II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title*		
	Economics and Management		
II.B.2	*faculty course code*		
II.B.3	*type of course*		
	obligatory		
II.B.4	*lewel of course*		
	basic		
II.B.5	*nominal semester (year) of studies*		
	Semester I		
II.B.6	*number of ECTS points*		
	3		
II.B.7	*teaching methods*		
	W-30, W-2		
II.B.8	*language of instruction*		
	english		
II.B.9	*course leader (responsible for course))*		
	Dr Jacek Szumigaj		
II.B.10	*prerequisites*		
	none		
II.B.11	*objectives of the course*		
	The course introduces students to the basic principles of micro- and macroeconomics, including supply, demand, production and customer behavior, unemployment, inflation and economic growth. After this course the students should understand the nature of basic economic processes and its influence on people's life and behavior.		

II.B.12	*course contents* • The Concepts of Economics • Supply and Demand: Elasticity and Applications • Demand and Consumer Behavior • Production and Business Organization • Analysis of Costs • Production, Cost Theory, and Decisions of the Firm • Analysis of Perfectly Competitive Markets • Factor markets: labor, land and capital • Imperfect Competition and Monopoly • Measuring Economic Activity • Consumption and Investment • Money and the Financial System • Monetary Policy and the Economy • Economic Growth • Unemployment • Inflation
II.B.13	*assesment methods* ***Written exam- test or open questions***
II.B.14	*recommended reading* Samuelson P., Nordhaus W., Economics, McGraw-Hill/Irwin; 19th edition or older
II.B.15	*additional remarks*

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title*		
	Experimental Work Methodology		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	obligatory		
II.B.4	*lewel of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	Semester I		
II.B.6	*number of ECTS points*		
	3		
II.B.7	*teaching methods*		
	W-15, W-1 + C-15, C-1		
II.B.8	*language of instruction*		
	english		
II.B.9	*course leader (responsible for course))*		
	Prof. Zbigniew Stojek		
II.B.10	*prerequisites*		
	no		
II.B.11	*objectives of the course*		
	The goal of the course is to provide students with the skills of planning and conducting experiments. Students also acquire knowledge regarding analysis and presentation of obtained results and their publication.		

II.B.12	*course contents* The lecture covers the following topics 1. Initial Hypothesis 2. Design of Experiments 3. Optimization of Experimental Techniques 4. Evaluation of Obtained Data 5. Verification of Obtained Data 6. Presentation and Publication of Results
II.B.13	*assesment methods* **Written examination**
II.B.14	*recommended reading* 1. D. Montgomery, “Design and Analysis of Experiments” Wiley, 2000
II.B.15	*additional remarks* ***no***

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title* **Social and Ecological Aspects of Biotechnology**		
II.B.2	*faculty course code*		
II.B.3	*type of course* **obligatory**		
II.B.4	*level of course* **medium**		

II.B.5	*nominal semester (year) of studies*
	semester I
II.B.6	*number of ECTS points*
	3
II.B.7	*teaching methods*
	W-30, W-2
II.B.8	*language of instruction*
	English
II.B.9	*course leader (responsible for course))*
	dr hab. inż. Andrzej Kulig, prof. PW
II.B.10	*prerequisites*
	……absence……
II.B.11	*objectives of the course*
	The objective of the module is to familiarise the students with the environmental impact assessment procedures to be followed in case of the planned projects and existing facilities. Lectures, provide the students with the knowledge of formal and legal procedures and give them skills required to carry out environmental impact assessments and ecological surveys, and produce formal reports which form the basis for social acceptance and administrative (e.g. environmental) decisions.
II.B.12	*course contents*
	Introductory issues. Environmental impact at the stage of implementation, operation and liquidation of a facility; and assessment of that impact. Basic definitions. Brief history of environmental impact assessments globally, in the EU and in Poland. International principles and regulations (directives and conventions) applicable to environmental impact assessments. Legal basis for environmental impact assessment procedures in Poland – evolution of regulations and their final status. Types of projects affecting the condition of the environment (policies, plans and programmes, and investment projects). Investment process in the context of environmental protection and social requirements. Technical objectives and types of environmental impact assessments (*screening*). Formal and legal procedures of environmental impact assessment – analysis of patterns. Environmental Impact Assessment in a Transboundary Context. Formal procedure of environmental impact assessment at the project planning stage. Schedule of assessment procedures. Environmental impact assessment procedure for small investment projects. Decision on environmental conditions of project implementation. Assessment methods and techniques. Source materials in environmental impact assessments. Use of environmental monitoring data. Determination of the scope for environmental impact assessment (*scoping*). Descriptive checklists. How to make the assessments more detailed (from qualitative to quantitative). Environmental impact assessment methods: scaled and weighted checklists, matrices, overlay matrix, network interrelation matrix, environmental status comparison matrix, mathematical modelling. Alternatives of solutions in environmental impact assessments. Extraordinary environmental hazards and their assessment. European Ecological Network *Nature 2000* and its implications for EIA procedures. Ex-post assessments and ecological surveys (ES). General principles of and formal requirements to be met by the surveys. ES of contaminated areas. Detailed ES procedures (privatisation processes, environmental management, solid waste management). Examples

