WNoŻiR

Faculty of Food Sciences and Fisheries

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	ANALYSIS OF LOCAL FISH MARKETS IN SELECTED COUNTRIES OF THE WORLD	Jolanta Kiełpińska	winter/summer	3	30
2	AQUACULTURE	Jacek Sadowski	winter/summer	6	60
3	AQUARIUM SCIENCE	Krzysztof Formicki	winter/summer	6	60
4	AQUATIC ECOTOXICOLOGY	Mikołaj Protasowicki	winter/summer	6	60
5	BIOCHEMISTRY	Artur Bartkowiak	winter/summer	6	60
6	BIOPROCESS AND MEMBRAN TECHNOLOGY	Agnieszka Tórz	winter/summer	6	60
7	BIOTECHNOLOGY IN MEAT PRODUCTION	Joanna Żochowska-Kujawska	winter/summer	6	60
8	CHEMICAL MONITORING OF FOOD AND ENVIRONMENT	Artur Ciemniak	winter/summer	3	30
9	CONSERVATION GENETICS	Remigiusz Panicz	winter/summer	6	60
10	CONSERVATION OF AQUATIC ANIMALS IN POLAND AND IN THE WORLD	Beata Więcaszek	winter/summer	6	60
11	DAIRY TECHNOLOGY	Izabela Dmytrów	winter/summer	6	60
12	EMBRYOPHYSIOLOGY AND COMPARATIVE ANATOMY OF FISHES	Krzysztof Formicki	winter/summer	6	60
13	ENZYMES IN FOOD PROCESSING	Katarzyna Felisiak	winter/summer	6	60
14	FISH BIOLOGY	Przemysław Czerniejewski	winter/summer	6	60
15	FISH DISEASE AND DIAGNOSTIC	Jolanta Kiełpińska		6	60
16	FISHERIES MANAGEMENT AND NEW FISH CATCHING TECHNIQUES	Przemysław Czerniejewski	winter/summer	6	60
17	FISHES IN AQUACULTURE AND RECREATIONAL FISHING IN THE WORLD	Beata Więcaszek	winter/summer	6	60
18	FISH TECHNOLOGY	Grzegorz Tokarczyk	winter/summer	6	60
19	FOOD ADDITIVES AND AUXILIARY SUBSTANCES	Katarzyna Felisiak	winter/summer	6	60
20	FOOD MICROBIOLOGY	Elżbieta Bogusławska-Wąs	winter/summer	6	60
21	GENERAL MICROBIOLOGY	Elżbieta Bogusławska-Wąs	winter/summer	6	60
22	GENETICS AND FISH SELECTION	Remigiusz Panicz	winter/summer	6	60
23	HATCHING PRACTISES AND STOCKING MATERIAL PRODUCTION	Krzysztof Formicki	winter/summer	6	60
24	HYDROCHEMISTRY	Agnieszka Tórz	winter/summer	6	60
25	HYGIENE AND TOXICOLOGY OF FOOD	Artur Ciemniak	winter/summer	6	60
26	HYGIENE IN FOOD INDUSTRY AND INTEGRATED PEST CONTROL	Agata Witczak	winter/summer	6	60
27	INSTRUMETAL ANALYSIS IN TOXICOLOGICAL STUDIES	Artur Ciemniak	winter/summer	4	45

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
28	INTRODUCTION TO CHEMICAL ANALYSIS	Agnieszka Tórz	winter/summer	6	60
29	INTRODUCTION TO HUMAN PHYSIOLOGY AND NUTRITION	Joanna Sadowska	winter/summer	6	60
30	MEAT TECHNOLOGY	Małgorzata Sobczak	winter/summer	6	60
31	PLANT TECHNOLOGY	Katarzyna Felisiak	winter/summer	6	60
32	PROCESSING OF BY-PRODUCTS	Małgorzata Sobczak	winter/summer	6	60
33	SEMINAR THESIS	- Nauczyciel WNoŻiR	winter/summer	30	60
34	STATISTICS FOR BIOLOGICAL SCIENCES	Agnieszka Strzelczak	winter/summer	6	60
35	TECHNIQUES OF MOLECULAR BIOLOGY	Remigiusz Panicz	winter/summer	6	60
36	TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS	Katarzyna Felisiak	winter/summer	6	60
37	TECHNOLOGY OF SNACK AND CONVENIENCE FOOD BASED ON FISH AND SEAFOOD	Grzegorz Tokarczyk	winter/summer	6	60
38	TOXICOLOGICAL METHODS OF THE ENVIRONMENT QUALITY CONTROL	Monika Rajkowska-Myśliwiec	winter/summer	3	30
39	WASTE MANAGEMENT IN AQUACULTURE	Agnieszka Tórz	winter/summer	6	60

Course title	ANALYSIS OF LOCAL FISH MARKETS IN SELECTED COUNTRIES OF THE WORLD		
Level of course	second cycle		
Teaching method	lecture		
Person responsible for the course	Jolanta Kiełpińska	**E-mail address to the person**	Jolanta.Kielpinska@zut.edu.pl
Course code (if applicable)	WNoZiR-2-38	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The student will get acquainted with the knowledge on the functioning of local fish sales mechanisms		
Entry requirements	Student should have basic knowledge on fish biology and fisheries		
Course contents	This course will introduce students to analysis of local markets in selected countries of the world (e.g. Thaiand. Korea, Australia, New Zealand, Canada, USA, Turkey, Malaysia, Indonesia). Content of the course will include whole sale and retail forms of trade, in particular market absorption and recovery (fish markets, trade centres, direct sell from the ships, or so-called small fish gastronomy "Buy and eat").		
Assessment methods	The presentation, Discussion, Analysis of photographic material Class test		
Recommended readings	1. Current articles on fish market trade, sells magagemnet and distribution of fish provided by lecturer on every classes		
Knowledge	The student will learn the rules for the distribution of fish in differences sales systems.		
Skills	Student is able to explain the causes and effects of various possibilities of fish sales development		
Other social competences	The student is aware of his knowledge and skills and the possibilities of their use in research work.		

