WBiHZ

Faculty of Biotechnology and Animal Husbandry

WEST POMERANIAN UNIVERSITY OF TECHNOLOGY
IN SZCZECIN, POLAND

THE OFFER FOR INTERNATIONAL STUDENTS FOR THE YEAR 2023/2024 SECOND DEGREE

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
1	Animal Embryology	Tomasz Stankiewicz	winter/summer	3	30
2	Animal Obsterics	Tomasz Stankiewicz	winter/summer	3	30
3	Animal Physiology	Katarzyna Michałek	winter/summer	3	30
4	Antibiotics and Antibiotic Resistance	Daria Ciecholewska-Juśko	winter/summer	3	30
5	Basic Microbiology	Karol Fijałkowski	winter/summer	3	30
6	Basics of Ultrasound Diagnostics	Tomasz Stankiewicz	winter/summer	3	30
7	Biological Databases	Andrzej Dybus	winter/summer	2	20
8	Biomaterials in Science and Industry	Anna Żywicka	winter/summer	3	30
9	Biotechnological Processes Design	Daria Ciecholewska-Juśko	winter/summer	3	30
10	Biotechnology and Genetic Engineering	Arkadiusz Terman	winter/summer	3	30
11	Cell Biology	Adam Lepczyński	winter/summer	3	30
12	Cellular Engineering in Animal Reproduction	Tomasz Stankiewicz	winter/summer	3	30
13	Clinical Microbiology	Karol Fijałkowski	winter/summer	3	30
14	Environmental Toxicology	Agnieszka Tomza-Marciniak	winter/summer	3	30
15	Enzyme Bioengineering	Radosław Drozd	winter/summer	3	30
16	Food and Nutrition in Relation to Human Health	Arkadiusz Pietruszka	winter/summer	3	30
17	Fundamentals of Laboratory Diagnostics	Agnieszka Tomza-Marciniak	winter/summer	3	30
18	General Genetics	Daniel Polasik	winter/summer	3	30
19	Genetic Engineering Methods	Arkadiusz Terman	winter/summer	3	30
20	Genetic Markers for Food Quality	Daniel Polasik	winter/summer	3	30
21	Genomics	Daniel Polasik	winter/summer	3	30
22	Human Genetics	Daniel Polasik	winter/summer	3	30
23	Immunology	Karol Fijałkowski	winter/summer	3	30
24	Industrial Enzymology	Radosław Drozd	winter/summer	3	30
25	Industrial Microbiology	Karol Fijałkowski	winter/summer	3	30
26	In vitro and in vivo Methods in Toxicological Assessment of Xenobiotics	Agnieszka Tomza-Marciniak	winter/summer	3	30
27	Methods in Cytotoxicity Testing	Daria Ciecholewska-Juśko	winter/summer	3	30
28	Methods of Monitoring the Reproductive Processes in Animals	Tomasz Stankiewicz	winter/summer	3	30

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
29	Microbial Nanotechnology	Anna Żywicka	winter/summer	3	30
30	Microorganisms in Food Production	Karol Fijałkowski	winter/summer	3	30
31	Molecular Biology	Arkadiusz Terman	winter/summer	3	30
32	Molecular Diagnostics	Arkadiusz Terman	winter/summer	3	30
33	Molecular Modeling of Enzymes	Radosław Drozd	winter/summer	3	30
34	Nanotechnology in Biology, Medicine and Pharmacy	Anna Żywicka	winter/summer	3	30
35	Pharmaceutical Biotechnology	Karol Fijałkowski	winter/summer	3	30
36	Proteomics	Agnieszka Herosimczyk	winter/summer	3	30
37	Protéomique	Małgorzata Ożgo	winter/summer	3	30
38	Transcriptomics	Andrzej Dybus	winter/summer	2	20
39	Vaccinology	Karol Fijałkowski	winter/summer	3	30
40	Veterinary Microbiology	Karol Fijałkowski	winter/summer	3	30

Course title	Animal Embryology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Tomasz Stankiewicz	**E-mail address to the person**	Tomasz.Stankiewicz@zut.edu.pl
Course code (if applicable)	WBiHZ-2-01	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To acquaint students with the course of the various stages of embryonic and fetal development. To acquaint students with the mechanisms that control the development of embryonic and fetal development with particular emphasis on the role of amniotic fluid and placenta.		
Entry requirements	The knowledge of animal physiology and biotechnology in animal reproduction.		
Course contents	The types of the placentas in various species of mammals and anatomical differences in their construction. The structure and function of the fetal membranes. The pregnancy (calculation date of birth). The parturition. The development of the fetus and fetal maturity. The development of the hematopoietic system: the development of erythroid and white blood cells. Evaluation age of the embryo and fetus based on the size and shape of the body. Embryology as a scientific discipline and a range of modern embryology of animals. The course and the types of implantation. The role of fetal-placental endocrine system in the fetal development. Hormonal regulation of pregnancy and parturition. The development and metabolism of the embryo in the initial period of postimplantation. The mechanism of the formation of the twin pregnancy. Adapting to embryonic and fetal life and the role of the transitional organs. The mechanisms of organogenesis and chronological division of the differentiation of the final organs. The differentiation of mesodermal organs (somites, median mesoderm). The embryonic induction. The possibilities of the using cord blood in the transplantation.		
Assessment methods	The informative lecture with the use of multimedia techniques. Activating methods (preparation and presentation of papers by students, discussion). The demonstration, laboratory exercises (the macro- and microscopic observation). The rating presentations prepared and delivered by students (teamwork) and engage in the discussion. The current control of the proper operation of students in laboratory classes. The rfinal test covering a range of content of lectures and exercises.		
Recommended readings	1. T. A. McGeady, P. J. Quinn, E. S. FitzPatrick, M. T. Ryan, Veterinary Embryology, Blackwell Publishing, 2006		
Knowledge	Student defines the basic terminology in the field of embryology. He describes the various stages and mechanisms of embryonic and fetal development. The student knows the course of implantation. It describes the function of the auxiliary organs and shows the importance of fetal-placental endocrine system in fetal development. He knows the mechanism of parturition.		
Skills	Student is able to determine the degree of development of the embryo and fetus on the basis of the morphological characteristics. He is able to assess the species adherence of placentas and fetal membranes. He points to the distinctiveness in the morphological images of the fetal blood.		
Other social competences	After completing the course, the student will have a basis for studying disciplines related to the obtaining of extracorporeal embryos in vitro, the cloning, transgenesis and transplantation. The student analyzes the problem of taking a group discussion.		

Course title	Animal Obsterics		
Level of course	second cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Tomasz Stankiewicz	**E-mail address to the person**	Tomasz.Stankiewicz@zut.edu.pl
Course code (if applicable)	WBiHZ-2-02	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The aim of this course is to acquaint of students with the parturition and the principles of obstetric care of the mother and newborn. The students will be acquainted with the rules to interpret signs of the impending parturition and properly reacting in case of any disturbance in its course. The students will be also acquainted with the assess of health risks for the mother and newborn baby during the perinatal period.		
Entry requirements	The knowledge of animal reproduction and embryology.		
Course contents	Severe parturition - clinical procedure (rapid intervention, interview, examination). General data. Calculating the date of birth. Obstetric examination. Analytical studies in the evaluation of the pregnancy and perinatal period. Postpartum care of the mother and newborn. Determining the age and maturity of the fetus based on morphometric measurements. Severe parturition in cows, mares, sheep, goats and sows. The analysis of different cases. Severe parturition in dogs and cats. The analysis of different cases. The parturition in cows and mares. Symptoms and stages of the parturition. Interference in the physiological parturition. The parturition in sheep, goats and sows. Symptomatic stages of childbirth. Interference in the physiological delivery. The parturition in bitches and cats. Symptoms and stages of the parturition. Interference in the physiological parturition. Pathology of the pregnancy. Multiple fertilization. Additional fertilization. Ectopic pregnancy. Rupture of the vagina and uterus. Hernia of pregnant uterus (types of hernias). Colpoptosia. Toxemia of the pregnancy. Prolonged pregnancy.		
Assessment methods	The informative lecture with the use multimedia techniques. Activating methods (preparation of presentations by students). The evaluation of presentations prepared by students (teamwork). The final test covering the range of content lectures and auditoria		
Recommended readings	1. Peter GG Jackson:, Handbook of Veterinary Obstetrics., Second editon, Elsevier, 2004		
Knowledge	Student knows of the course of parturition and the principles of obstetric care of the mother and newborn.		
Skills	Student is able to interpret signs of the impending parturition and properly react in case of any disturbance in its course. Student is able assess the health risks for the mother and newborn baby during the perinatal period.		
Other social competences	After completing the course, the student will have a basis for studying disciplines related to obstetrics. The student analyzes the problem of taking a group discussion.		