	of environmental impact assessments produced for industrial projects. Sources and types of the impact. Active and passive methods of reducing unfavourable impact. Public participation in environmental impact assessment procedures. Formats and techniques of consultation exercises involving the general public. Environmental Impact Report – principles of elaboration and formal requirements.
II.B.13	*assessment methods*
	Colloquy – credit in a written format.
II.B.14	*recommended reading*
	1. Environmental protection regulations, including Act of 3 October 2008 on *Making Accessible Information about Environment and its Protection, Public Participation in Environmental Protection and Environmental Impact Assessment* (Official Journal No 194, Item 1227 as amended) and *Regulation on Determination of the Types of Projects Which May Have a Substantial Impact on the Environment, and on Detailed Conditions to Be Met for a Project to Qualify for Preparation of the Environmental Impact Report* issued by the Cabinet on 9 November 2004 (Official Journal No 257, Item 2573). **2.** Glasson J., Therivel R., Chadwick A. (1999): *Introduction to Environmental Impact Assessment. Principles and procedures, process, practice and prospects.* The Natural and Built Environment Series. 2nd edition. UCL Press Ltd. London. **3.** Harrop O. D., Nixon A. J. (1999): *Environmental Assessment in Practice*. Routledge Environmental Management Series. Routledge. London. **4.** Selected publications (bibliography items) from magazines, including *"Problemy ocen środowiskowych*". **5.** Selected internet sources (with accurate indication of the website address)
II.B.15	*additional remarks*
	……no additional remarks……

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**……**
II.B.1	*course title*		
	Environmental Biotechnology		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	Obligatory		
II.B.4	*lewel of course*		
	Semi -advance		
II.B.5	*nominal semester (year) of studies*		

	Semester I
II.B.6	*number of ECTS points*
	3
II.B.7	*teaching methods*
	W-15, W-1+C-15, C-1
II.B.8	*language of instruction*
	English
II.B.9	*course leader (responsible for course))*
	Prof. dr hab. Stanislaw W. Gawronski
II.B.10	*prerequisites*
	Basic knowledge on sources of emission, behavior in the environment and toxicity of most important groups of pollutants as: heavy metals, polycyclic aromatic hydrocarbons, aliphatic hydrocarbons, explosives, particulate matter and gaseous pollutants: SO_2, NO_x CO, O_3, TBEX.
II.B.11	*objectives of the course*
	Possessing by students current knowledge in the area of phyto/bioremediation and information of the possibilities of utilization environmental biotechnologies for restoration of polluted environment.
II.B.12	*course contents*
	Sites with elevated level of pollutants, mostly of anthropogenic origin, may create serious hazard to environment and human health which can be lowered or eliminated by the use of bioremediation. Many of organic pollutants along with time are degraded by microorganisms (bacteria and fungi). Higher plants, as sessile organisms, during evolution developed mechanism(s) of tolerance and degradation of pollutants that we also should be able to utilize in newly emerging environmental biotechnology – phytoremediation. Bioremediation can be applied both at industrially polluted sites (brown fields) and urban areas, polluted mainly by transport systems. Plants in polluted environment might remediate simultaneously several various pollutants, level of which differs depending upon traffic intensities or the vicinity of factories. Most common pollutants considered for phytoremediation are as follow: heavy metals (Pb, Zn, Cd), organic pollutants (PAHs, TCE, PCB, PCDDs/Fs), exhaust gases (NOx, CO, O_3 and additives) and noble metals (Pt, Pl, Ro). Microorganisms and higher plants significantly differ in level of tolerance to pollutants and capability of their uptake, accumulation, transport to easy harvesting organs and degradation/detoxification mechanisms Among cultivated plants, some species of trees, climbers, shrubs, ornamental perennials and annuals, show useful for phytoremediation characters as accumulation and/or degradation of pollutants. Recently it has been shown that these plants can uptake recalcitrant chemicals from the soil or water through roots as well as from air *via* leaves and either incorporates and stably immobilize them in plant tissues or transform and degrade them by enzymatic processes. Most of these plants are already extensively cultivated for aesthetic reasons or for landscaping purposes in the urban environment and the pollutants in low level are taken up by plants by the way, what means that phytoremediation take place though on low efficiency level. Thus our goal is to enhance and speeding up these processes.

	Lecture: Introduction: Development of discipline and state of art. Definition of bio- and phytoremediation and area of application. Phytoremediation of heavy metals (HM) from the soil. Plant defense mechanism against HM. Phytoremediation of noble metals. Plant species with high phytoremediation capabilities. Bio/phytoremediation of organic pollutants from the soil Mycoremediation of oil spill from the water and soil. Mechanism(s) of detoxification/degradation of organic pollutants by plants organism. Air phytoremediation of gaseous pollutants: benzene, NO_2, CO, O_3 and particulate matter. Indoors air phytoremediation in houses, offices and public places. Phytoremediation of sites with high salinity, polluted by radionuclides or explosive materials. Actual regulations and arising area of research and application with new pollutants: pharmaceutical, contraceptive, cosmetics. Necessary information and condition for undertaking decision of phytoremediation application. **Lab Practicum**: Effect of heavy metals (Pb^{2+}, Cd^{2+} and Cu^{2+}) on germination and growth of mustard and corn. Level of salinity and pH in soil samples collected from sites of de-icing roads in Warsaw, Effect of soil salinity on vegetation. Capacity of *Canna* × *generalis* and *Coleus blumei* plants for degradation of organic pollutants (RBBR dye). Utilization of mushroom *Pleurotus ostreatus* for bioremediation of oil pollution. Deposition of particulate matters (PM_{10} and $PM_{2,5}$) on leaves of several tree species (*Quercus rubra, Taxus baccata* and *Carpinus betulus)* or plant samples from students neighborhoods or apartments Amount of waxes on leaves of plants (*Hedera helix, Ficus benjamina, Schefflera arboricola*) assigned for indoor phytoremediation.
II.B.13	*assesment methods* . Test passing the laboratory work and final test from the possessed knowledge in the subject.
II.B.14	*recommended reading* 1. Mench M., Schwitzgebel J-P., Schroeder P. Bert V., Gawronski S., Gupta S. 2009. Assessment of successful Experiments and limitations of phytotechnologies: contaminant uptake, detoxification and sequestration, and consequences for food safety. Environ Sci. Pollut. Res. Vol.16 (7): 876-900. 2. Gawronski S.W. and Gawronska H. 2007. Plant taxonomy for phytoremediation. In: Advanced Science and Technology for Biological Decontamination of Sites Affected by Chemical and Radiological Nuclear Agent Ed. Marmirioli N, Samotokin B. and Marmirioli M. Springer, Amsterdam. p. 79-89. 3 McCutcheon S.C., Schnoor J.L. 2003. Phytoremediation- Transformation and Control of contaminants, Wiley –Interscience. New Jersey, USA 4. Gawronski S.W. 2001. Biotechnologia środowiskowa – Fitoremediacja. Rozdzial:7.9 s.p 455-461 W: Edytor: S. Malepszy Biotechnologia roślin . PWN. 5. Raskin I., Ensley B.D. 2000. Phytoremediation of Toxic Metals. Wiley –Interscience. New York, USA. 6. Brooks R.R., 1998. Plants that Hyperaccumulate Heavy Metals.CAB International, Wallingford. UK.
II.B.15	*additional remarks* Part of literature for the students will be provided by lecturer