Course title	AQUACULTURE		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Jacek Sadowski	**E-mail address to the person**	Jacek.Sadowski@zut.edu.pl
Course code (if applicable)	WNoZiR-2-21	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students will be familiar with basic methods of fish and crustacean culture, with particular attention to the fish culture in carp ponds, cages, trout ponds and recirculation systems.		
Entry requirements	Basics of aquaculture, fish feeding and feed production, hydrotechnics in aquaculture		
Course contents	Analysis of selected problems of carp pond design: number of fish per pond, Norquist curve, summer pond parts, oxygen fluctuation in carp ponds, estimation requirements for fertilizers, feed, oxygen concentration in different type of ponds. Analysis of technical and environmental properties to build facilities for trout production. Analysis of technical and environmental properties to build facilities in RAS and cage culture Students will be introduced into different techniques of freshwater fish production that are important in polish and international aquaculture sector. Aquaculture production in Poland. Carp production (environmental requirements, basic biological data). Carp ponds as a natural environment. Fish feeding in carp ponds. Polycultures. Rainbow trout culture (environmental requirements, basic biological data, production in open systems). Sturgeon production. Fish culture in recirculation systems and cages. Fish hatching - basic information. Basic problems of feeding and feed production. Crayfish production. Aquaponics		
Assessment methods	Lectures/laboratory Lecture – exam Laboratory - grade		
Recommended readings	1. Hongsheng Yang, Jean-François Hamel and Annie Mercier, Developments in Aquaculture and Fisheries Science, Elsevier, Amsterdam, 2015 2. Aquaculture (scientific journal) 3. Fish Farmer (scientific journal) 4. Bamigdeh (scientific journal)		
Knowledge	Has knowledge about basic rearing techniques in aquaculture		
Skills	knows how to make basic calculations regarding selected ones aquaculture techniques		
Other social competences	is aware of the impact of human activities in the field of breeding aquatic animals on the shaping and condition of the aquatic environment		

Course title	AQUARIUM SCIENCE		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Krzysztof Formicki	**E-mail address to the person**	Krzysztof.Formicki@zut.edu.pl
Course code (if applicable)	WNoZiR-2-31	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The main aim of the course is to learn techniques of designing and arranging various aquaria for fish, selection of appropriate species, care and reproduction of aquatic plants and selection of equipment to ensure optimal conditions for breeding aquatic organisms. After completing the course, students should be able to set different types of aquarium including spawning aquarium in order to perform a controlled breeding of fish.		
Entry requirements	Basic knowledge of anatomy and embryology and also biology and taxonomy of fish		
Course contents	Designing and arranging an aquarium: substratum, control, maintenance Selection of accessories: filters, light, heating, aeration Water quality and treatment Aquarium interior: plants, ornaments, maintenance Selection of fish species and their adaptive ability Feeding: selection of food, rations, frequency of feeding, threats Introduction: selection of containers Acquisition and selection of fish species; stock density and composition Reproduction: selection of spawners, spawning control Spawning: natural versus artificial, transport, quarantine Selected problems of fish diseases (prophylaxis, diagnosis)		
Assessment methods	- Lectures - Consultation - Seminars and group workshops - Work in laboratories To complete the course, a student is required to successfully pass all written tests (2) and keeping an aquarium.		
Recommended readings	1. Alderton D., Encyclopedia of Aquarium & Pond Fish., DK ADULT, 2003 2. Fletcher N., What Fish? A Buyer's Guide to Tropical Fish: Essential Information to Help You Choose the Right Fish for Your Tropical Freshwater Aquarium, Barron'sEducational Series,, 2006 3. Walstad D., Ecology of the Planted Aquarium., Echinodorus Publishing, 2013 4. Boruchowitz D.E., Freshwater Aquariums (Animal Planet Pet Care Library)., TFH Publications, 2006 5. Boruchowitz D.E., The Simple Guide to Freshwater Aquariums, TfhPubnsInc, 2009		
Knowledge	The student has the knowledge on techniques of designing and arranging various aquaria for fish, selection of appropriate species, care and reproduction of aquatic plants and selection of equipment to ensure optimal conditions for breeding aquatic organisms.		
Skills	The student should be able to set different types of aquarium including spawning aquarium in order to perform a controlled breeding of fish.		
Other social competences	The student is aware of the responsibility for his own work and the principles of working in a team.		

Course title	AQUATIC ECOTOXICOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Mikołaj Protasowicki	**E-mail address to the person**	Mikolaj.Protasowicki@zut.edu.pl
Course code (if applicable)	WNoZiR-2-3	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The transfer to the student basic knowledge of environmental toxicology and the use of test methods		
Entry requirements	Knowledge base of chemistry, biochemistry, ecology and environmental chemistry		
Course contents	Health and safety in the lab and work organization Defensive reactions invertebrate animals to the xenobiotics Determination of LC50 selected toxic substances Research methodology in the case of mass poisoning of the environment Toxicity tests Analysis of selected poisons and pollutants in environmental samples and biological materials The delivery papers prepared on the basis of audit work. Final exam Development of toxicology, establishing of the aquatic ecotoxicology, its aims and tasks Classification and specification of poisons. Mechanisms of intoxication and its course, reactions of organisms and symptoms of poisoning. Abiotic and biotic factors deciding on the toxicity of xenobiotics and course of intoxication. Toxins absorption and metabolism in a body Methodology of examination of the environment contamination cases with particular emphasis on water environment. Establishing the maximum permissible concentrations and contents. Influence of oxidants, acids, bases and gaseous contaminants on the water and land organisms. Phenols, cyanides and their derivatives – sources and effects onto the water biocenoses Migration of heavy metals and other microelements in biosphere and the effects of their occurrence in aquatic ecosystems Radioactive contamination of the environment and biocenoses Pesticides, PCB and PAH in the environment, their transformations and migrations in the aquatic ecosystems, influence on organisms. Dioxins in the environment, level of bioaccumulation and danger to organisms Contaminations with crude oil and its derivatives. Surfactants (soaps, detergents). Natural deleterious and toxic substances in the environment (toxins of bacteria, fungi, plants and animals) Plant and animal contamination as the indirect danger to human health		
Assessment methods	informative lecture laboratory Discussions checking preparation for classes final exam		
Recommended readings	1. Lam P., B. Richardson, R. Wu, Introduction to Ecotoxicology, Blackwell Science Ltd., London, 1999 2. Walker C.H., R.M. Sibly, S.P. Hopkin, D.B. Peakall, Principles of Ecotoxicology, CRC Press, 2012, 4th ed., ISBN 9781439862667 3. Aquatic Toxicology, JOURNAL		
Knowledge	The student is able to define the basic concepts in the field of aquatic ecotoxicology, is able to characterize the basic threats to the environment, can indicate methods to prevent its threats.		
Skills	student can to use a knowledge of testing methods and the ability to assess sources of intoxication and risk assessment of aquatic ecosystems		
Other social competences	The student is creative, has a concern for self-education, taking care of effects of their work. The student follows the rules of professional ethics, he can work in a team, he is able to assume the role of leader		