Course title	Animal Physiology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Katarzyna Michałek	**E-mail address to the person**	Katarzyna.Michalek@zut.edu.pl
Course code (if applicable)	WBiHZ-2-03	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Get knowledge about fundamental processes of the animal physiology. To familiarise studenst with the laboratory techniques and equipment used in the study of animal physiology.		
Entry requirements	Basics of cell biology, biochemistry and animal anatomy.		
Course contents	Examination of the unconditioned reflexes: patellar reflex, plantar reflex, achilles reflex, pupillary light reflex, corneal reflex. Analysis of a conditioned reflexes. Analysis of a reflec arc. Observation of the muscle slides under the microscope. Mechanism of muscle contraction. Hematocrit (Ht) estimation. Erythrocyte sedimentation rate (ESR) measurement. The influence of calcium ions for blood clotting process. Hearing heart sounds. Observation of apex beat. Pulse rate measurement. Blood pressure measurement. The influence of physical exercises on pulse rate and blood pressure. Qualitative analysis of saliva content. Examination of the rate of digestion of starch by the salivary amylase. The amylolytic properties of the pancreatic juice. The proteolytic properties of pancreatic juice. The lipolytic properties of the pancreatic juice. Emulsification of lipid aggregates by the bile. Microscope observation of renal cortex and medulla. Examination of physical characteristics of urine of distinct animal species. The test for presence of glucose and ketones in the human urine. The influence of water excess on diuresis and urine osmolality. Observation of aquaporin 2 (AQP2) in the kidney. Mechanism of inhalation and exhalation – the model of Donders. Measuring the vital capacity and its components using spirometer. The influence of skin blood flow on its temperature. The influence of water evaporation and convection on human skin temperature. Introduction to electrophysiology. Membrane potential. Action potential. Sodium potassium pomp. Structure and role of electrical synapse. Nerve cells and their function. Central and peripherial nervous system. Sympatic and parasympatic nervous system. The structure and function of a chemical synapse. Synaptic transmission. Components of a reflex: receptors – types and function; nerve centres and their properties; effectors. The definition of a reflex time. The mechanisms of conditioned reflexes. Molecular mechanism of muscle contraction. Types of muscle contraction. Energetics of muscle contraction. Differences between physiological properties of skeletal and smooth muscles. Plasma and the cellular elements of blood. Homeostatic functions of blood. Blood cell production. Platelets and coagulation. Blood clotting process. Structure of the heart. Physiology of the cardiac muscle. Cardiac muscle as the syncytium. The regulation of the heart beat and blood pressure. Factors responsible for blood flow and blood pressure. Cardiac cycle. Digestion in the oral cavity. The role of saliva. The components of gastric juice. Regulation of secretion of gastric juice. Ruminant digestive system.Digestion in duodenum. The components of pancreatic juice. Regulation of secretion of pancreatic juice. The composition and functions of bile. Mechanisms of absorption in small intestine. Kidney function. Macro- and micro structure of the kidneys. Physical properties of normal urine of various animals species. Pathological components of urine. Mechanisms of urine production. The composition of primary and final urine. Glomerulal filtration, clearance, renal blood flow. Hormonal regulation of the renal function (AVP, ANP RAA). Mechanisms of inhalation and exhalation. Respiratory gas exchange at lungs and tissues. Transport of oxygen and carbon dioxide through the blood. Nervous regulation of breathing. Pulmonary volumes and capacities (total lung volume, lung volume, residual volume, expiratory reserve volume, inspiratory reserve volume). The role of the thermoregulatory system in maintaining the heat balance. Heat gain by the organisms. Heat loss effectors. Nervous and behavioural regulation of body temperature. Hypothermia, hyperthermia and heat – differences and definitions.		
Assessment methods	Informative lectures with multimedia presentation. Laboratory works. Writing test. Assessment of student activity and preparing for classes.		
Recommended readings	1. Hill RW, Animal Physiology, PALGRAVE MACMILLAN, 2012 2. Schmidt-Nielsen K, Animal Physiology: Adaptation and Environment, Cambridge University Press, 2002 3. Johnson BR, Ober WC, Garrison CW, Silverthor AC, Human Physiology: an integrated approach, Pearson Education., Boston, 2013		
Knowledge	Understanding of fundametal processes of the animal physiology. Understandnig of physiological processes that regulate body functions and the regulation of an organ system from the molecular all the way to the whole animal level.		
Skills	Ability to describe the anatomy of different physiological systems and their specific functions. Ability to describe interactions between different organ systems. Ability to explain how a whole animal physiological process occurs.		
Other social competences	Teaching and explaining of fundamental processes of the animal system.		

Course title	Antibiotics and Antibiotic Resistance		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Daria Ciecholewska-Juśko	**E-mail address to the person**	daria.ciecholewska@zut.edu.pl
Course code (if applicable)	WBiHZ-2-04	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The aim of the course is to provide comprehensive theoretical and practical knowledge about antibiotics, their modes of action and mechanisms of microbial resistance.		
Entry requirements	Basic knowledge of antibiotics, principles of their action and mechanisms of microbial resistance.		
Course contents	Antibiotic susceptibility of bacteria isolated from skin and mucous membranes. Antibiotic susceptibility of bacteria isolated from environment (water, soil). Inducible resistance to clindamycin – D test. Comparison of antibiotic resistance of MRSA and MSSA isolates. Determining the potential of using various materials as carriers for antibiotics. Antibiotic releasing test. Antibiotics – history, development and classification. Mechanism of action of different classes of antibiotics. Antibiotic resistance – definition, causes and mechanisms in bacteria, viruses and fungi. Detection methods of antibiotic resistance. Antibiotic resistance prevention. Approaches and challenges in new antibiotic development.		
Assessment methods	Informative lecture Laboratory work Report from the laboratory work Writing test		
Recommended readings	1. Black, Jacquelyn G., Microbiology : international student version, John Wiley & Sons, 2013		
Knowledge	The students knows the basics related to antibiotics and their mechanisms of action and mechanisms of antibiotic resistance in bacteria, viruses and fungi.		
Skills	The student is able to perform antibiotic sensitivity tests and correctly interpret their results.		
Other social competences	The student is aware of the problem of antibiotic resistance and knows the schemes of sustainable use of antibiotics.		

Course title	Basic Microbiology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-05	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of basic microbiology.		
Entry requirements	Basic lab knowledge and skills. Ability to pipet, make solutions and dilutions and to execute protocols which require the use of sterile techniques.		
Course contents	Information about working in microbiological laboratory Sterlization and asepsis Bacterial growth and cultivation Methods of culturing bacteria Conditions of culturing microorganisms Basics of mycological examination Detection and identification of various kind of microorganisms Bacterial colony and cell morphology Introduction to microbiology Bacterial taxonomy Bacterial classification Sterlization and asepsis Bacterial colony and cell morphology Microbiology techniques Culture media & culture methods Detection and identification of various kind of microorganisms		
Assessment methods	Informative lectures with multimedia presentations Laboratory Writing test Presentation of the project Assessment of student activity and preparing for classes		
Recommended readings	1. L. M. Prescott, Microbiology, McGraw-Hill Science, USA, 2002 2. . L. Gyles, J. F. Prescott, J. G. Songer, C. O. Thoen C., Pathogenesis of Bacterial Infections in Animals 4th Ed, Blackwell Publishing, 2010 3. Winn W., Allen S., Janda W., Koneman E., Procop G., Schreckenberger P., Woods G., Color Atlas and Textbook of Diagnostic Microbiology, Lippincott Williams and Wilkins, 2006, 5		
Knowledge	The student can choose the appropriate techniques for examination and identification of bacteria and fungi		
Skills	The student can use the appropriate techniques for examination and identification of bacteria and fungi.		
Other social competences	The student demonstrates responsibility and awareness of the decisions made during the conduct of microbiological tests.		

Course title	Basics of Ultrasound Diagnostics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Tomasz Stankiewicz	**E-mail address to the person**	Tomasz.Stankiewicz@zut.edu.pl
Course code (if applicable)	WBiHZ-2-06	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The aim of the course is to acquaint of students with ultrasound diagnostic imaging of animals and mastering the skill of describing some organs of the body on the basis of the ultrasound images.		
Entry requirements	Basic knowledge of the topography of the internal organs and anatomy of animals. The knowledge of physics and biophysics at the level of secondary school.		
Course contents	Preparation of the patient and technical examination. Assessment of functional status of the ovary on the basis of the ultrasound image. Evaluation of uterus at different stages of ovarian cycle. Evaluation of embryo and fetal development and parturition date calculation in selected species based on the size of the fetus. Imaging external and internal of male sex organs. Imaging of physiological and pathological changes of thyroid on the example of selected mammalian species. The achievements and the importance of diagnostic ultrasound in practice and science. The construction, and working principle of ultrasound. The concepts echogenicity in ultrasound. Echogenicity of various tissues and organs in the body. Artefacts in ultrasound. Indications for ultrasound. The most common tests using ultrasound. The use of ultrasound in animal reproduction. Examinations by per-rectum and abdominal wall. Abdominal organs. Normal and pathological images based on selected species.		
Assessment methods	The informative lecture with the use of multimedia techniques. Activating methods (preparation and presentation of papers by students, discussion). The demonstration, laboratory exercises (ultrasound examinations in the practice). The rating presentations prepared and delivered by students (teamwork) and engage in the discussion. The current control of the proper operation of students in laboratory classes. The final test covering a range of content of lectures and exercises.		
Recommended readings	1. Gregory R. Lisciandro, Focused Ultrasound Techniques for the Small Animal Practitioner., Wiley-Blackwell, 2014		
Knowledge	Student knows the possibilities of using the ultrasound examination in practice and describes the structure and function of ultrasound apparatuses. Student lists the indications and the most common examinations by using ultrasonography. Student knows the definition of echogenicity and presents echogenicity of selected tissues and organs in physiological and pathological conditions.		
Skills	Student is able to use the right technique of ultrasound examination depending on the species, physiological status and purpose of examination. The student will be able to apply the acquired knowledge and skills to the proper selection of ultrasound techniques and interpretation of ultrasound images in the evaluation of selected physiological and pathological conditions.		
Other social competences	After completing the course, the student will have a basis for studying disciplines in further education in this field. The student analyzes the problem of taking a group discussion.		