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title*		
	Control and Regulation of Bioprocesses		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	obligatory		
II.B.4	*lewel of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	Semester I		
II.B.6	*number of ECTS points*		
	3		
II.B.7	*teaching methods*		
	W-15, W-1 + L-30, L-2		
II.B.8	*language of instruction*		
	english		
II.B.9	*course leader (responsible for course))*		
	Marek Henczka Ph.D., D.Sc.		
II.B.10	*prerequisites*		
	Basic course on mathematics and physics		
II.B.11	*objectives of the course*		
	The goal of the course is to provide students with the knowledge of concept of process control, open and close-loop control systems, process parameters measuring devices, feedback control, performance criteria and importance of control systems in biotechnology.		

II.B.12	*course contents*
	The lecture covers the following topics: **1. Introduction to control systems (basic concepts and definitions)** **2. Open and closed loop control - objectives and benefits** **3. Measuring devices (sensors of temperature, pH, pressure, level, flow rates etc.)** **4. Mathematical modelling principles** **5. Modelling and analysis for process control** **6. Dynamic behavior of typical process systems** **7. Feedback control: P, PI and PID control** **8. PID Controller tuning for dynamic performance** **9. Performance criteria of feedback control** **10. Cascade control** **11. Examples of application of control systems in biotechnology** **The laboratory exercices includes:** **1. Dynamic behavior of temperature sensors** **2. Dynamic behavior of pressure transducers** **3. On-off control of temperature in reactors and bioreactors** **4. Practical applications of PID controlers** **5. Tuning and settings of PID controlers** **6. Numerical simulations of control systems with Matlab**
II.B.13	*assesment methods*
	Written examination
II.B.14	*recommended reading*
	1. Chau P.C., Process Control, Cambridge University Press, 2002. **2. Stephanopoulos G., Chemical Process Control: An Introduction to Theory and Practice, Prentice-Hall, Inc., 1984.** **3. Dębowski A., Automatyka – podstawy teorii (in polish), WNT, 2008.**
II.B.15	*additional remarks*
	none

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title*		
	Analytical Methods in Biotechnology		
II.B.2	*faculty course code*		
II.B.3	*type of course*		
	optional		
II.B.4	*lewel of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	semester 1		
II.B.6	*number of ECTS points*		
	5		
II.B.7	*teaching methods*		
	W-15, W-1 + L-60, L-4		
II.B.8	*language of instruction*		
	English		
II.B.9	*course leader (responsible for course))*		
	dr inż. Katarzyna Pawlak, dr inż. Mariusz Pietrzak		
II.B.10	*prerequisites*		
	Laboratory of instrumental analysis		
II.B.11	*objectives of the course*		
	The goal of the course is to provide students with the knowledge of basic concept of planning of the experiments in routine analysis or research. Definition of analytical problem, writing short instructions using English technical vocabulary and analysis of obtained results		

	course contents
II.B.12	**Project - Students select one of the proposed subjects presented as an analytical problem to solve. They are expected to design analytical procedure (on the basis of literature) in aim to determine or identify chosen compound(s) with the special emphasis on matrix composition. The report containing analytical procedure is obligatory for admission of student to an experimental part. The project will include following problems:** - **determination of metals, amino acids or other components in biological tissue** - **determination of metals, dyes or preservatives in food** - **determination of bioactive components in drugs** **Laboratory - Experiments will be carried out by students with minimal control of assistant (short training and safety precautions only). Simple instrumental and classic analytical methods will be proposed as optional in frame of the project:** - **Volumetric analysis** - **Spectrophotometry** - **Capillary electrophoresis** - **Liquid chromatography** - **Potentiometry** - **Voltammetry** **Seminary - As a summary students are required to present the aim of the project, procedure, results and conclusions in the form of oral presentation.**
II.B.13	*assesment methods*
	Project 50 %, laboratory 20% and oral presentation 30% of total points
II.B.14	*recommended reading*
	Analytical and biotechnological journals from data bases like Elseviere and Springer
II.B.15	*additional remarks*
	4-5 persons in the group