Course title	BIOCHEMISTRY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Artur Bartkowiak	**E-mail address to the person**	Artur-Bartkowiak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-6	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Providing students with basic knowledge in the field of biochemistry. Thie goal will be implemented by discussing the chemical composition and basic metabolic processes occurring in living cells, with particular emphasis on energy, regulation and integration of cell metabolism. Students will also be introduced to the basic experimental methods used in biochemistry.		
Entry requirements	knowledge in the field of inorganic chemistry, organic chemistry, biology, chemistry, and mathematics at the level resulting from graduating from high school is necessary. In particular, knowledge of organic chemistry at the academic level (after first year) will be helpful, including the ability to use chemical formulas, the ability to write chemical reactions and ability to calculate.		
Course contents	Introduction: Organization of work in a biochemical laboratory. Required theoretical basis of chemical waste treatment. Required theoretical basis of experiments and results elaborating, formulating conclusions. Denifitions of the molar and percentage concentrations and calculation of dilutions of the solutions. Convertion between percentage concentration and molar concentration. Preparation of the solutions of given molarities. Dilutions. Monosaccharides and polysaccharides. Characteristic reactions (e.g. reducing sugars), Hydrolysis of glycosidic bond. Invertase. The effect of inhibitors and physical factors on enzymatic reactions. Lipids. Characteristic reactions of saturated and unsaturated fats. Lipids. Determination of the properties of chosen fat (determination of the acidity of the substance and calculation of the acid value). Calculation of a saponification value. Amino Acids and Peptides. Characteristic reactions. Isoelectric point. Determination of isoelectric point of chosen selected protein Vitamins. Detection of the selected vitamins. Oxidation of vitamin C Written test I Salivary amylase. Depolimerization of starch using amylase. Lipase. Determination of enzyme activity using a titration method. Trypsin. Determination of the rate of gelatin digestion by trypsin. Onion DNA isolation. DNA hydrolysis. RNA isolation from yeast. Characteristic reactions. Written test II An introduction to amino acids and proteins. Structure and properties of amino acids and proteins. Function of proteins Enzymes. The structure and mode of action of selected enzymes. An introduction to kinetics of enzymatic reactions Biological membranes and transport Muscle structure. Biochemistry of contraction. Protein folding Bioenergetics and metabolism. Principles of bioenergetics Glycolysis and the catabolism of hexoses. The citric acid cycle. Fatty acids metabolism. Amono acids oxidation and production of urea. Oxidative phosphorylation and photophosphorylation. Lipid biosynthesis. Carbohydrate biosynthesis Biosynthesis of amino acids, nucleotides and related molecules. DNA metabolism, RNA metabolism, protein metabolism. Integration and hormonal regulation of mammalian metabolism		
Assessment methods	Conveying the information through the lecture Performing experiments with students, preparing reports of experiments (containing results with observations, calculations and conclusions) Engaging the students to give verbal feedback (discussion) attendance control continuous assessment written tests		

	experiment reports written examination
Recommended readings	1. Lehninger A.L., Nelson D.L., Cox A.M., Principles of Biochemistry, Worth Publishers, New York, 1993, II 2. Donald Voet, Judith G. Voet, Biochemistry, John Wiley & Sons, 2010, IV 3. Denise R. Ferrier, Biochemistry, Wolters Kluwer, 2017 4. J. Stenesh, Biochemistry, Springer Science+Business Media, New York, 1998 5. Reginald H. Garrett, Charles M. Grisham, Biochemistry, Brooks/Cole, Cengage Learning, Boston, USA, 2010, Fourth Edition 6. Berg Jeremy M., Biochemistry, Macmillan Learning, New York, 2019 7. Lubert Stryer, Biochemistry, W.H.Freeman & Co Ltd,, 1999
Knowledge	The student is able to define the basic concepts in the field of biochemistry, is able to characterize the basic processes in the cell, can indicate methods to analyse them.
Skills	The student is able use a knowledge of testing methods and the ability to analyse activity of cell pathways.
Other social competences	The student is creative, has a concern for self-education, taking care of effects of their work. The student follows the rules of professional ethics, he can work in a team, he is able to assume the role of leader

Course title	BIOPROCESS AND MEMBRAN TECHNOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agnieszka Tórz	**E-mail address to the person**	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-2-7	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students will develop their knowledge and understanding of microalgae biomass production and membrane separation methods used in technological processes.		
Entry requirements	Students must have successfully completed organic and inorganic chemistry subjects		
Course contents	Determining the level of deletion of biogenic elements and microalgae biomass accretion in the culture developed with the usage of the sample sewage and the technical sewage. Calculation of the total resistance, the membrane resistance, the resistance connected with reversible and irreversible fouling. The measurement of volumetric flux of permeate. Purification and concentration of model solution. The influence of such factors as water temperature, solar radiation, accessibility of biogenic elements, on the accretion of microalgae biomass. Membrane techniques - division of membranes; the membrane modules. Physical and chemical phenomena occurring during the membrane separation: creation of membrane fouling and factors influencing the process.		
Assessment methods	Lecture and Laboratory (practical exercises) Continuous assessment		
Recommended readings	1. Mukesh Doble, Anil Kumar Kruthiventi, Vilas Ganjanan Gaikar, Biotransformations and Bioprocesses, CRC Press, 2004 2. Alper, Hal S. (Ed.), Systems Metabolic Engineering, Humana Pres, 2013 3. Zhong, Jian-Jiang, Future Trends in Biotechnology, Humana Press, 2013 4. Fane A.G., Wang R., Jia Y., Membrane and desalination technologies. Volume 13, Handbook of Environmental Engineering., Published by Humana Press, 2011		
Knowledge	After the course student will gain knowledge of: • influence of biogenic elements on the growth of microalgae biomass, • membrane separation processes,		
Skills	Student will be able to: • adjust conditions to increase growth of microalgae biomass, • conduct separation using ceramic membranes in order to concentrate technological medium		
Other social competences	Student will be able to design and conduct an experiment.		