Course title	Biological Databases		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Andrzej Dybus	**E-mail address to the person**	Andrzej.Dybus@zut.edu.pl
Course code (if applicable)	WBiHZ-2-07	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	1	**Hours per semester**	20
Objectives of the course	Knowledge of biological databases, their structure and diversity		
Entry requirements	Basics of biology		
Course contents	DDBJ, European Nucleotide Archive, GenBank PubMed database. REBASE - restriction enzymes and related proteins database. miRNA sequence databases (miRBase, miRPathDB 2.0) PDBe - biological macromolecular structures. Biological databeses - history, current status Nucleotide sequence databases Protein sequence databases Human and animals genes and genetic disorders. The National Center for Biotechnology Information.		
Assessment methods	Informative lectures with PP presentations Laboratory works. writting the final test assessment of preparation for classes and work during laboratory classes		
Recommended readings	1. Daniel J Rigden, Xosé M Fernández, The 27th annual Nucleic Acids Research database issue and molecular biology database collection, Nucleic Acids Research,, 2019, Volume 48, Issue D1, 08 January 2020, Pages D1–D8,, https://doi.org/10.1093/nar/gkz1161		
Knowledge	The student has knowledge of biological databases and their diversity.		
Skills	The student is able to find the necessary information in a specific biological database		
Other social competences	Student shows a moderate interest in participating in a verbal discussion with the teacher during the classes		

Course title	Biomaterials in Science and Industry		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Anna Żywicka	**E-mail address to the person**	Anna.Zywicka@zut.edu.pl
Course code (if applicable)	WBiHZ-2-08	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of application of biomaterials in various branches of industry.		
Entry requirements	Basic knowledge in the field of general microbiology and biochemistry.		
Course contents	In situ and ex situ modifications of physicochemical properties of the biomaterials. Analysis of biocompatibility of different biomaterials. Analysis of water properties of biomaterials - water holding capacity, swelling, and release ratio. History and development of biomaterials in various industries. Different types of biomaterials - metallic, ceramic, polymer and composite Biomaterials used in regenerative and implantation medicine. Biomaterials used in the reconstruction of soft (tendon prostheses, skin) and hard tissues (bone prostheses, bone cement) Biomaterials used in the pharmaceutical industry. Biocompatibility, hemocompatibility and bioactivity of biomaterials. Biomaterial-tissue interactions.		
Assessment methods	informative lecture laboratory work writing test report form the laboratory work		
Recommended readings	1. Pellicer, Eva. et al., Advances in applications of industrial biomaterials /, 2011		
Knowledge	The student has knowledge about the types of biomaterials and the possibility of their use in various industries.		
Skills	The student is able to use the basic methods of production of biomaterials and research methods to assess the properties.		
Other social competences	Student demonstrate responsability and awarnes of the decidon made duting the conducted of the final test.		

Course title	Biotechnological Processes Design		
Level of course	second cycle		
Teaching method	auditory class / laboratory class / lecture		
Person responsible for the course	Daria Ciecholewska-Juśko	**E-mail address to the person**	daria.ciecholewska@zut.edu.pl
Course code (if applicable)	WBiHZ-2-09	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of principles of biotechnological processes, criteria for the selection of equipment and process conditions.		
Entry requirements	Basic knowledge in the field of biotechnological processes design.		
Course contents	Project of selected biotechnological processes. Upstream processing – preparation of fermentation process. Fermentation and downstream processing. Biotechnological processes - types, stages, assumptions, main problems. Modelling and optimization of biotechnological processes. Bioreactors.		
Assessment methods	Informative lecture Laboratory work Project preparation Report from the laboratory work Project presentation Writing test		
Recommended readings	1. Butler, Michael, Comprehensive biotechnology : principles and practices in industry, agriculture, medicine and the environment. Vol. 1, Scientific fundamentals of biotechnology, Elsevier, Amsterdam, 2011 2. Webb, Colin E., Comprehensive biotechnology : principles and practices in industry, agriculture, medicine and the environment, Vol. 2, Engineering fundamentals of biotechnology, Elsevier, 2011 3. Mukhopadhyay, Satya N., Advanced process biotechnology, Tunbridge Wells : Anshan, 2006		
Knowledge	The student knows the basics of biotechnological processes design, principles of biotechnological processes, criteria for the selection of equipment and process conditions.		
Skills	The student is able to design a biotechnological process, taking into account the necessary equipment and the selection of all process parameters.		
Other social competences	The student knows the most important goals and problems in the design of biotechnological processes		

Course title	Biotechnology and Genetic Engineering		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Arkadiusz Terman	**E-mail address to the person**	Arkadiusz.Terman@zut.edu.pl
Course code (if applicable)	WBiHZ-2-10	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Get knowledge about biotechnology and genetic engineering Get the practical experience in genetic analysis		
Entry requirements	Basics of biotechnology methods		
Course contents	Isolation of genomic DNA came from different tissue Enzymes in genetic engineering Methods of nucleic acid detection. Variations in PCR and their applications. Molecular diagnostic in medicin. Analysis of polymorphisms in different gene in human. Role of genes within cells, gene code and elements that control gene expression Marker-assisted sellection for animal breedeng PCR and its applications Introductions and methods in gene therapy Quantification and storage of nucleic acid Construction of genomic library		
Assessment methods	Theoretical lectures Laboratory works Writting test Presentation		
Recommended readings	1. Nair A.J., Introduction to biotechnology and genetic engineering, Infinity Science, 2011 2. Brown, Genomes 3, 2006		
Knowledge	Studenst has knowledge how to use modern molecular methods		
Skills	Student knows how to use genetic engineering methods		
Other social competences	Explaining of basic of new methods use in genetic engineering		

Course title	Cell Biology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Adam Lepczyński	**E-mail address to the person**	Adam.Lepczynski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-11	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To obtain knowledge concerning structure and differentiation of distinct cells. To gain insight into the specific functions displayed by cell membrane and various cellular organelles. To develop the ability to think critically about issues in cell biology		
Entry requirements	Basicsof biochemistry and physiology		
Course contents	Types of cells and tissues. The interdependence between the cell structure and its function Analysis of a cytoskeleton and cell cortex functions on the example of erythrocyte and sperm cells. Experimental destruction of the cell membrane of erythrocytes. Localization, function and signal transduction of taste receptors. Practical recognition of different stages of the processes of mitosis and meiosis Visualization of leucocyte nucleus. The influence of pH and temperature on enzymes activity. Structure of cell membrane. Transport of small molecules across the cell membrane. Principle of cell signaling. Major classes of cell-surface receptor proteins. Structure and function of the cytoskeleton Cell cycle and its regulation. The compartmentalization of cells: rough and smooth endoplasmic reticulum, Golgi apparatus, mitochondrion, lysosome. Mechanism of vesicular transport.		
Assessment methods	Informative lectures with multimedia presentations laboratory Writing test Assessment of student activity and preparing for classes.		
Recommended readings	1. Alberts B., Johnson A., Lewis J., Morgan D., Raff M., Roberts K., Walter P., Molecular biology of the cell, Garland Science, Taylor & Francis Group, 2015, 6th edition		
Knowledge	Student should exhibit a general knowledge of the basic structures and cell biology-related mechanisms in an eukaryote cell.		
Skills	- describe and carry out basic methods in cell biology - explain the theory behind the practical parts in the course and be able to summarise and interpret experimental results		
Other social competences	Student creates an active attitude, has the ability to holisitc view on the facts in the field of the molecular biology		

Course title	Cellular Engineering in Animal Reproduction		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Tomasz Stankiewicz	**E-mail address to the person**	Tomasz.Stankiewicz@zut.edu.pl
Course code (if applicable)	WBiHZ-2-12	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Acquainting students with the methods of cellular engineering used in manipulations on gametes and embryos of mammals. Acquainting students with the procedure for the transfer of embryos in different species of animals. Acquainting students with the possibilities of using cell culture in the studies of mammalian reproductive processes. Formation of proper attitude of the students in relation to the use of cell engineering in mammalian reproduction.		
Entry requirements	Knowledge of the basics of biotechnology and biotechnology in animal reproduction.		
Course contents	Morphological evaluation of the oocytes by using histological preparations. Obtaining of the oocytes from the ovaries of selected mammals, evaluation of the quality and usefulness of the oocytes for in vitro studies. The preparation of the oocytes for in vitro maturation. The assessment of the degree of maturity of the oocytes in IVM procedure. The evaluation of the sperm. Methods of sperm capacitation and their preparation for in vitro fertilization . In vitro fertilization and culture of embryos to the blastocyst stage. The evaluation of the quality of embryos. The analysis of the physiological state of the female reproductive system as a potential recipient of embryos. The history, development and current state in the use of cellular engineering of mammalian reproduction. The reproductive potential of the female. Methods of collection and storage the female gametes. The reproductive potential of the male. Methods of obtaining male gametes. Possibility of using sperm in the transgenesis as a carrier foreign of genetic information. In vivo fertilization and in vitro fertilization. Methods for the possibility of using in vitro fertilization in various mammalian species (insemination of oocytes, intracytoplasmic injection). The possibility of long-term preservation of embryos and the processes that occur during freezing and thawing. The properties and the possibility of germ cell transplantation. The control of gender in livestock - of applications of practical importance.		
Assessment methods	The informative lecture using multimedia techniques. The demonstration, laboratory exercises (slides, macro- and microscopic observation). Current control on the proper operation of laboratory classes by students. Final test covering a range of content lectures. Final test covering a range of exercise program content.		
Recommended readings	1. Hafez E.S.E., Hafez B., Reproduction in farm animals, Lippincott Williams & Wilkins, Philadelphia (U.A), 2000		
Knowledge	Student knows the most important facts and achievements in the field of cellular engineering in mammalian reproduction. He knows the factors that determine the reproductive potential of mammals. Student specifies and describes methods of cellular engineering used in manipulations on gametes and embryos. Student knows methods of embryos collection and transfer. He describes potential benefits of embryo transfer in animal husbandry.		
Skills	Students know how to acquire and assess the quality of gametes. He can carried out sperm capacitation and set up the cultures in procedures IVM, IVF and IVC. Student knows how to evaluate the quality of embryos. He can correctly schedule of embryo transfer procedure.		
Other social competences	Student is aware of the importance of the knowledge. He knows the advantages and limitations associated with the use of cellular engineering in mammalian reproduction. The completion of the course will be helpful in his future professional work.		