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title*		
	Biofuels		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	obligatory		
II.B.4	*lewel of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	Semester 1		
II.B.6	*number of ECTS points*		
	3		
II.B.7	*teaching methods*		
	W-30, W-2		
II.B.8	*language of instruction*		
	english		
II.B.9	*course leader (responsible for course))*		
	Prof. Krzysztof W. Szewczyk		
II.B.10	*prerequisites*		
	no		
II.B.11	*objectives of the course*		
	The goal of the course is to provide students with the knowledge of basic concept of biofuels production and modern technologies of biomass conversion into liquid and gaseous fuels. Students acquire expertise in technology evaluation and qualitative description of biofuels production processes		

	course contents
II.B.12	The lecture covers the following topics 7. Biomass Feedstocks 7.1. Biomass Characterization 7.2. Chemistry of Lignocellulosic Biomass 7.3. Cellulases and chemicellulases 8. Biorenewable Liquid Fuels 8.1. Bioethanol 8.2. Vegetable Oils 8.3. Biodiesel 8.4. Butanol 8.5. Other Alternate Liquid Fuels 9. Biorenewable Gaseous Fuels 9.1. Biogas 9.2. Hydrogen 10. Thermochemical Conversion Processes 10.1. Hydrothermal Liquefaction of Biorenewable Feedstocks 10.2. Pyrolysis Processes 10.3. Biofuels Economy and Policy
II.B.13	*assesment methods*
	Written examination
II.B.14	*recommended reading*
	1. A.Demirbas, “Biofuels. Securing th33 Planer Future Energy Needs” Springer, 2009 2. D.M.Mousdale “Biofuels. Biotechnology, Chemistry and Sustainable Development”, RCR Press, 2008 3. S.T.Yang “Bioprocessing for Value-Added Products from Renewable Resources: New Technologies and Applications”, Elsevier, 2007
II.B.15	*additional remarks*
	no

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title*		
	Selected topics in Biomedical Engineering		
II.B.2	*faculty course code*		

	……
II.B.3	*type of course*
	obligatory
II.B.4	*lewel of course*
	advanced
II.B.5	*nominal semester (year) of studies*
	Semester 1
II.B.6	*number of ECTS points*
	1
II.B.7	*teaching methods*
	W-15, W-1
II.B.8	*language of instruction*
	english
II.B.9	*course leader (responsible for course))*
	Dr inż. Tomasz Ciach
II.B.10	*prerequisites*
	no
II.B.11	*objectives of the course*
	The goal of the course is to provide students with the knowledge of basic concept of biomedical engineering, particularly in implantable medical devices. Students acquire expertise in evaluation and selection of materials and technologies used in implant production.
II.B.12	*course contents*
	The lecture covers the following topics **1.** Introduction to biomedical engineering and tissue engineering. - Introduction to the human anatomy and physiology. Presentation of major mammalian tissues properties. Cell signalling process and signalling molecules. Biology of the mammalian cell division process and cell ageing phenomenon. **2.** Materials applied in implantable medical devices. a) Non biodegradable materials: metals, polymers and ceramic. b) Biodegradable natural and synthetic materials applied in implants, biodegradable polymers available on the market. c) Hydrogels, material that mimics properties of the natural tissue.

	d) Interaction of cells and foreign body implanted in the organism. - Information about metallic alloys employed in prosthesis construction, their properties and behaviour in the body. Biodegradable and non biodegradable polymers applied in implants. Ceramic materials and bioglass applied in implants. Hydrogels preparation methods, their properties and applications in medicine. Proteins and cells adhesion to various materials and surfaces, foreign body response. **3.** Principles of regenerative medicine. a) Regeneration process, stimulation of the tissue regeneration process. b) Stem cells; their origin and properties. Stem cells harvesting, multiplication and differentiation. c) In situ recruitments of cells. - Description of the regeneration process with and without the active participation of stem cells. of Stem cells harvesting methods from bone marrow, placenta, blood and fat. Stem cells multiplication, properties, differentiation and application. **4.** Examples of the existing implantable medical systems. a) Implantable drug delivery systems, particles, pumps and other. b) Bone implants, biodegradable bone implants and non biodegradable bone and joints prosthesis. c) Implantable heart prosthesis and heart pacemakers. d) Vane grafts and urine ducts. e) Coronary stents. f) Implantable hearing aid. g) Surgical sutures – biodegradable and nonbiodegradable. h) Dental implants, breast implants. - Description of implantable medical devices which are already available in hospitals and currently applied in clinical routine or medical devices which are currently tested in hospitals. Safety aspects and reliability of implantable medical devices. **5.** Future of regenerative medicine and artificial organs. - Short review of the current research trends in the area of regenerative medicine, implantable devices and artificial organs. Review on possible power sources for implantable devices. Nanotechnology application in medicine and in implantable medical devices.
II.B.13	*assesment methods*
	Written examination
II.B.14	*recommended reading*
	Clemens van Bliterswijk, Tissue Engineering, Academic Press, 2009
II.B.15	*additional remarks*
	no

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title*		
	Bioprocess Laboratory		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	obligatory		
II.B.4	*lewel of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	semester I		
II.B.6	*number of ECTS points*		
	6		
II.B.7	*teaching methods*		
	L-90, L-6		
II.B.8	*language of instruction*		
	english		
II.B.9	*course leader (responsible for course))*		
	Małgorzata Jaworska, PhD, Ludwik Synoradzki PhD		
II.B.10	*prerequisites*		
	Courses of process engineering and biotechnology		
II.B.11	*objectives of the course*		
	The aim of the course is to provide students with physicochemical and technical aspects of typical bioprocesses and training in laboratory – scale apparatus and measurements		