Course title	BIOTECHNOLOGY IN MEAT PRODUCTION		
Level of course	second cycle		
Teaching method	lecture / workshops		
Person responsible for the course	Joanna Żochowska-Kujawska	**E-mail address to the person**	Joanna.Zochowska-Kujawska@zut.edu.pl
Course code (if applicable)	WNoZiR-2-43	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60

Objectives of the course	Acquiring knowledge and skills regarding the production of fermented and dry-cured meat products
Entry requirements	A student who starts the course should have a basic knowledge of general food technology, food microbiology, and characteristics of basic raw materials animal origin, meat technology, food quality analysis
Course contents	Production technology for dry-cured meats Characteristics, classification and production technology of fermented sausages Use of selected enzymatic methods to modify the texture of meat Effect of raw meatrial and salt addition on quality of dry-cured meats Production technology of fermented sausages. Effect of technological and raw material factors on product quality Production of other types of dry fermented products and assessment of their quality Use of selected enzymatic methods to modify the texture of meat
Assessment methods	Lecture and discussion Laboratory exercises (experiment, observation), exercise report supported by conclusions Completing the workshop on the basis of reports Completing lectures based on the grade of the written exam with open questions Assessment of individual work
Recommended readings	1. Fidel Toldrá, Handbook of Meat Processing, Wiley-Blackwell, 2010 2. Fidel Toldra, Meat Biotechnology, Springer, 2008 3. R.A. Lawrie, Meat Science, Woodhead Publishing Limited, 1998
Knowledge	Student has in-depth knowledge of meat dry fermented product production and modeling their quality.
Skills	Student can produce various types of meat ripening products and assess their quality
Other social competences	Studentd is aware of the need for further training, responsibility for own work as a team member or leader. He understands the need to provide broad information to the public on food and nutrition technology issues human. Is able to act in an entrepreneurial manner.

Course title	CHEMICAL MONITORING OF FOOD AND ENVIRONMENT		
Level of course	second cycle		
Teaching method	laboratory class		
Person responsible for the course	Artur Ciemniak	**E-mail address to the person**	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-40	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	polish
Hours per week	2	**Hours per semester**	30
Objectives of the course	Providing students with basic knowledge in the field of food toxicology and hygiene as well as practical ability to use analytical methods in the assessment of the environment and food safety The transfer to the student basic knowledge of toxicology and hygiene of food, and practical ability of using analytical methods in assessment of the environmental and food safety		
Entry requirements	Knowledge base of food chemistry and ecotoxicology		
Course contents	Knowledge of research methods used in monitoring food safety Downloading and preservation of environmental samples (water, sediments, plants) for the analysis of toxic compounds Preparation of analytical samples and analysis of selected hazardous substances (heavy metals, organic pollutants) in various environmental components (water, sediments, plants, fish), according to a model developed for monitoring exercises Assessment of pollution of selected components of the environment based on the own students research results Knowledge of research methods used in monitoring of food safety Collecting and preservation of food samples (fish, bread, fruit and vegetables) for the analysis of toxic compounds Preparation of analytical samples and analysis of the content of selected pollutants (heavy metals, organic compounds) in different raw materials and foodstuffs according to a model developed for monitoring exercises Estimation of the potential health hazard to the consumer based on the own students research		
Assessment methods	informative lecture practical excercises checking preparation for classes continuous assessment of laboratory work		
Recommended readings	1. Stine K.E.,T.M. Brown, Principles of Toxicology, CRC Press, 2006, 2nd edition 2. Baltic Sea Environment Proceedings, HELCOM, 1986, 1990		
Knowledge	WM_1-_??_W01 The student is able to define the basic concepts in the subject. He knows and understand the dangers connected with contaminants presents in the environment and food		
Skills	WM_1-_??_U01 Student ist able to use the basic analytical methods useful in the study of environmental and food safety. Student can explain the results and asses the degree of environment and food contamination.		
Other social competences	WM_1-_??_K01 The student is creative, has a concern for self-education, taking care of effects of their work. The student follows the rules of professional ethics, he can work in a team, he is able to assume the role of leader		

Course title	CONSERVATION GENETICS		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Remigiusz Panicz	**E-mail address to the person**	rpanicz@zut.edu.pl
Course code (if applicable)	WNoZiR-2-35	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The Conservation Genetics subject aims to provide an opportunity to understand values of: • biodiversity and genetic diversity, • current conservation issues, • importance of genetic information in conservation of living organisms, • molecular tools for conservation biology.		
Entry requirements	Students should have completed Ecology, Genetics, Biology courses.		
Course contents	During laboratory classes following topics will be discussed: • Hardy-Weinberg principle, • Genetic drift, • Effective population size, • Population subdivision, • Quantitative genetics, • Molecular phylogenetics, • Evolutionary biology, • Heterozygosity, • Computer programs for population genetics data analysis, • . . . During lectures following topics will be presented: • Scope of conservation genetics, • Genetic structure of natural and managed populations, • Hybridization in native populations, • Introgression between species, • Identification of hybrid species, • Variation in small or endangered populations, • Values of biodiversity and loss of biodiversity, • Use of Genetics in Forensics, • . . .		
Assessment methods	Lectures Laboratory classess Continuous assessment (laboratory) Written exam (lecture)		
Recommended readings	1. Hartl D.L., Principles of population genetics, Sinauer Associates, Sunderland, 2007, Fourth edition 2. Słomski R. [Ed.], Restoration of endangered and extinct animals, Poznań University of Sciences, Poznań, 2010 3. Conservation genetics, http://www.springer.com/life+sciences/ecology/journal/10592		
Knowledge	Upon completion of this course the students will know: - basics and laws of the conservation genetics, - molecular methods related to the course topics; - sampling procedures, - define alien, rare and invasive species.		
Skills	Upon completion of this course the students will be able to: - demonstrate use of molecular tools, - describe problems related to conservation genetics, - calculate basic genetic indices.		
Other social competences	Student is aware that constant self-improvement is needed and its role in the society.		