Course title	Clinical Microbiology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-13	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of medical microbiology.		
Entry requirements	Basic lab knowledge and skills. Ability to pipet, make solutions and dilutions and to execute protocols which require the use of sterile techniques.		
Course contents	Methods of culturing clinically significant bacteria Conditions of cultures of clinically significant bacteria Microscopic examination of clinically significant bacteria Detection and identification of various kind of clinically significant microorganisms Determination of antibiotic susceptibility of clinically significant bacteria Study of biochemical activity of clinically significant microorganisms Information about working in clinical microbiological laboratory Methods for determination and controlling growth of pathogenic bacteria Methods of detection and identification of various kind of clinically significant microorganisms Determination of antibiotic susceptibility of pathogenic bacteria Upper Respiratory Tract Infections Lower Respiratory Tract Infections Gastrointestinal Tract Infections Genitourinary Tract Infections Skin and Soft Tissue Infections Immunoprophylaxis and Immunotherapy		
Assessment methods	Informative lectures with multimedia presentations Laboratory Writing test Presentation of the project Assessment of student activity and preparing for classes		
Recommended readings	1. L. M. Prescott, Microbiology, McGraw-Hill Science, USA, 2002 2. L. Gyles, J. F. Prescott, J. G. Songer, C. O., Pathogenesis of Bacterial Infections in Animals 4th Ed, Blackwell Publishing, 2010		
Knowledge	The student can choose the appropriate research techniques for the isolation and identification of clinically significant microorganisms.		
Skills	The student uses skills on the methods of diagnosis of clinically significant microorganisms.		

Course title	Environmental Toxicology		
Level of course	second cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Agnieszka Tomza-Marciniak	**E-mail address to the person**	Agnieszka.Tomza-Marciniak@zut.edu.pl
Course code (if applicable)	WBiHZ-2-14	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30

Objectives of the course	To acquaint students with the toxicological characteristic of selected environmental pollutants. To acquaint students with metabolism of toxins. To acquaint students with factors influencing toxicity of xenobiotics. To acquaint students with the basic mechanisms of functional disorders and morphological changes in selected organs and systems.
Entry requirements	Knowledge of issues related to ecology and environmental protection.
Course contents	Toxicity testing of xenobiotics. Degrees of toxicity. Dose-response relationship. Bioconcetration, bioaccumulation and biomagnification. Determination of BCF, BSAF and BMF (for different types of ecosystems). Toxicological characteristics of metals (Cd, Hg, Pb) and metalloids. Source of pollution, route of absorption, fate and mechanism of toxicity. MRLs. Estimation of dietary daily intake of toxic substances. Persistent organic pollutants (POPs) - toxicological characteristcs. Estimation of dietary daily intake of selected POPs. Pollution and their fate in aquatic and terrestrial ecosystems. Classes of contaminants. Global transport of pollution. Factors determining the distribution of pollutants in the environment. Models of pollutants spread in the environment. Metabolism of xenobiotics. Factors affecting the toxicity of xenobiotics (the physicochemical properties - dissociation, solubility, particle size, biological factors - age, sex, individual development). The biochemical effects of impurities (induction of detoxifying enzymes, and proteins capable of binding to heavy metal inhibition of cholinesterase, endocrine dysfunction, DNA adduct formation). Physiological effects of pollution (osmoregulation disorders, metabolic and neurological). The effects of toxicological interactions (additive effects, toxicity potentiation, antagonism). Mutagenic and carcinogenic effects of xenobiotics. The impact of environmental pollution on the development of cancer. Types of carcinogens (genotoxic - working directly influence the metabolic activation; epigenetic - promoters, cytotoxic compounds, modifiers of hormones, immunosuppressive compounds). Poisons of animal origin (poisons of insects, snakes, scorpions, fish). Symptoms and mechanism of toxicity. Toxicological characteristics of plastics. Toxicological classification of some preparations used in households.
Assessment methods	Delivery method, lecture/presentation Discussion Explanation test continuous assessment
Recommended readings	1. (Eds), General, Applied and Systems Toxicology, John Wiley and Sons, Online ISBN: 9780470744307, 2009, DOI: 10.1002/9780470744307
Knowledge	The student discusses the toxins biotransformation and factors affecting the toxicity of xenobiotics. Student discusses the mechanisms of functional disorders and changes morphological organs and systems under of selected toxins. Student characterizes of selected xenobiotics.
Skills	Student is able to calculate the LD50 for a specific subtance with using different methods.
Other social competences	The student demonstrates an active engagement with solving the identified problems.

Course title	Enzyme Bioengineering		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Radosław Drozd	**E-mail address to the person**	Radoslaw.Drozd@zut.edu.pl
Course code (if applicable)	WBiHZ-2-15	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Introduction to enzymes structure modification with use molecular biology methods		
Entry requirements	Basic knowledge of molecular biology methods, biochemistry and chemistry		
Course contents	Design of expression vectors with using bioinformatic tools Expression vectors purification and analysis Preparation of vector-insert construct with use restriction free protocol Preparation of competent hosts cells Transformation of competent host cells Purification of recombinant enzyme with using affinity chromatography Principles of enzymes structural and catalytic properities Enzyme engineering, current trends, methods and future perspectives Expression vectors, structure, properties and application in enzymes engineering Purification and analysis of recombinant enzymes		
Assessment methods	Lectures Laboratories Presentation Raport from laboratories		
Recommended readings	1. Wolfgang Aehle red., Enzymes in Industry: Production and Applications, Willey VCH, 2007, III 2. Allan Svendsen, Enzyme Functionality: Design, Engineering and Screening, 2004		
Knowledge	Student has knowledge methods of modification of enzymes from various sources		
Skills	Students choose and apply appropriate molecular biology protocols for obtaining recombinant enzyme		
Other social competences	Student know and understand a consequences of modifications of the enzyme native structure		

Course title	Food and Nutrition in Relation to Human Health		
Level of course	second cycle		
Teaching method	seminar / lecture		
Person responsible for the course	Arkadiusz Pietruszka	**E-mail address to the person**	Arkadiusz.Pietruszka@zut.edu.pl
Course code (if applicable)	WBiHZ-2-16	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Knowledge by a student chemical structure and properties of food components, their role in human nutrition, and changes during technological processes		
Entry requirements	Knowledge on the subject in human physiology and biotechnology		
Course contents	Methods of determination of the basic nutrients in feed– introduction Determination of dry matter, ash and crude protein Determination of crude fiber, fiber fractions (NDF, ADL, ADF) and crude fat Assessment of the nutritional protein value Estimate chemical assessment of the nutritional protein value Interpretation of the obtained results and conclusions Human nutrition – basic terms Lipids - role of fatty acids in human health Carbohydrates and glicemic index. Food Additives Conclusions		
Assessment methods	Lecture Didactic disscusion Educational films Short test Practical exam Exam		
Recommended readings	1. Julian E. Spallholz, Mallory Boylan, Judy A. Driskell., Nutrition: CHEMISTRY AND BIOLOGY, CRC Press, 1998, II, ISBN 0-8493-8504-0 2. Rudolf Steiner, Nutrition: Food, Health and Spiritual Development., Rudolf Steiner Press., 2006 3. Susan Allport, The Queen of Fats: Why Omega-3s Were Removed from the Western Diet and What We Can Do to Replace Them, University of California Press, 2006		
Knowledge	Student get knowledge about the basic nutrients and their impact on human health.		
Skills	The student has the ability to evaluate food products and their composition for human development and health.		
Other social competences	The student can explain the dangers associated with improper nutrition.		

Course title	Fundamentals of Laboratory Diagnostics		
Level of course	second cycle		
Teaching method	laboratory class		
Person responsible for the course	Agnieszka Tomza-Marciniak	**E-mail address to the person**	Agnieszka.Tomza-Marciniak@zut.edu.pl
Course code (if applicable)	WBiHZ-2-17	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30

Objectives of the course	To acquaint students with the fundamental methods used in laboratory diagnostic To acquaint students with the basic terms used in laboratory diagnostic.
Entry requirements	physiology, anatomy
Course contents	Complete Blood Count (CBC) test. Semi-automated blood analysis. Evaluation of White Blood Cell The urine analysis (Reader Urine Analyser). The physico-chemical and microscopic properties of the urine. Urine sediment analysis. Biochemical tests. The qualitative and quantitative methods in parasitology. Coproscopic techniques for detection and quantitative estimation of endoparasites. Microscopic Examination. The post-mortem parasitological examination: dissection, parasites isolation, preservation and examination of collected samples. Detection of Trichinela in meat samples. Trichinoscopy and pool-sample digestion method. Determination of selenium (Se) in biological samples Laboratory diagnosis of cryptosporidiosis.
Assessment methods	laboratory Continuous assessment of activities performed by student.
Recommended readings	1. Pagana K., Pagana T., Mosby's Diagnostic and Laboratory Test Reference, Elservier Health Sciences, 2006 2. Garcia L., Practical Guide to Diagnostic Parasitology, American Society for Microbiology, 2009
Knowledge	The student knows the basic terms used in laboratory diagnostics.
Skills	The student is able to prepare samples of biological material, perform tests and interpret the results.
Other social competences	The student demonstrates responsibility for their own safety and others.