II.B.12	*course contents* Mass and energy balances of bioprocess. Yield coefficients. Kinetics of the growth of microorganisms in different bioreactors. Measurements of process parameters describing culture conditions. Isolation of microorganisms. Kinetics of simple enzymatic reactions. Measurements for enzymatic activity. Immobilization of enzymes. Kinetics of immobilized enzymes reactions. Separation of enzymes from biomass and purification (ultrafiltration, salting out, diafiltration). Balance of enzyme activity.
II.B.13	*assesment methods* Written / oral
II.B.14	*recommended reading* K.W.Szewczyk; "Bilanse i kinetyka procesów biochemicznych", OW PW, Warszawa 2000. Shuler M.L., Kargi F., "Bioprocess Engineering. Basic concepts", Printice Hall, 2002 R.Gaworoński; "Metody oczyszczania cieczy", OW PW 1999. R.A.Copland; "Enzymes", 2nd ed., Willey-VCh, 2000.
II.B.15	*additional remarks* **……**

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title* **Bioethics**		
II.B.2	*faculty course code* **……**		
II.B.3	*type of course* **obligatory**		
II.B.4	*lewel of course*		

	basic
II.B.5	*nominal semester (year) of studies*
	Semester II
II.B.6	*number of ECTS points*
	4
II.B.7	*teaching methods*
	W-30, W-2
II.B.8	*language of instruction*
	english
II.B.9	*course leader (responsible for course))*
	Dr Beata Witkowska-Maksimczuk
II.B.10	*prerequisites*
	no
II.B.11	*objectives of the course*
	The purpose of this course is introduce students to bioethics as an interdisciplinary subject through critical thinking, writing, and discussing contemporary issues. Bioethical thinking is neither biology nor ethics but, rather, a melding of both of them. Interdisciplinary thinking is solidly rooted in the processes of scientific thinking and, simultaneously, is solidly rooted in the processes of philosophical thinking.
II.B.12	*course contents*
	A participant who has successfully completed this course should: 1) Be able to understand the complex normative systems of bioethics, health law and international human rights as they impact on the development of health policy, locally, nationally and internationally. 2) Be able to apply the complex normative systems of bioethics, health law and international human rights as they apply to a variety of contemporary issues in this area locally, nationally and internationally 3) Be able to understand the impact on the complex normative systems of bioethics, health law and international human rights of international trade agreements and the lobbying principles of corporate globalisation 4) Be able to write and speak effectively at an academic or high policy level in the areas of regulation of cost-effectiveness evaluation of medicines and access to health services 5) Be able to effectively resolve disputes arising in this area in private or public legal practise.
II.B.13	*assesment methods*
	Written examination
II.B.14	*recommended reading*

II.B.15	*additional remarks*
	no

II.B Opis przedmiotu *(Course description)*

nazwa Wydziału, kierunek studiów ewentualnie specjalność

PL ***instrukcja:*** *proszę podać nazwę Wydziału, kierunek studiów ewentualnie specjalność*

II.B.a **Wydział Chemiczny, kierunek Biotechnologia**

name of Faculty, field of study, specialization

Chemistry , Biotechnology

nazwa przedmiotu

PL ***instrukcja:*** *proszę podać nazwę przedmiotu*

II.B.1 Bioinformatyka

course title

ENG Bioinformatics

wydziałowy kod przedmiotu

PL ***instrukcja:*** *proszę wypełnić opcjonalnie, jeżeli wydział ma ustalone kody przedmiotów*

II.B.2

faculty course code

ENG Optionally if faculty established course code

typ przedmiotu

PL ***instrukcja:*** *proszę wybrać spośród: obowiązkowy / fakultatywny ograniczonego wyboru / fakultatywny dowolnego wyboru*

II.B.3 obowiązkowy

type of course

ENG obligatory

II.B.4 PL **poziom przedmiotu**

instrukcja: *proszę opcjonalnie wybrać spośród: podstawowy / średnio-zaawansowany / zaawansowany*

Średnio-zaawansowany

level of course

ENG

an intermediate level

nominalny semestr (rok) studiów

PL ***instrukcja:*** *proszę podać nominalny semestr (rok) studiów*

Semestr II

II.B.5

nominal semester (year) of studies

ENG

Semester II

liczba punktów ECTS

PL ***instrukcja:*** *Punkty winny być przyporządkowane wszystkim przedmiotom, które kończą się ewaluacją, zgodnie z zasadą, że nakład pracy przeciętnego studenta przypadający na rok akademicki odpowiada 60 punktom ECTS, również w przypadku, gdy przedmioty pogrupowane są w moduły, lub większe „bloki". Punkty powinny uwzględniać także czas studenta poświęcony na wykonanie takich zadań obowiązujących w ramach zajęć z danego przedmiotu jak prace semestralne/roczne/ dyplomowe, dysertacje, projekty/ćwiczenia realizowane w laboratorium, prace terenowe itp.*

II.B.6

3

number of ECTS points

ENG

3

metody nauczania

PL ***instrukcja:*** *1) podać rodzaj prowadzonych zajęć dla danego przedmiotu do wyboru z listy: wykłady (W); ćwiczenia (Ć); laboratorium (L); projekt (P)*
2)podać liczbę godzin w tygodniu np. W - 2; Ć - 2; L - 3; P - 0
3) podać liczbę godzin w semestrze np. W - 30; Ć - 30; L - 45; P - 0

II.B.7

W-15, W-1 + L-15, L-1

teaching methods

ENG

W-15, W-1 + L-15, L-1

II.B.8 PL

język wykładowy

instrukcja: *język w jakim będzie prowadzony przedmiot*

polski

language of instruction

ENG

english

prowadzący przedmiot (odpowiedzialny za realizację przedmiotu)