Course title	CONSERVATION OF AQUATIC ANIMALS IN POLAND AND IN THE WORLD		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Beata Więcaszek	**E-mail address to the person**	Beata.Wiecaszek@zut.edu.pl
Course code (if applicable)	WNoZiR-2-24	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student knows the principal laws and regulations to protect wild fish in Poland and in the world, especially in Europe. Student knows the most important fish species endangered in Poland and in the world. Student can work with different data bases in the web-site. Student bequeathes the knowledge on the fish conservation in Poland and in the world, as well as on the international conventions concerned both the conservation and trade of the protected fish		
Entry requirements	Basic of anatomy and embryology of fishes, Biology of fishes, Fish taxonomy, Principles in the fishery law		
Course contents	Aquatic animals species under protection in Poland - threats, characteristics of their habitat, status in in IUCN and Polish Red Book Regional Inspectorate of Marine Fisheries in Szczecin - visiting the administration point and areas of its activity Cartilaginous fish species in the world - main threats, forms of conservation Methods of taxonomical status estimation of fish under protection - Gadus morhua morhua and G. morhua callarias in the areas of stocks mixing The most important anadromous teleost fish species under conservation - sturgeons and salmons; morphometric characters, habitat, threats and ways of protection Work in FishBase and NOBANIS website Instructions in legal instruments and regulations concerned the status of aquatic animals conservation in Polish marine waters and freshwaters. Habitat, biology and ecology and conservation status of aquatic animals in Poland, validated through IUCN procedures. Presentation of the spawning period, legal length, close and open seasons, limits of capture etc. for the important economically and protected fish species. Legal status of Baltic fishes and inland-water basins fishes. Ecological net of protected water areas in Poland - Nature 2000. Role of the Polish Union of Anglers in fish conservation in Poland. Fish restitution programs in Polish waters The international conventions concerned both the conservation and trade of the protected aquatic animals with focus on fish and the marine mammals.		
Assessment methods	Lecture, workshop, working in the web-bases, work in laboratory, visiting the administration points Continuous assessment, multimedial presentation, grade		
Recommended readings	1. Nelson J.S., 2006:, Fishes of the World., J.Wiley and Sons. Inc. New York., Toronto, New York, 2006 2. M. Kottelat and J. Freyhof, Handbook of European Freshwater Fishes., Kottelat and Co. Switzerland, 2007 3. Whitehead, P. J. P., M.-L. Bauchot, J.-C. Hureau, J. Nielsen, E. Tortonese., Fishes of the North-eastern Atlantic and the Mediterranean., Vol.I- III. UNESCO. Fish. N-e. Atl. and Mediterranean., 1986		
Knowledge	Student knows the principal laws and regulations to protect wild aquatic animals in Poland and in the world		
Skills	Student protects aquatic animals and their environment		
Other social competences	Student is able to manage the aquatic animals and aquatic resources conservation process		

Course title	DAIRY TECHNOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Izabela Dmytrów	**E-mail address to the person**	Izabela.Dmytrow@zut.edu.pl
Course code (if applicable)	WNoZiR-2-10	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To familiarize students with the factors affecting the quality and durability of raw milk, production technology of basic groups of dairy products, changes occurring in milk and dairy products during processing and storage		
Entry requirements	Basic knowledge in the field of chemistry, biochemistry and microbiology		
Course contents	Raw milk - methods of evoluation of guality and technological usefulness Drinking milk, sour and sweet cream Fermented milk Butter Ice cream Spreads Evaluation of the quality and technological suitability of raw milk The physiology of lactation Drinking milk and cream Fermented milk Butter Casein and caseinates Spreads Ripening cheeses and tvarog Ice cream and frozen desserts		
Assessment methods	Lectures class test exam		
Recommended readings	1. Izabela Dmytrów, Manual for DAIRY TECHNOLOGY, the student will receive the manual from the teacher		
Knowledge	The student is able to define the basic concepts used in dairy technology. Characterize the chemical composition of raw milk, drinking milk and butter. It is able to characterize the basic technological processes used in milk processing and processing by-products The student knows the methods of production of processed cheese and ice cream		
Skills	Student will be able to run processes relaed to dairy technology		
Other social competences	Student will be able to use new knoledge in the work		

Course title	EMBRYOPHYSIOLOGY AND COMPARATIVE ANATOMY OF FISHES		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Krzysztof Formicki	**E-mail address to the person**	Krzysztof.Formicki@zut.edu.pl
Course code (if applicable)	WNoZiR-2-29	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The subject include knowledge on embryophysiology of fishes and elements of comparative anatomy.		
Entry requirements	Basic knowledge of biology fish		
Course contents	Construction of eggs and their diversity morpho-mechanical adaptation to the environmental conditions. The sperm and motility parameters. Embryonic development in selected fish species. External and internal threats - ectoparasites, mycosis, abnormal embryonic development. Factors affecting embryonic development - temperature (constant factor, thermal shock), oxygen saturation (the effects of temporary deficiency), photoperiod, salinity, suspended solids, heavy metals, magnetic field. Hatching fish, hatching glands factors to accelerate the hatch. Juvenile specimens of crayfish. Structure (cell membrane, mikropyle, egg membrane, periwitelar fluid , egg yolk etc.) and a composition (proteins, lipids, nucleic acids etc.). Early morphogenesis (fertilization, safeguards against polyspermy, cortical avreole, zygote, parthenogenesis. Anatomical and functional aspects of organogenesis, symmetry of the body, formation of neuroendocrine and endocrine system in embryos. Definition and sex determination. Embryonic metabolism, respiration of embryos. The larva (yolk sac, the level of maturity of individual systems depending on the species, adapting to larval and transitional organs.		
Assessment methods	- Lectures - Consultation - Seminars and group workshops - Work in laboratories Estimation of work and presentation (50% estimation), estimation activity on classes (30%), estimation discipline – present on the classes and individual consultation (20% estimation concluding)		
Recommended readings	1. Evans D.H., Claiborne J.B., Currie S., The Physiology of Fishes, Fourth Edition (CRC Marine Biology Series), CRC Press, 2013 2. Genten F., Terwinghe E., Danguy A., Atlas of Fish Histology, Science Publishers, 2009 3. Depeche J., Billard R.,, Embryology in fish review, Société Française d'Ichtyologie, 1994 4. Edited by Roderick Nigel Finn and BG Kapoor, Fish larval physiology, Enfield, NH, Science Publishers, Enfield, NH,,, 2008		
Knowledge	The student has knowledge on structure of spermatozoa and eggs, motility of spermatozoa, fertilization and embryogenesis different species of fish, as well as natural spawning and early ontogenetic stages.		
Skills	After the course student is able to use embryophysiological and anatomical terminology of fishes and understand selected references on this topic.		
Other social competences	The student is aware of the responsibility for his own work and the principles of working in a team.		