Course title	General Genetics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Daniel Polasik	**E-mail address to the person**	Daniel.Polasik@zut.edu.pl
Course code (if applicable)	WBiHZ-2-18	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Get knowledge about inheritance of traits Training and practice in methods using in molecular genetics		
Entry requirements	Basics of molecular biology and biochemistry		
Course contents	Genetic and physical mapping Population genetics DNA analysis methods and their practical use Milestones in genetics and basic terms Inheritance of quantitative and qualitative traits Structure of DNA and chromosomes. Genes and genetic code Mutations and other sources of biodiversity Genes expression and their regulation		
Assessment methods	Invormative lectures with multimedia presentations Laboratory works Writing test Assessment of student activity and preparing for classes		
Recommended readings	1. E. Passarge, Color Atlas of Genetics, Thieme Medical Publishers, 2012 2. H. Fletcher, I. Hickey, BIOS Instant Notes in Genetics, Garland Science, 2012		
Knowledge	Student defines the mechanisms of traits inheritance and indicates the sources of genetic variability		
Skills	Student is able to solve genetic problems and gained experience in basic molecular methods		
Other social competences	Student is aware of benefits and dangers resulting from achievements in modern genetics		

Course title	Genetic Engineering Methods		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Arkadiusz Terman	**E-mail address to the person**	Arkadiusz.Terman@zut.edu.pl
Course code (if applicable)	WBiHZ-2-19	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Get knowledge about techniques used in genetic engineering Get the practical experience in genetic analysis methods		
Entry requirements	Basics of molecular methods		
Course contents	Using different mothods to extract nucleic acid. Set up a PCR. Restriction enzyme digestrin, analyze PCR product using agarose gel electrophoresis. HRM - High- esolution melt curve analysis, RT-PCR, Real Time PCR, Introduction: different methods used in genetic engineering and thair application. DNA amplification methods including RT-PCR (reverse transcriptase), in situ PCR, mutational analysis. PCR based mutation detection: SSCP, AS-PCR analysis, heteroduplex analysis, denaturing gradient gel electiophoresis, DNA microarrays (DNA chips), sequencing, nucleotide enumeration. Genetic engineering methods and ethical considetations		
Assessment methods	Theoretical lectures Laboratory works Writting test Presentation		
Recommended readings	1. Nair A.J., Introduction to biotechnology and genetic engineering, Infinity Science, 2011 2. Brown, Genomes 3, 2006		
Knowledge	Studenst has knowledge how to use modern molecular methods		
Skills	Student knows how to use genetic engineering methods		
Other social competences	Explaining of basic of new methods use in genetic engineering		

Course title	Genetic Markers for Food Quality		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Daniel Polasik	**E-mail address to the person**	Daniel.Polasik@zut.edu.pl
Course code (if applicable)	WBiHZ-2-20	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To familiarize students with possibility of genetic markers use in food analysis Practical use of DNA analysis to assess food quality		
Entry requirements	Basics of genetics, physiology and molecular genetics		
Course contents	Methodological approach for food markers detection Food fraud detection DNA test for lactose intolerance Tests for "supertaster" Introduction, basic terms, markers classes, criteria of markers application Genetic markers for taste and food preferences Methods for GMO detection in food Application of markers in food authentication DNA barcoding and its application in food industry Genetic markers for: •fruit and vegetables quality •milk quality and quantity •different meat species quality		
Assessment methods	Invormative lectures with multimedia presentations Laboratory works Writing test Assessment of multimedia presentation Assessment of student activity and preparing for classes		
Recommended readings	1. R. Blair, J. M. Regenstein, Genetic Modification and Food Quality: A Down to Earth Analysis, John Wiley & Sons, Ltd., 2015 2. D. Sun, Modern Techniques for Food Authentication, Elsevier, 2008		
Knowledge	Students indicates the need and practical application of DNA markers in food analysis		
Skills	Student gained skills in the food analysis by use DNA markers and can define the dangers associated with consumption of non-authentic food		
Other social competences	Student is aware of needs and benefits of DNA markers application by the food analysis		

Course title	Genomics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Daniel Polasik	**E-mail address to the person**	Daniel.Polasik@zut.edu.pl
Course code (if applicable)	WBiHZ-2-21	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Get knowledge about genomes structure, sizes and evolution Get knowledge and training in methods of genomes analysis		
Entry requirements	Molecular biology and genetics		
Course contents	Isolation of plasmids and restriction mapping Isolation of mtDNA and D-loop polymorphism analysis Practical application of genomic databases. Introduction - history of genomics, fields, connection with other sciences Size and structure of pro-, eukaryotic and organelle genomes with its comparison Origin of new genes, role of noncoding DNA Genomic disasters Physical and genetic maps Sequencing of genes and genomes Methods in functional genomics		
Assessment methods	Informative lectures with multimedia presentations Laboratory works Writing test Assessment of student activity and preparing for classes		
Recommended readings	1. T.A. Brown, Genomes 3, Garland Science, 2006 2. A. Lesk, Introduction to genomics, Oxford University Press, 2012		
Knowledge	Student explains the issues related to the analysis of genomic sequences including genome projects and has knowledge in the area of the functional and comparative genomics.		
Skills	Student perceives genome in holistic way regarding to its structure and function and acquired the ability to explore the databases containing deposited sequences and genomes data		
Other social competences	Student creates an active attitude, has the ability to holisitc view on the facts and see the issues in a broader context		

Course title	Human Genetics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Daniel Polasik	**E-mail address to the person**	Daniel.Polasik@zut.edu.pl
Course code (if applicable)	WBiHZ-2-22	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To get knowledge about inheritance of different traits, diseases and predispositions in human Practical use of methods based on DNA analysis in human genetics		
Entry requirements	Basics of Genetics		
Course contents	DNA testing for chosen traits and predispositions in human History of human genetics and milestones Mitochondrial diseases Model organisms in human genetics The role of environment and genes in carcinogenesis Ecogenetics Genetic theories of aging Genetics of sport performance		
Assessment methods	Informative lectures with multimedia presentations Laboratory works Writing test Assessment of student activity and preparing for classes		
Recommended readings	1. Lewis R., Human Genetics, 11th Edition, McGraw-Hill Education, 2014		
Knowledge	Description of genetic defects and predispositions in human and indication of practical knowledge application in human genetics		
Skills	Ability to interpret genetic data and use of acquired knowledge in daily life and in evaluation of the latest achievements in the field of human genetics		
Other social competences	Awareness of the advantages and risks of the achievements in genetics		

Course title	Immunology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-23	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The aim of the course is to provide students with knowledge about the division, functions and components of the human and animal immune system.		
Entry requirements	The student should have basic knowledge in the field of biology.		
Course contents	Division, functions and components of the immune system. The red cell and white cell system of human and various animal species. Immunological techniques based on the properties of antibodies. Acute phase proteins. Phagocytosis. In vitro isolation and culture of lymphocytes. Introduction to the immune system. Cells involved in the immune response. Cell type immune responses. Phagocytosis. Soluble mediators of immunity. The complement system. Antigens and immunoglobulins. Antigen recognition and presentation. Immune system disorders. Immunological techniques.		
Assessment methods	Informative lectures with multimedia presentations Laboratory Writing test Presentation of the project Assessment of student activity and preparing for classes		
Recommended readings	1. Roitt I., Brostoff J., Male D., Immunology, Verlag, Brema, 1998		
Knowledge	In terms of knowledge, the student names, distinguishes and characterizes the components of the immune system.		
Skills	Is able to characterize the most important functions of the immune system and uses basic immunological techniques.		

Course title	Industrial Enzymology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Radosław Drozd	**E-mail address to the person**	Radoslaw.Drozd@zut.edu.pl
Course code (if applicable)	WBiHZ-2-24	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The purpose of the course is to teach students about technologies of industrial enzymes manufacturing and characterize the advantages of using enzyme preparations in the industry.		
Entry requirements	Basic knowlage of chemistry, biochemistry and biophysic		
Course contents	Estimation of basic catalytical parameters of enzymes with invertase form S. cerevisiae as model Production laccase from T.versicolor Immobilization of alpha amylase on polysaccharides carriers Starch conversion by immobilised amylolytic enzymes for biofuel production Principles of enzymology Methods of enzymes production for industrial applications Strategies for improving enzymes for industrial application Enzymes in food industry Enzymes in biofuel production Enzymes in environment protection		
Assessment methods	lectures disscusion laboratory lectures preparation of project Presentation of project		
Recommended readings	1. Wolfgang Aehle red., Enzymes in Industry: Production and Applications, Willey VCH, 2007, III 2. Allan Svendsen, Enzyme Functionality: Design, Engineering and Screening, 2004 3. Christoph Wittmann i Rainer Krull red., Biosystems Engineering I: Creating Superior Biocatalysts, Tom 1, Springer, 2010 4. Girish Shukla i Ajit Varma, Soil Enzymology, Springer, 2011		
Knowledge	Student has knowledge about importance, usefulness and application area, sources and methods of modification of enzymes from various sources for use in industry		
Skills	Students choose and apply appropriate tools for enzyme characterisation, and its modification for further use in industry		
Other social competences	Students understand importance of technical enzymes in modern industry development		

Course title	Industrial Microbiology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-25	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of application of microorganisms in various branches of industry.		
Entry requirements	Basic knowledge in the field of general microbiology and biochemistry.		
Course contents	Isolation of strains with high biotechnological potential Analysis of enzymatic properties of isolated strains Analysis of antimicrobial properties isolated strains Methods of isolation of microorganism with high biotechnological potential. Industrial application of microorganisms. Modelling and optimization of biotechnological process Application of immobilized microorganism in order to improve fermentation performance Application of bioreactors in various industries Microorganisms in environmental protection - Biodegradation and bioremediation, microbiological biosensors		
Assessment methods	Informative lecture with multimedia presentations Laboratory Writing test Presentation of the project Assessment of student activity and preparing for classes		
Recommended readings	1. Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton, Industrial Microbiology: An Introduction, John Wiley & Sons, 2013 2. Richard H. Baltz, Arnold L. Demain, Julian E. Davies, Manual of Industrial Microbiology and Biotechnology, American Society for Microbiology Press, 2010 3. David B. Wilson, Hermann Sahm, Klaus-Peter Stahmann, Mattheos Koffas, Industrial Microbiology, John Wiley & Sons, 2020		
Knowledge	The student knows the microbiological basics related to the fermentation process, production bioproducts, the role of microorganism in various branches of industry.		
Skills	Student is able to use theoretical and practical knowledge to isolate and characterize microorganisms with high biotechnological potential.		