PL ***instrukcja:*** *tytuł i/lub stopień naukowy /*

II.B.9

Prof. Piotr Zielenkiewicz

course leader (responsible for course realization)

ENG

wymagania wstępne

PL ***instrukcja:*** *Zakres wiadomości / kompetencji / umiejętności, jakie powinien już posiadać student przed rozpoczęciem nauki przedmiotu, a także specyfikacja innych przedmiotów lub programów, które należy zaliczyć wcześniej.*
Uwaga: maksymalna objętość tekstu to 1/2 standardowej strony A4

II.B.10

Chemia organiczna, biochemia, genetyka

prerequisites

ENG

Organic chemistry, biochemistry, genetics,

cele przedmiotu

PL ***instrukcja:*** *Opis zakładanych kompetencji i umiejętności jakie student nabywa w wyniku zaliczenia przedmiotu.*
Uwaga: maksymalna objętość tekstu to 3 linie standardowej strony A4

II.B.11 .

objectives of the course

ENG Students will learn about modern methods of databases searching using both nucleic and amino acid sequences, methods for sequencing genomes, comparative and functional genomics and protein structure modeling methods

II.B.12

treści merytoryczne przedmiotu

PL ***instrukcja:*** *treści merytoryczne przedmiotu dla każdej składowej przedmiotu tj. dla W; Ć; L; P.*
Uwaga: maksymalna objętość tekstu to 1 standardowa strona A4

ENG

course contents

The lecture will address various databases used in molecular biology and biotechnology, and the linkage between types of data. Basic operations on a single and multiple sequences will be discussed along with methods allowing two-sequence comparison and searching databases with nucleotide or amino acid sequences. During the lecture we will assess the concept of protein families, motifs related to function, cell compartments segregation signals and sequences controlling gene expression. Advanced methods for finding similarity between sequences will also be presented. The lecture will further describe methods for genome sequencing, distinguishing between coding and noncoding DNA sequences (ab initio methods and homology based methods), genome annotations, and comparative and functional genomics at the genomic level. Finally the lecture will address theories of protein folding, tools exercised by molecular graphics, modeling of protein structures, structure of biopolymers, protein-protein interaction networks, types of biological networks, and the analysis of various -omics data taken from -omics experiments data, with basic concepts in systems biology.

metody oceny

PL ***instrukcja:*** *Uwaga: należy wypełnić jeżeli skrócony regulamin przedmiotu zawiera coś ponadto co znajduje się w Regulaminie Studiów §6, 7 i 8. (link w nazwie punktu 13 w jęz. Polskim*

II.B.13

egzamin

assessment methods

ENG

exam

spis zalecanych lektur

PL ***instrukcja:*** *Wykaz lektur i innych materiałów zalecanych studentom podejmującym naukę przedmiotu*

II.B.14

recommended reading

ENG

uwagi dodatkowe

PL ***instrukcja:*** *np. limit osób w grupie, termin rejestracji na zajęcia; inne istotne dla studenta informacje.*

II.B.15

additional remarks

ENG

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of ……	**Biotechnology**	**Chemical Biotechnology……**
II.B.1	*course title*		

	Chemical Biotechnology:Biomolecules in Synthesis and Therapy
II.B.2	*faculty course code*
	……
II.B.3	*type of course*
	……obligatory … ……..
II.B.4	*lewel of course*
	……advanced……..
II.B.5	*nominal semester (year) of studies*
	semester II
II.B.6	*number of ECTS points*
	……1……..
II.B.7	*teaching methods*
	W-15, W-1
II.B.8	*language of instruction*
	……english…….
II.B.9	*course leader (responsible for course))*
	prof. dr hab. Maria Bretner, prof. dr hab. Anna Boguszewska-Chachulska, dr. inż Monika Wielechowska……..
II.B.10	*prerequisites*
	…Enzymology, Organic Chemistry, …..
II.B.11	*objectives of the course*
	The aims of this lecture is to acquaint students with the use of biomolecules in the synthesis of chemicals used in medicine, or as a therapeutic agents. ……
II.B.12	*course contents*

	1. Protein expression in bacterial systems – promoter types, tag systems, secretion machinery, protein stability and folding **2. Protein engineering – site-directed mutagenesis and directed protein evolution as the tools for enzymes modifications, examples of procedures (DpnI protocol, error-prone PCR, DNA shuffling)** **3. Synthetic application – modification of enantioselectivity of hydrolases, substrate specificity, pH and temperature profile and solvent tolerance** **4. High-throughput screening – methods for variant selection (spectrophotometric methods, gas chromatography, mass spectrometry, NMR)** **5. Enzymes as a therapeutic target - viral enzymes important for replication and their inhibitors,** **6. Cancer cell enzymes and their inhibitors** **7. Enzymes used as therapeutic agents** **8. Antibodies in therapy – special focus on cancer treatment** **9. Antisense Oligodeoxynucleotides as pharmacological and therapeutic agents.** **10. RNA interference in therapy, studies and modulation of biological processes,** **11. Therapeutic applications of ribozymes, DNAzymes and aptamers** **12. Viral vectors a in gene therapy, and delivery of nucleic acids and DNA vaccines** **13. Prospects of stem cells therapy and therapeutic cloning**
II.B.13	*assesment methods* **.....credit .....**
II.B.14	*recommended reading* **Journals: Nature, Nature Medicine, Science, Cancer, Protein engineering……..**
II.B.15	*additional remarks* **……**

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of……	**Biotechnology**	**Chemical biotechnology……**

