLOK ZAJĘCIA SPORTOWE**
Name in English: **Block of Sports Activities**
Main field of study (if applicable): **Biomedical Engineering**
Specialization (if applicable):
Level and form of studies: **II level, full-time**
Kind of subject: **optional**
Subject code: **WFW010000BK**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		15			
Number of hours of total student workload (CNPS)		30			
Form of crediting		Crediting with grade			
Group of courses					
Number of ECTS points		1			
including number of ECTS points for practical (P) classes		1			
including number of ECTS points for direct teacher-student contact (BK) classes		1.0			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

II. Relating to skills:

III. Relating to social competences:

PROGRAMME CONTENT

Form of classes – Classes		Number of hours
Cl1		15
		Total hours: 15

TEACHING TOOLS USED

N1.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

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

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Block of Sports Activities
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Biomedical Engineering

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_K01	K2IB_K09	wg kart przygotowanych przez SWFiS		wg kart przygotowanych przez SWFiS