Course title	In vitro and in vivo Methods in Toxicological Assessment of Xenobiotics		
Level of course	second cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Agnieszka Tomza-Marciniak	**E-mail address to the person**	Agnieszka.Tomza-Marciniak@zut.edu.pl
Course code (if applicable)	WBiHZ-2-26	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30

Objectives of the course	To acquaint students with the in vivo and in vitro methods used in assessing the toxicity of xenobiotics. To acquaint students with the mechanisms of action of toxic substances and their metabolism. To acquaint students with the computational methods in toxicity, exposure and risk assessment.
Entry requirements	no requirements
Course contents	Metabolism of xenobiotics. The mechanisms of toxicity. Methods for determining the median lethal dose/concentration (LD50 i LC50). Calculation methods in the toxicity assessment. Exposure and risk assessment. Determination of NOAEL, LOAEL, LoAL and RfD. Toxicological evaluation of raw materials and cosmetic products. Alternative methods in ecotoxicological studies. The use of animals in toxicometric research. The main organizations promoting alternative methods in the world. Database of in vitro techniques used in toxicology. Use of in vivo tests in evaluation of the toxicity of chemicals. Types and directions of toxicological research. Acute toxicity - classic and alternative methods. Repeated dose toxicity. The methods used in assessing the genotoxicity, carcinogenicity, neurotoxicity, effects on reproduction, fertility and offspring. Evaluation of toxicity of a compound based on the relationship between the chemical structure and biological activity (structure-activity relationship). Factors affecting the toxicity. Genetic factors increasing the sensitivity to chemical compounds. Chemical safety. The most important rules governing the issue of chemical safety. The classification and labeling of chemicals.
Assessment methods	Delivery method, lecture/presentation. Discussion Explanation test assessment of student's activity and attitudes towards discussed issues. report
Recommended readings	1. Michael Balls, Robert Combes, Andrew Worth, The History of Alternative Test Methods in Toxicology (1st Edition), Elsevier, 2018
Knowledge	Student describes methods using in toxicity assessment of xenobiotics. Student desribes the metabolism of toxins and mechanisms of toxicity
Skills	Student uses the computational methods in toxicity, exposure and risk assessment.
Other social competences	Student understands the need to reduce the use of animals in toxicological studies.

Course title	Methods in Cytotoxicity Testing		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Daria Ciecholewska-Juśko	**E-mail address to the person**	daria.ciecholewska@zut.edu.pl
Course code (if applicable)	WBiHZ-2-27	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge about principals of toxicological testing and cytotoxicity assays.		
Entry requirements	Basic knowledge in the field of toxicological research.		
Course contents	Analysis of the viability of cells stained with trypan blue. Effect of selected active substances on the enzymatic activity of cells - MTT and Alamar Blue tests. Determination of the cytotoxicity threshold of selected antiseptic substances against staphylococci isolated from the skin. Agar overlay assay. Basics of toxicological research. Cytotoxicity testing – stages, cell models and regulations. Extract cytotoxicity tests. Direct contact cytotoxicity tests. Indirect contact cytotoxicity tests. Novel strategies in cytotoxicity testing.		
Assessment methods	Informative lecture Laboratory work Report from the laboratory work Writing test		
Recommended readings	1. Hayes, Andrew Wallace, Principles and methods of toxicology, Taylor & Francis, 2001		
Knowledge	The student knows basics of toxicological testing including cytotoxicity assays - extract, direct and indirect tests.		
Skills	The student is able to carry out the procedure of direct and indirect cytotoxicity tests.		
Other social competences	The student is able to choose the appropriate cytotoxicity test and solve basic problems in toxicological research.		

Course title	Methods of Monitoring the Reproductive Processes in Animals		
Level of course	second cycle		
Teaching method	auditory class / lecture		
Person responsible for the course	Tomasz Stankiewicz	**E-mail address to the person**	Tomasz.Stankiewicz@zut.edu.pl
Course code (if applicable)	WBiHZ-2-28	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Acquainting students with the possibility of controlling the reproductive processes in male and female taking the performance of detection of various ailments and disorders. Developing skills of the proper selection of methods and interpretation of the results in the evaluation of the reproductive processes.		
Entry requirements	The knowledge of the biotechnology in animal reproduction.		
Course contents	The indirect methods for monitoring of ovarian cycle (signs of oestrus, hormonal tests, evaluation of cervical mucus and its degree of crystallization, cytological smear evaluation, measurement of body temperature). The direct methods for monitoring of ovarian cycle (laparoscopy, ultrasound). Methods for detection and monitoring of course of the pregnancy. The monitoring of seasonal reproductive processes. Macroscopic evaluation of ovarian cysts and abnormalities of the reproductive organs. The monitoring of the ovarian cycle. The diagnostic methods used in dysfunction of the ovary (ovarian cysts, ovarian tumors). The hormonal basis for the detection of pregnancy. Achievements in the field of the imaging course of the pregnancy. The contemporary andrological diagnostic.		
Assessment methods	The informative lecture with the use multimedia techniques. Activating methods (preparation of presentations by students). The evaluation of presentations prepared by students (teamwork). The final test covering the range of content lectures. The final test covering the range of exercise program content.		
Recommended readings	1. Hafez E.S.E., Hafez B., Reproduction in farm animals, Lippincott Williams & Wilkins, Philadelphia (U.A), 2000 2. T. A. McGeady, P. J. Quinn, E. S. FitzPatrick, M. T. Ryan, Veterinary Embryology, Blackwell Publishing, 2006		
Knowledge	The student knows the methods for monitoring the ovarian cycle, taking into account the various phases of this cycle and its potential disorders. He knows the basics of hormonal methods for the detection of pregnancy. The student knows the current methods of used in the andrological diagnosis.		
Skills	The student should be able to apply an appropriate method for monitoring the ovarian cycle and pregnancy. He is able to interpret indicator parameters of disorders in the reproduction. The student is able to interpret of parameters of the clinical evaluation in the male reproduction.		
Other social competences	The student will be able to apply the acquired knowledge and skills for the proper selection of and interpretation of the results in the evaluation of the reproductive processes. The completion of the course will be helpfull for the future work in the veterinary and medical laboratories.		

Course title	Microbial Nanotechnology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Anna Żywicka	**E-mail address to the person**	Anna.Zywicka@zut.edu.pl
Course code (if applicable)	WBiHZ-2-29	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of application of nanomaterials produced by microorganizms in various branches of industry. The course aim is to provide a provide a comprehensive theoretical and practical knowledge about microorganisms that can be used in nanotechnology. The course aim is to provide a provide a comprehensive theoretical and practical knowledge about microorganisms that can be used in nanotechnology.		
Entry requirements	Basic knowledge in the field of general microbiology and biochemistry.		
Course contents	Isolation and characterization of bacteria producing nanocellulose. Optimization of the nanocellulose production process. Evaluation of the physicochemical properties of nanocellulose. Biological methods of producing nanomaterials. Plants and algae in the production of nanoparticles. Yeast and bacteria in the production of nanoparticles. Magnetotactic bacteria. Microorganisms used in medical nanobioengineering. Bacterial cellulose - the nanobiomaterial of the future.		
Assessment methods	informative lecture laboratory work writing test report form the laboratory work		
Recommended readings	1. Madou, Marc J., Fundamentals of microfabrication and nanotechnology., 2012		
Knowledge	The student has theoretical knowledge about microorganisms that can be used in nanotechnology.		
Skills	Student can use appropriate technique to isolate and identify microorganisms capable of producing nanbiomaterials. Student can use appropriate techniques to produce nanomaterials using microorganisms. Student konws how to apply nanomaterials produced by microorganisms.		
Other social competences	Student will be able to apply aqurate knowledge and skills for the proper methods selection and interpretation of the results obtained during classes.		

Course title	Microorganisms in Food Production		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-30	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of application of enzyme and microorganisms in fermentation technologies in the food industry.		
Entry requirements	Basic knowledge of chemistry, biochemistry and microbiology.		
Course contents	Quality assessment of dairy products Quality assessment of meat products Fermentation processes - assessment of process efficiency Basic fermentation processes in the food industry. Fermentation technologies in the dairy industry, the distillery industry, the baking industry Food microbiology - food poisoning, food safety, prognostic microbiology Enzymatic, chemical and biological methods of food preservation		
Assessment methods	Informative lecture with multimedia presentations Laboratory Writing test Preparation of the project Assesment of student activity and preparing for classes		
Recommended readings	1. Carl A. Batt, Encyclopedia of Food Microbiology, Academic Press, 2014 2. W. F. Harrigan, Laboratory Methods in Food Microbiology, Gulf Professional Publishing, 2000		
Knowledge	The student has a basic knowledge of the use of microorganisms in the food industry.		
Skills	Student is able to use of microorganisms in fermentation processes.		