Course title	ENZYMES IN FOOD PROCESSING		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Katarzyna Felisiak	**E-mail address to the person**	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-44	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Getting to know with enzymes properties used in food technology. The transfer of utilized skills of enzymes to produce of food products and the use of various methods for this purpose. Learning self-solve complex problems related to the processing of food with using enzymes (food biotechnology).		
Entry requirements	Basic knowledge of food chemistry and food technology		
Course contents	Determination of enzymes activity Isolation and purification of hydrolases from by-products The use of enzymes in the dairy industry The use of enzymes in the plant industry The use of enzymes in the fish industry The use of proteolytic enzymes to improve protein raw materials The use of amylolytic enzymes to improve cereal products The use of hydrolytic enzymes to stabilize fermented beverages Enzymes in food technology Production of industrial enzymes Asparaginase – an enzyme for acrylamide reduction in food products Enzymes in dairy product manufacture Enzymes in bread making Enzymes in non-bread wheat-based foods Brewing with enzymes Enzymes in potable alcohol and wine production Enzymes in fish processing Enzymes in fruit and vegetable processing and juice extraction Enzymes in meat processing Enzymes in protein modification Starch-processing enzymes Lipases for the production of food components		
Assessment methods	Expository methods (lecture, explanation or clarification) Activity method (discussion related to the lecture) Exposing method (movie related to the lecture) Practical method (demonstration, workshop and laboratory) continuous assessment observation of students activity during laboratories written or oral exam		
Recommended readings	1. Robert J. Whitehurst and Maarten van Oort, Enzymes in Food Technology. Second edition., Blackwell Publishing Ltd., 2010 2. Wolfgang Aehle, Enzymes in Industry. Production and Applications. Third, Completely Revised Edition., Wiley, 2007 3. Norman F. Haard , Benjamin K. Simpson, Seafood Enzymes: Utilization and Influence on Postharvest Seafood Quality., CRC Press, 2000, 1st edition 4. Alejandro Marangoni, Enzyme kinetics. A Modern Approach., John Wiley & Sons, 2003 5. Julio Polaina and Andrew P. MacCabe, Industrial Enzymes. Structure, Function and Applications., Springer, 2007		
Knowledge	Student is able to recognize and characterize what enzyme is used in food industry. Is able to properly choose the kind of enzyme and the parameters of application according to raw materials and effect. He can explain the processes occurring in the raw material after enzymatic treatment. He can propose the appropriate technological process depending on the type of raw material and its properties. Knowledge is provided by Prof. www.mszymczak.zut.edu.pl		
Skills			

	The student is able to organize a work station for himself and a group of people taking part in classes. He is able to assign tasks to individual team members in a proper way, he is able to organize work in a team and supervise it to realise the work schedule. He is aware of the benefits of constantly acquiring skills. Student properly uses the acquired knowledge while performing the tasks entrusted. He is able to solve problems arising during the implementation of tasks and to use appropriate methods and materials for this purpose. Able to use the available methods and equipment for enzymatic treatment and processing of food raw material depending on its type.
Other social competences	The student properly uses the acquired knowledge and skills in the implementation of the tasks entrusted to him. He can responsibly solve problems and tasks set before him. He independently makes decisions related to the implementation of tasks. He is creative and open to suggestions, follows ethical principles and is not afraid to express his opinion. He is aware of the need to constantly acquire knowledge.

Course title	FISH BIOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Przemysław Czerniejewski	**E-mail address to the person**	Przemyslaw.Czerniejewski@zut.edu.pl
Course code (if applicable)	WNoŻiR-02-39	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	• Knowledge of general aspects of fish biology • General knowledge of Polish, and European fishes • The ability to synthesize biological information spanning multiple areas (e.g., swim bladder function and its relation to catch-and-release mortality) • Recognition of large-scale tradeoffs in fish feeding, growth, and reproduction • Practical laboratory experience in identification, external and internal morphology, tagging, reproduction, and aging of fishes • Effective data collection, analyses, and written communication skills appropriate for a graduating senior or incoming graduate student entering the professional workforce.		
Entry requirements	Systematics and biogeography of fish Hydrobiology Limnology		
Course contents	- The Diversity of Fishes - Fishes and their Habitats - Food and Feeding of fish - Reproduction, and Life Histories - Behavior and Cognition This course will survey fundamental aspects of the biology of different components of the marine and freshwater fish community through lectures and practicals. At the individual-level, the life cycles and life history strategies of fish will be summarised. Key aspects of population-level biology, including fish migration and population structure, will be covered. Case studies for a range of key Polish and European species will also be presented. The relevance of fisheries biology to fisheries management will be highlighted throughout the course		
Assessment methods	Workshop/lecture Grade, essays, project work		
Recommended readings	1. Paul J.B. Hart, John D. Reynolds, Handbook of Fish Biology and Fisheries, Blackwell Science Ltd, 2008 2. Lagler KF, Bardach J, Miller RR, Passino DR, Ichthyology, John Wiley & Sons, New York, 1977, 2nd edn 3. Nelson JS, Fishes of the World, John Wiley and Sons, New York, 2006, 4th edition 4. Gross MR, Evolution of diadromy in fishes. In: Common Strategies of Anadromous and Catadromous Fishes, American Fisheries Society, Bethesda, MD., 1987 5. Pitcher TJ, Behaviour of Teleost Fishes, Chapman & Hall, London, 1993, 2nd 6. Pitcher TJ, Parrish JK, Functions of shoaling behaviour in teleosts. In: Behaviour of Teleost Fishes, Chapman & Hall, London, 1993, 2nd 7. Pitcher TJ, Wyche CJ,) Predator avoidance behaviour of sand-eel schools: why schools seldom split. In: Predators and Prey in Fishes,, The Hague, 1983		
Knowledge	Students will have knowledge of taxonomy and important features of the various groups of fishes and the study of the effects of environmental variables on physiology. Students will explore the physiological approaches used by different fish groups to cope with environmental variables and the physiological basis of fundamental life processes such as respiration, blood circulation, reproduction, metabolism, osmoregulation and migration. The life cycle of important fish species will also be covered including development, age, growth and survival and mortality. Students will be introduced to scientific experimentation: health and safety in laboratory conditions, record keeping, and presentation and reporting, and learn biological sample preservation techniques.		
Skills	Student will be able to use knowledge about fsh biology in practice		
Other social competences	Student will have ability to care about fish biology and welfare		