II.B.1	*course title* **Laboratory of synthesis and biotransformations**
II.B.2	*faculty course code* **……**
II.B.3	*type of course* **……obligatory…….**
II.B.4	*lewel of course* **…….advanced…….**
II.B.5	*nominal semester (year) of studies* **semester II**
II.B.6	*number of ECTS points* **……5……..**
II.B.7	*teaching methods* **L-75, L-1**
II.B.8	*language of instruction* **……english……**
II.B.9	*course leader (responsible for course))* **Dr inż. Monika Wielechowska……..**
II.B.10	*prerequisites* **Enzymology, …Microbiology, Organic Chemistry advanced……..**
II.B.11	*objectives of the course* The objective of the course is to broaden the ability to perform chemical synthesis and biotransformation, to achieve good results and skills at work with microorganisms and enzymes
II.B.12	*course contents*

	Training to acquire skill of using chemical and biological databases. Learning to plan chemical and biotransformation experiments Practicing methods of expression, isolation and purification of proteins. Broadening of ability of work with microorganisms, immobilized and native enzymes. Learning of designing mutagenic primers for side directed mutagenesis, carrying out mutagenesis experiments. Evaluation of variants enantioselectivity during synthesis and biotransformations. Training of using of advanced analytical methods of purification and characterization of chemical compounds and proteins (UV, NMR, IR, GC)**……**
II.B.13	*assesment methods* **.....evaluation of report.....**
II.B.14	*recommended reading* **…….**
II.B.15	*additional remarks* **……**

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title* **Microbial Cultures**		
II.B.2	*faculty course code*		
II.B.3	*type of course* **obligatory**		
II.B.4	*lewel of course*		

	advanced
II.B.5	*nominal semester (year) of studies*
	semester II
II.B.6	*number of ECTS points*
	6
II.B.7	*teaching methods*
	L-90, L-6
II.B.8	*language of instruction*
	english
II.B.9	*course leader (responsible for course))*
	Paweł Sobieszuk , PhD
II.B.10	*prerequisites*
	No
II.B.11	*objectives of the course*
	Practical training in selected methods of microbial cultivation.
II.B.12	*course contents*
	Laboratory program contains aerobic and anoxic cultures: • **Surface culture of fungi on liquid substrates;** • **Batch, submerged culture;** • **Growth of sulphuric bacteria on solid material;** • **Solid state fermentation;** • **Microbial growth in biofilm;** • **Membrane bioreactor.**
II.B.13	*assesment methods*
	written
II.B.14	*recommended reading*

	• **Brian McNeil, Linda M. Harvey, *"Practical Fermentation Technology"*, WILEY, Chichester 2008.** • **Shuler M.L., Kargi F., "Bioprocess Engineering. Basic concepts", Printice Hall, 2002**
II.B.15	*additional remarks*
	Laboratory exercises are carry out in 2÷4 persons groups

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title*		
	Microbioanalytics		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	obligatory		
II.B.4	*level of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	semester II		
II.B.6	*number of ECTS points*		
	7		
II.B.7	*teaching methods*		
	W-30, W-2 + P-60, P-4		
II.B.8	*language of instruction*		
	English		
II.B.9	*course leader (responsible for course))*		
	Prof. dr hab. Zbigniew Brzózka (professor), dr inż. Michał Chudy (assistant professor)		

II.B.10	*prerequisites*
	inorganic chemistry course, analytical chemistry course
II.B.11	*objectives of the course*
	After course of "Microbioanalytics" passing students will have theoretical knowledge about technologies, tools and applications of analytical microsystems. They will know fundamental technological aspects of various processes of fabrication of miniaturized analytical systems, microdetectors, microreactors etc. Moreover, each operation unit (dosing, pumping, separation and detection) of biological sample analysis procedure in the microsystem will be presented and discussed. After the laboratory course of microbioanalytics, students will be also able to design and fabricate a simple microanalytical system by themselves. The scientific quality of proposed project will be evaluated during the presentation and discussion.
II.B.12	*course contents*
	<u>Lecture:</u> **Definition of microbioanalytics and miniaturised analytical systems** **Ideas of miniaturization (integrated systems vs. modular architecture)** **Basic sample treatment in microsystems (dosing, pumping, separation, analytical reactions, detection)** **Technologies for microanalytical systems** **Application of miniaturized systems for various bioanalytical procedures (medical diagnostics, genomics and proteomics, food analysis and environmental monitoring and pollution control)** **<u>Laboratory (Project)</u>** **Design, fabrication and tests of a simple microanalytical module/system (microdetector, microreactor, heating system etc.)** **Project preparation** **Presentation of the results, discussion and evaluation.**
II.B.13	*assesment methods*
	colloquium or final test and project presentation
II.B.14	*recommended reading*
	1. Z. Brzózka, Miniaturyzacja w analityce, Oficyna Wydawnicza PW 2005 (in Polish) **2. Z. Brzózka, Mikrobioanalityka, Oficyna Wydawnicza PW 2009 (in Polish)** **3. M. Madou, Fundamentals of Microfabrication, CRC Press, Inc. 2002** **4. Andreas Manz, Nicole Pamme, Dimitri Lossifidis, Bioanalytical Chemistry, Imperial College Press Language: English, ISBN: 1860943713** **5. A. Van Den Berg, Lab-On-A-Chip: Miniaturized Systems for (Bio)Chemical Analysis and Synthesis, Elsevier Science ISBN: 0444511008, 2003**
II.B.15	*additional remarks*
	……