Course title	Molecular Biology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Arkadiusz Terman	**E-mail address to the person**	Arkadiusz.Terman@zut.edu.pl
Course code (if applicable)	WBiHZ-2-31	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Get knowledge about molecular gene organization Get the practical experience in genetic analysis		
Entry requirements	Basics of molecular genetics		
Course contents	Extraction and purification of cellular RNA Gel electrophoresis to check RNA. PCR- clean up and cloning reaction Primer design, CAPS search. Genomic sequence analysis: gene finding, BLAST searching, genome annotation. DNA sequence analysis - cloning strategies, computer-assisted restriction analysis. Introduction: History of molecular biology, DNA as the genetic material, nucleic acid structure, hybridization. DNA replication, bacterial and eucaryotic DNA polymerases. Gene structure, replication, transcription, translation. RNA processing: splicing, spliceosomes, snRNPs, self splicing introns, polyadenylation. Eucaryotic transcriptional regulation, transposons, recombination.		
Assessment methods	Theoretical lectures Laboratory works Writting test Presentation		
Recommended readings	1. Weaver R., Hill M.G., Miolecular Biology, 2001 2. Watson J.D., Molecular Biology of the gene, Pearson Education, 2013		
Knowledge	Understanding of molecular mechanisms of genome functioning		
Skills	Ability to differentiate basic processes ongoing in a living cell		
Other social competences	Teaching and explaining of basic molecular processes ongoing in cells of living organisms		

Course title	Molecular Diagnostics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Arkadiusz Terman	**E-mail address to the person**	Arkadiusz.Terman@zut.edu.pl
Course code (if applicable)	WBiHZ-2-32	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Acquaint the students to versatile tools and techniques employed in diagnostic molecular and recombinant DNA technology.		
Entry requirements	Basic knowledge of molecular technique.		
Course contents	Preventing contamination, DNA extraction, asses purity of DNA Application of DNA testing. preparation the samples to analysis. Molecular laboratory diagnostic of different genetic deseases. Analysis of results Nucleid acid structure, extraction and probe preparation. Manipulation DNA sequences with versatile DNA modifying enzymes. DNA amplification methods, mutational analysis, sample preparations. Alternative methods for amplified nucleic acid testing Genes therapy, applications in diagnostic of genetic disorden, human genome project.		
Assessment methods	Theoretical lectures Laboratory works Writting test Presentation		
Recommended readings	1. Bruns D.E, Ashwood E.R., Burtis C.A., Fundamentals of molecular diagnostic, 2011 2. Coleman W.B., Molecular Diagnostic, Springer, 2005		
Knowledge	Studenst knows the diagnostic basics used in the laboratory		
Skills	Student can indenpendently perform genetic diagnostic test		
Other social competences	Can explain the purpose of use genetic diagnostic test		

Course title	Molecular Modeling of Enzymes		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Radosław Drozd	**E-mail address to the person**	Radoslaw.Drozd@zut.edu.pl
Course code (if applicable)	WBiHZ-2-33	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Developing skills for selection of appropriate tools to solve and analyze the structure of enzymes		
Entry requirements	Knowledge of organic and inorganic chemistry, biochemistry, biophysics, English at intermediate level,		
Course contents	Analysis of enzymes structural properities by molecular modeling software Prediction of tretairy structure of alpha - amylase form A. niger Modeling of catalytic properities of alpha - amylase from A. niger Methods and source of obtaining information about the structure of enzymes Methods of functional analysis of the primary structure of enzymes Methods of prediction and analyze the secondary structure of enzymes In silico methods to prediction and analyze the tretiary structure of enzymes Methods for prediction and modeling functional properities of enzymes		
Assessment methods	lectures disscusion laboratory lectures preparation of project projekt projekt		
Recommended readings	1. Huzefa Rangwala, George Karypis, Introduction to Protein Structure Prediction: Methods and Algorithms, 2010 2. Allan Svendsen, Enzyme Functionality: Design, Engineering and Screening, 2004 3. Christoph Wittmann i Rainer Krull red., Biosystems Engineering I: Creating Superior Biocatalysts, Tom 1, Springer, 2010 4. Arieh Warshel, Computer Modeling of Chemical Reactions in Enzymes and Solutions, Wiley, 1997		
Knowledge	Student has knowledge about enzyme molecular structure organisation principles and methods of its analysis, determination and modification with use a bioinformatics tools.		
Skills	Student choose and apply correctly a molecular modeling tools for enzyme structure analysis and designing		
Other social competences	Student know and understand a consequences of modifications of the enzyme native structure		

Course title	Nanotechnology in Biology, Medicine and Pharmacy		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Anna Żywicka	**E-mail address to the person**	Anna.Zywicka@zut.edu.pl
Course code (if applicable)	WBiHZ-2-34	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of application of nanotechnology in various branches of industry.		
Entry requirements	Basic knowledge in the field of general microbiology and biochemistry.		
Course contents	Evaluation of the physicochemical properties of different types of nanoparticles. Interactions of nanoparticles with eukaryotic, prokaryotic and plant cells Application of nanomaterials as a carrier of drug delivery system. Nanoparticles - definitions and methods of their production. Properties and modifications of the nanoparticle. Nanotechnology in biomedical industry. Nanotechnology in pharmaceutical industry. Nanotechnology in science. Nanotechnology in environmental protection and its impact on the environment. Future of nanotechnology in biology, medicine and pharmacy.		
Assessment methods	informative lecture laboratory work writing test report form the laboratory work		
Recommended readings	1. Sethuraman, Swaminathan. - Red., Biomaterials and nanotechnology for tissue engineering, 2017		
Knowledge	The student has knowledge about the structure and properties of nanomaterials as well as the possibility of their importance in biology, medicine and pharmacy.		
Skills	Student can use appropriate technique to assess the properties of nanomaterials, the interactions of nanoparticles with eukaryotic, prokaryotic and plant cells and use nanomaterials as a carrier of drug delivery system.		
Other social competences	Student will be able to apply aqurate knowledge and skills for the proper methods selection and interpretation of the results obtained during classes.		

Course title	Pharmaceutical Biotechnology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-35	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of application of microorganisms in the production of selected pharmaceuticals, production and evaluation of bioactive substances with antimicrobial activity.		
Entry requirements	Basic knowledge in the field of biology.		
Course contents	Information about working in microbiological laboratory Evaluation of antimicrobial activity of different bioactive substances Assessment of the properties of biomaterials used in medicine Cytotoxicity tests Introduction to pharmaceutical biotechnology - types of antibiotics and production methods Biopharmaceuticals from microorganisms: from production to purification Biotechnological production of plant secondary metabolites Safety of biopharmaceuticals - pharmacokinetics and pharmacodynamics of drugs produced using biotechnology techniques Evaluation of antimicrobial properties of bioactive substances -cytotoxicity tests Nanobiomaterials in medicine and pharmacy - intelligent dressings, modern drug delivery systems Biotechnology possibilities to replace animal in lab experiments		
Assessment methods	Informative lecture with multimedia presentations Laboratory Writing test Preparation of the project Assensment of student activity and preparing for classes		
Recommended readings	1. Gary Walsh, Pharmaceutical Biotechnology: Concepts and Applications, Wiley, 2013 2. Oliver Kayser, Heribert Warzecha, Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications, Wiley, 2012		
Knowledge	The student knows the role of microorganisms in the production of selected pharmaceuticals, main biotechnology techniques used in the production and evaluation of bioactive substances with antimicrobial activity.		
Skills	Student is able to use theoretical and practical knowledge regarding production methods and mechanisms of action of bioactive substances with antimicrobial activity.		

Course title	Proteomics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agnieszka Herosimczyk	**E-mail address to the person**	Agnieszka.Herosimczyk@zut.edu.pl
Course code (if applicable)	WBiHZ-2-36	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Theoretical and practical knowledge of gel-based and chromatographic protein separation techniques. The ability of the participants to use advanced bioinformatic tools to analyse proteomic data (1-D and 2-D gels, mass spectra). Practical use of MALDI-TOF MS (matrix-assisted laser desorption/ionisation time of flight mass spectrometer) for protein identification.		
Entry requirements	Basic of the cell biology and the protein biochemistry.		
Course contents	Sample preparation techniques for proteomic analysis. Protein separation using two-dimensional electrophoresis (2-DE). Protein separation using SDS-PAGE (1-DE). Protein gel staining methods. Identification of proteins using mass spectrometer MALTI-TOF. Identification of proteins using Western-blot technique. 1-DE and 2-DE gel image acquisition and bioinformatic analysis. Introduction to proteomics. Biological significance of post-transcriptional and post-translational protein modifications. Proteome organization. The general principles of proteomic analysis. Gel-based protein separation techniques. The components of resolving gel matrix. Sodium-dodecyl polyacrylamide gel electrophoresis (SDS-PAGE), the principle and application of native PAGE electrophoresis. Two dimensional electrophoresis (2-DE) – the principle of the method, sample preparation for 2-DE, IPG strips, isoelectric focusing. Protein detection methods: coomassie stain, silver stain, negative ion staining (copper, zinc), autoradiography, fluorography, fluorescent staining. Two-dimensional difference in gel electrophoresis (2D-DIGE) – the principle and application of the method. Image acquisition and analysis of 1-D and 2-D gels. 1-D and 2-D gels analysis softwares. Application of mass spectrometry (MS) for protein identification. Ionization methods in mass spectrometry. Types of mass analyzers. Peptide mass fingerprinting (PMF). Chromatographic methods for protein separation. Liquid chromatography (LC). Two-dimensional liquid chromatography (2-D LC). The proteomic strategies based on liquid chromatography: LC-MS, LC-MS/MS, multidimensional LC-MS/MS. Affinity chromatography (AC). Identification of proteins using Western-blot technique. Sample preparation. Methods of protein transfer. Incubation with antibodies. Visualisation. Branches of proteomics: structural, functional and clinical.		
Assessment methods	Theoretical lectures. Discussion during laboratory classes. Project preparation. Project presentation in the writing form. Writing test.		
Recommended readings	1. Sheehan D., Tyther R. (Ed.)., Two-dimensional electrophoresis protocols., Humana Press, New York, 2009 2. Garfin D., Ahuja S. (Ed.), Handbook of isoelectric focusing and proteomics., Elsevier Academic Press, Amsterdam, 2005 3. Heftmann E. (Ed.)., Chromatography, sixth edition., Elsevier Academic Press, Amsterdam, 2004 4. Walker J.M. (Ed.), second edition., The proteomics protocols handbook., Humana Press, New Jersey, 2002 5. Rabilloud T. (Ed.), Proteome research: two-dimensional gel electrophoresis and identification methods., Springer, Berlin, 2000 6. Hames B.D. (Ed.), third edition., Gel electrophoresis of proteins: a practical approach., Oxford University Press, England, 1998		
Knowledge	Student can enumerate and describe commonly used techniques used in the study of proteins.		
Skills	Student is able to use commonly known proteomic techniques such as: 1-DE, 2-DE, MALDI-TOF MS and Western-blot.		
Other social competences	Student is aware that there is a number of methods to analyse the different levels of protein changes in response to various physiological/patophysiological stimmuli in the biological material.		