Course title	FISH DISEASE AND DIAGNOSTIC		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Jolanta Kiełpińska	**E-mail address to the person**	Jolanta.Kielpinska@zut.edu.pl
Course code (if applicable)	WNoZiR-2-32	**ECTS points**	6
Semester		**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The student will learn about selected fish diseases and the mechanisms of infection		
Entry requirements	Student should have basic knowledge on microbiology, immunology and epidemiology.		
Course contents	Fish section Diagnostic analysis Basics of epidemiology The mechanism of infection Selected viral diseases in fish Selected bacterial diseases in fish Selected fungal and parasitic diseases in fish Procedures for the quarantine of live aquatic animals		
Assessment methods	The presentation, Discussion, Practical analyzes in the laboratory Weekel meetings/lectures/fish section		
Recommended readings	1. Edward J. Noga, Fish disease: diagnosis and treatment, Iowa State University Press, Iowa, 2010		
Knowledge	The student will learn about selected fish diseases, methods of diagnosis and prevention methods		
Skills	The student can recognize selected diseases and give the reason for their occurrence in the environment		
Other social competences	The student is aware of his knowledge and skills and the possibilities of their use in research work.		

Course title	FISHERIES MANAGEMENT AND NEW FISH CATCHING TECHNIQUES		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Przemysław Czerniejewski	**E-mail address to the person**	Przemyslaw.Czerniejewski@zut.edu.pl
Course code (if applicable)	WNoZiR-2-27	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students will know about wordwilde fisheries, value chains, and ecological research. They will learn traditional methods to investigate exploited organisms, such as determination of population parameters, and field work for direct estimation of fish density.		
Entry requirements	Basic of technology, growth, and types of fishery.		
Course contents	History of Polish fisheries management . Fisheries: recreation commercial. Institutions of fisheries management: domestic and international and fisheries law . Anadromous fish management. New fish catching technics. Fish collection in lake, rivers and Baltic sea. Principles of fisheries management and methods for assessment and analysis of fish populations and aquatic habitats. Modelling and Quantitative Methods in Fisheries. Using new technics in fisheries.		
Assessment methods	Lectures/Laboratory Lecture - exam Laboratory - grade		
Recommended readings	1. John C. Sainsbury, Commercial Fishing Methods: An Introduction to Vessels and Gears, Wiley 3 edition, 1996 2. Ian Wellby, Ash Girder, Robin Welcomme, Fisheries Management: A Manual for Still - Water Coarse Fisheries, John Wiley & Sons, 2010 3. R. Quentin Grafton, Ray Hilborn, Dale Squires, Meere Tait, Handbook of Marine Fisheries Conservation and Management, Oxford University Press, 2010		
Knowledge	Students will learn about the role of the fisheries management authority in Poland, the importance of sustainable fishing and protecting the marine environment.		
Skills	Student will be able to use catching gears		
Other social competences	Student will be aware of sustainable fisheries		

Course title	FISHES IN AQUACULTURE AND RECREATIONAL FISHING IN THE WORLD		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Beata Więcaszek	**E-mail address to the person**	Beata.Wiecaszek@zut.edu.pl
Course code (if applicable)	WNoZiR-2-25	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student knows the principal regulations of fishing in Poland and in the world, especially in Europe. Student knows the most important game fish species in Poland and in the world.		
Entry requirements	Basic of biology of fish and fish taxonomy, Principles in the fishery law and management		
Course contents	Presentation of cartilaginous fish of great significance in the recreational angling Presentation of teleost fish of great significance in the recreational angling Visit in the Polish Angling Assocation - methods of working, area of research, fish reproduction Multimedial presentation on game-fish species and fishes in aquaculture from the students' country The most important fish species in aquaculture in Poland and in the world. Game fishes of the world are presented, arranged due to their taxonomic position and fishing-grounds in freshwater and marine areas, with their Latin nomenclature, English names, and local names. Main fishing-grounds and methods of angling of particular fish species in Poland and inthe world. Legal regulations of angling in different countries. Rules of safe fishing. Presentation of the spawning period, legal length, close and open seasons, limits of capture etc. for the important game fish species. Role of the Polish Union of Anglers in fisheries management in Poland and IGFA in the world. The most important fish species in the aquaculture in Poland and in the world.		
Assessment methods	Lecture, workshop, working in the web-bases, work in laboratory, visiting the administration points Continuous assessment, presentation, grade		
Recommended readings	1. 3. Reese J.T.,, World Record Fishes.,, IGFA,, USA, 2002, 2002 2. Golani D., Ozturk B., Basusta N., F., ishes of the Eastern Mediterranean, Turkish Marine Research Foundation., Turkey., 2006, 2006		
Knowledge	Student knows the important species in aquaculture and recreational fishing, and principal regulations of fishing in Poland and in the world		
Skills	Student can name the most important fish species in aquaculture and recreational fishing, and forms of their protection in the world		
Other social competences	Student is able to evaluate the proper management in aquaculture and in angling associations		