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial Biotechnology**
II.B.1	*course title*		
	Sensors and biosensors		
II.B.2	*faculty course code*		
	……		
II.B.3	*type of course*		
	elective		
II.B.4	*lewel of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	semester II		
II.B.6	*number of ECTS points*		
	4		
II.B.7	*teaching methods*		
	W-15, W-1 + L-30, L-2		
II.B.8	*language of instruction*		
	English		
II.B.9	*course leader (responsible for course))*		
	Prof. dr hab. Elżbieta Malinowska		
II.B.10	*prerequisites*		
	Analytical chemistry		
II.B.11	*objectives of the course*		
	This course gives the knowledge regarding fundamental elements of biosensors architecture and their functions, including bioanalyte recognition mechanism and detection signal generation. The objective of this lecture is the ability of biosensor designing, characterization of biosensors working parameters		

	as well as receiving data interpretation.
II.B.12	*course contents*
	1. Introduction to (bio)sensors 2. (Bio)recognition of analytes 3. Types of recognition layers 3. Transducers and measurement systems (electrochemical, optical, etc.,) 4. Working parameters and factors affecting response of (bio)sensors 5. Chemical sensors for bioanalyte determination 6. Application of (bio)sensors in analytical control of bioprocesses, medical diagnostics, environmental protection, etc., 7. Trends in (bio)sensors developments
II.B.13	*assesment methods*
	.....
II.B.14	*recommended reading*
	1. Z. Brzózka, W. Wróblewski, „Sensory chemiczne" (Oficyna Wydawnicza Politechniki Warszawskiej, 1998) 2. U. E. Spichiger-Keller, "Chemical Sensors and Biosensors for Medical and Biological Applications" (Wiley-VCH, 1998) 3. B. Eggins, "Biosensors" (John Wiley & Sons, 1996)
II.B.15	*additional remarks*
	……

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title*		
	Characterization of Biomaterials (Biocompatibility)		
II.B.2	*faculty course code*		
	……		

II.B.3	*type of course*
	elective
II.B.4	*lewel of course*
	advanced
II.B.5	*nominal semester (year) of studies*
	Semester II
II.B.6	*number of ECTS points*
	4
II.B.7	*teaching methods*
	W-15, W-1 + L-30, L-2
II.B.8	*language of instruction*
	english
II.B.9	*course leader (responsible for course))*
	Prof. dr hab. inż. Gabriel Rokicki **Dr inż. Paweł Parzuchowski**
II.B.10	*prerequisites*
	organic chemistry
II.B.11	*objectives of the course*
	The goal of the course is to provide students with the knowledge of biomedical materials and their properties (physical properties, surface properties, biocompatibility and biodegradability).
II.B.12	*course contents*
	The lecture covers three main groups of biomedical metrials: metals and their alloys, ceramics and their composites and polymers, co-polymers and their composites. The main areas of application and requirements for biomaterials will be given.
II.B.13	*assesment methods*

	written examination, oral presentation
II.B.14	*recommended reading*
	1. M. Blicharski, Wstęp do inżynierii materiałowej, WNT, Warszawa 2003 2. R. Pampuch, Materiały ceramiczne, PWN, 1988. 3. H. Saechtling, Tworzywa sztuczne – poradnik, WNT,1995 4. D. Żuchowska, Polimery konstrukcyjne WNT, 2000. 5. red. Buddy D. Ratner "Biomaterials Science, an Introduction to Materials in Medicine", and Allan S. Hoffman, Academic Press, London, 1996.
II.B.15	*additional remarks*
	none

II.B Course description

II.B.a	***name of Faculty***	***field of study***	***specialization***
	Faculty of Chemistry	**Biotechnology**	**Industrial biotechnology**
II.B.1	*course title*		
	Separation Processes in Biotechnology		
II.B.2	*faculty course code*		
II.B.3	*type of course*		
	elective		
II.B.4	*level of course*		
	advanced		
II.B.5	*nominal semester (year) of studies*		
	Semester II		
II.B.6	*number of ECTS points*		
	4		
II.B.7	*teaching methods*		
	W-30, W-2 + C-15, C-1		

II.B.8	*language of instruction*
	English
II.B.9	*course leader (responsible for course))*
	Andrzej Kołtuniewicz, professor
II.B.10	*prerequisites*
	Unit processes and operations.
II.B.11	*objectives of the course*
	The lecture focuses on main separation operations applied in in up- and downstream processing.
II.B.12	*course contents*
	1. Introduction to separation processes in biotechnology. 2. Mechanical processes of solid particles separation. Motion of solid particles in liquids. Sedimentation. Flocculation and coagulation. Filtration. Centrifugation. 3. Cell disruption. Elements and properties of cell walls of bacteria, yeast, mould, plant cells and mammalian cells. Cell disintegration techniques: mechanical, chemical and biological. 4. Membrane processes. 5. Adsorption. Liquid chromatography. 6. Extraction. Distillation and rectification. 7. Precipitation. Crystallization. Drying of bioproducts. 8. Advanced separation processes 9. Separation in Bioreactors 10. Separation of enantiomers 11. Affinity separation 12. Membrane chromatography 13. Advanced oxidation 14. Hybrid processes
II.B.13	*assesment methods*
	Examination.
II.B.14	*recommended reading*
	1. R.G. Harrison et all.Bioseparation Science Engineering, Oxford University Press, Oxford 2003. **2.** A. Kołtuniewicz and Enrico Drioli, Membranes In Clean Technologies, Theory and Practice, WILEY VCH, 2008.
II.B.15	*additional remarks*

	no

Legenda:

W- wykład
C- ćwiczenia
L- laboratorium
P- projekt

Rekrutacja na tę specjalność będzie tożsama z rekrutacją na specjalności prowadzone w języku polskim.