Course title	Protéomique		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Małgorzata Ożgo	**E-mail address to the person**	Malgorzata.Ozgo@zut.edu.pl
Course code (if applicable)	WBiHZ-2-37	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	french
Hours per week	2	**Hours per semester**	30
Objectives of the course	La Protéomique a pour objectif la formation d'étudiants capables d'identifier et/ou de déterminer la structure de molécules biologiques simples ou complexes de toute nature (protéine, acide nucléiques, lipides), soit dans le cadre d'une démarche analytique, soit dans le cadre d'une démarche d'analyse globale du métabolisme.		
Entry requirements	la connaissance de la biochimie, de la biologie moleculaire, la genetique		
Course contents	Electrophorèse en gel de polyacrylamide contenant du dodécylsulfate de sodium (SDS-PAGE), le principe et les applications de l'électrophorèse sur gel natif PAGE. Electrophorèse bidimensionnelle (2-DE) – principe de la méthode, préparation des échantillons pour la 2-DE, bandes d'IPG (IPG strips), focalisation isoélectrique. Méthodes de détection des protéines: coloration au Bleu de Coomassie, coloration à l'argent, coloration inverse avec des ions (cuivre, zinc), autoradiographie, fluorographie, coloration fluorescente. Analyse différentielle sur un gel unique (two-dimensional difference in gel electrophoresis 2D-DIGE) – principe et applications de la méthode. Acquisition d'image et analyse de gels 1D et 2D. Logiciels d'analyse des gels 1D et 2D. Utilisation pratique du MS MALDI-TOF (spectromètre de masse matrix-assisted laser desorption/ionisation time of flight) pour l'identification de protéines Introduction à la protéomique. Importance biologique des modifications post-transcriptionnelles et post-translationnelles des protéines. Organisation du protéome. Les principes généraux de l'analyse protéomique. Techniques de séparation des protéines basées sur gel. Les composants de la matrice du gel de séparation. Applications de la spectrométrie de masse (MS) pour l'identification des protéines. Méthodes d'ionisation en spectrométrie de masse. Types d'analyseurs de masse. Cartographie peptidique massique (peptide mass fingerprinting PMF). Méthodes chromatographiques pour la séparation des protéines. Chromatographie en phase liquide (LC). Chromatographie liquide bidimensionnelle (2D LC). Les stratégies protéomiques basées sur la chromatographie liquide : LC-MS, LC-MS/MS, LC-MS/MS multidimensionnelle. Chromatographie d'affinité. Types de protéomique : structurelle, fonctionnelle et clinique. Techniques de séparation des protéines basées sur gel.		
Assessment methods	présntation oral travaux pratiques test écrit preparation raport		
Recommended readings	1. Sheehan D., Tyther R. (Ed.)., Two-dimensional electrophoresis protocols, Humana Press, New York, 2009 2. Garfin D., Ahuja S. (Ed.)., Handbook of isoelectric focusing and proteomics., Elsevier Academic Press, Amsterdam, 2005 3. Walker J.M., The proteomics protocols handbook, Humana Press,, New Jersey, 2002		
Knowledge	l'élève peut énumérer et décrire les techniques couramment utilisées dans l'étude des protéines		
Skills	l'étudiant est capable d'utiliser des techniques protéomiques communément connues comme: MALDI TOF, Western Bloting, 2DE l'étudiant est capable d'utiliser des techniques protéomiques communément connues comme: MALDI-TOF, 2DE, Western Bloting		
Other social competences	L'étudiant est conscient qu'il existe un certain nombre de méthodes pour analyser les différents niveaux de protéines en réponse à diverses stimulations physiologiques dans le matériel biologique. L'étudiant est conscient qu'il existe un certain nombre de méthodes pour analyser les différents niveaux de protéines en réponse à diverses stimulations physiologiques dans le matériel biologique		

Course title	Transcriptomics		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Andrzej Dybus	**E-mail address to the person**	Andrzej.Dybus@zut.edu.pl
Course code (if applicable)	WBiHZ-2-38	**ECTS points**	2
Semester	winter/summer	**Language of instruction**	english
Hours per week	1	**Hours per semester**	20
Objectives of the course	Knowledge of the RNA world and transcriptomic research		
Entry requirements	Basics of genetics and molecular biology		
Course contents	Isolation of total RNA from different tissues. Micro RNA (miRNA) isolation. Agarose Gel Electrophoresis of RNA. Reverse transcription (cDNA synthesis). Analysis of gene expression - real time PCR. Introduction to transcriptomics. RNA classes. RNA - biology and function. RNA interaction partners. Diagnostics and therapies - RNA as a diagnostic tool. RNA expression. DNA microarrays and RNA-Seq in transcriptomics. RNA isolation – before it starts.		
Assessment methods	Informative lectures with PP presentation Laboratory works Writting the final test Assessment of preparation for laboratory classes and activity in the classroom		
Recommended readings	1. E.A.MilwardA.ShahandehM.HeidariD.M.JohnstoneN.DaneshiH.Hondermarck, Transcriptomics, Encyclopedia of Cell Biology, 2016, Volume 4, 2016, Pages 160-165, https://doi.org/10.1016/B978-0-12-394447-4.40029-5 2. T. A. Brown, Genomes 3 3rd Edition, Garland Science, 2006 3. T. A. Brown, 4th Edition Genomes 4, Garland Science, 2017		
Knowledge	The student describes the variability of RNA, its biology and has knowledge of the methods of studying transcriptomes.		
Skills	The student is able to prepare and perform the isolation of selected RNA fractions, perform cDNA synthesis and analyze gene expression by real time PCR.		
Other social competences	The student is aware of the various methods of analyzing transcriptomic profiles		

Course title	Vaccinology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-39	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of vaccinology, including the production of the vaccines.		
Entry requirements	Basic lab knowledge and skills. Ability to pipet, make solutions and dilutions and to execute protocols which require the use of sterile techniques. Basic knowledge of microbiology and immunology.		
Course contents	Preparation of vaccine Evaluation of prepared vaccine Immunological aspects of vaccines Composition and types of vaccines Vaccination of humans and animals Methods for the preparation of vaccines Vaccines for tomorrow		
Assessment methods	Lecture Laboratory Writing test Presentation of the project Assessment of student activity and preparing for classes		
Recommended readings	1. L. M. Prescott, Microbiology, McGraw-Hill Science, 2002 2. C. L. Gyles, J. F. Prescott, J. G. Songer, C. O. Thoen, Pathogenesis of Bacterial Infections in Animals 4th Ed, Blackwell Publishing, 2010 3. Roitt I., Brostoff J., Male D., Immunology, Brema, 1998		
Knowledge	The student knows the immunological basics related to the production bioproducts, knows the role of adjuvants and carriers for synthetic vaccines, knows the rules of prevention and treatment of certain human and animal diseases using vaccines and immunomodulators or autovaccines.		
Skills	Student is able to classify the vaccine and analyze the reactions of the immune system after immunization.		

Course title	Veterinary Microbiology		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Karol Fijałkowski	**E-mail address to the person**	karol.fijalkowski@zut.edu.pl
Course code (if applicable)	WBiHZ-2-40	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The course aims are to provide a comprehensive theoretical and practical knowledge of veterinary microbiology.		
Entry requirements	Basic lab knowledge and skills. Ability to pipet, make solutions and dilutions and to execute protocols which require the use of sterile techniques.		
Course contents	Methods of culturing veterinary significant microorganisms Conditions of cultures of veterinary significant microorganisms Microscopic examination of veterinary significant microorganisms Detection and identification of veterinary significant microorganisms Determination of antibiotic susceptibility of veterinary significant microorganisms Study of biochemical activity of veterinary significant microorganisms Information about working in microbiological veterinary laboratory Methods for determination and controlling growth of veterinary significant microorganisms Methods of identification of various kind of veterinary significant microorganisms Methods of assesment of antibiotic susceptibility of veterinary significant microorganisms Veterinary staphylococcal infection Veterinary streptococcal infection Veterinary infection caused by Gram negative rods Veterinary immunoprophylaxis and immunotherapy		
Assessment methods	Informative lectures with multimedia presentations Laboratory Writing test Presentation of the project Assessment of student activity and preparing for classes		
Recommended readings	1. L. M. Prescott, Microbiology, McGraw-Hill Science, USA, 2002 2. . L. Gyles, J. F. Prescott, J. G. Songer, C. O. Thoen C., Pathogenesis of Bacterial Infections in Animals 4th Ed, Blackwell Publishing, 2010 3. Winn W., Allen S., Janda W., Koneman E., Procop G., Schreckenberger P., Woods G., Color Atlas and Textbook of Diagnostic Microbiology, Lippincott Williams and Wilkins, 2006, 5		
Knowledge	The student can choose the appropriate research techniques for the isolation and identification of veterinary significant microorganisms.		
Skills	The student uses skills on the methods of diagnosis of veterinary significant microorganisms.		