Course title	FISH TECHNOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Grzegorz Tokarczyk	**E-mail address to the person**	Grzegorz.Tokarczyk@zut.edu.pl
Course code (if applicable)	WNoZiR-2-14	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Getting to know with physico-chemical and technological suitability of fish, crustaceans and molluscs. The transfer of processing skills of aquatic food products and the use of various methods for this purpose. Learning self-solve complex problems related to the processing of edible fish and aquatic invertebrates for food.		
Entry requirements	Basic knowledge of fish taxonomy, food chemistry and food technology		
Course contents	The yield of total edible parts from fish Heat treatment of fish, crustaceans and molluscs - physical and chemical changes Salted fish technology Marinated fish technology Technology of fishburgers Technology of canned fish and other aquatic organisms. Smoked fish technology. Technology of fish sausage Fish pastes technology Technology of minced meat Raw material of fish industry - species and morphological diversity, availability and seasonal changes. Optional sources of raw materials for the fishing industry. Form of raw materials, their utility value and technological usefulness. Quality changes in aquatic food products Processing systems and unit processes Refrigerated processes Salted and marinated fish technology Heat processing Smoked fish technology. Technology of minced and comminuted fish flesh products. Aquatic organisms by-products The utilization of low value raw materials in fish processing. Designing of convenience, functional and fortified foods based on aquatic organisms. Optimization of technological processes used in fish processing. Traditional and regional foods made from aquatic organisms.		
Assessment methods	Expository methods (lecture, explanation or clarification) Activity method (discussion related to the lecture) Exposing method (movie related to the lecture) Practical method (demonstration, workshop and laboratory) formative - continuous assessment formative - observation of students activity during laboratories summarising - written or oral exam		
Recommended readings	1. 1.R. E. Martin, E. P. Carter, G. J. Flick, Jr., L. M. Davies (Eds.)., Marine & Freshwater Products Handbook, Technomic Publishing Company, Inc., 851 New Holland Avenue, Box 3535, Lancaster, PA 17604, USA, 2000 2. E. G. Bligh (Ed.), Seafood Science And Technology, Fishing New Books. Canadian Institute of Fisheries Technology. A division of Blackwell Scientific Publications Ltd, 1992 3. Zdzislaw E . Sikorski, Chemical and Functional Properties of Food Components, CRC Press, 2006, Third Edition 4. Venugopal V. (Ed.), Seafood Processing. Adding Value Through Quick Freezing, Retortable Packaging, and Cook-Chilling, CRC Press Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, 2006		
Knowledge	Student is able to recognize and characterize aquatic organisms used in the fishing industry. Is able to properly choose the type of pre-treatment and the method of protecting the raw material against deterioration. He can explain the processes occurring in the raw material after its acquisition, before and after the processing. He can propose the appropriate technological process depending on the type of raw material and its properties.		

Skills	The student is able to organize a work station for himself and a group of people taking part in classes. He is able to assign tasks to individual team members in a proper way, he is able to organize work in a team and supervise it to realise the work schedule. He is aware of the benefits of constantly acquiring skills. Student properly uses the acquired knowledge while performing the tasks entrusted. He is able to solve problems arising during the implementation of tasks and to use appropriate methods and materials for this purpose. Able to use the available methods and equipment for treatment and processing of fish raw material depending on its type.
Other social competences	The student properly uses the acquired knowledge and skills in the implementation of the tasks entrusted to him. He can responsibly solve problems and tasks set before him. He independently makes decisions related to the implementation of tasks. He is creative and open to suggestions, follows ethical principles and is not afraid to express his opinion. He is aware of the need to constantly acquire knowledge.

Course title	FOOD ADDITIVES AND AUXILIARY SUBSTANCES		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Katarzyna Felisiak	**E-mail address to the person**	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-46	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Getting to know with physico-chemical and technological suitability of food additives and axiliary substances The transfer of skills of food additives utilization. Learning self-solve complex problems related to the using of food additives and auxiliary substances for food processing.		
Entry requirements	Basic knowledge of organic and not organic chemistry, food chemistry		
Course contents	Characteristics and correct use of preservatives and antioxidants Characteristics of natural and artificial adyes. Effect of technological and environmental factors on their stability. Taste and odour forming additives Texture shaping additives The polyphosphates Auxiliary raw materials Conformity assessment of use and information on food additives in products - practical tasks from industry General information on food additives Shelf life extension additives – preservatives Shelf life extension additives - antioxidants and synergists Technological functions and characteristics of added acids to food Natural dyes Organic and synthetic dyes Hydrocolloids Emulsifiers and polyphosphates Sweeteners Additives applied on the surface Enriching additives, auxiliaries, isolates, flavourings and enzymes Legislation and problems when using food additives		
Assessment methods	Expository methods (lecture, explanation or clarification) Activity method (discussion related to the lecture) Exposing method (movie related to the lecture) Practical method (demonstration, workshop and laboratory) continuous assessment observation of students activity during laboratories written or oral exam		
Recommended readings	1. Avventuroso, Emanuela et al., Chemistry and Hygiene of Food Additives, Springer, 2017 2. Mike Saltmarsh, Sue Barlow, Vanessa Richardson, Anne-Laure Robin, David Jukes, Essential Guide to Food Additives-Royal Society of Chemistry, 2013 3. Titus A M Msagati, The chemistry of food additives and preservatives, Wiley-Blackwell, 2012 4. Jim Smith, Lily Hong-Shum, Food Additives Data Book, Wiley-Blackwell, 2011		
Knowledge	Student is able to recognize and characterize diferences between additives used in food industry. Is able to properly choose the kind of food-additive and method of application according to raw materials and needed effect. He can explain the processes occurring in the raw material after adding food additive. He can propose the appropriate technological process depending on the type of raw material and its properties. Knowledge is provided by Prof. www.mszymczak.zut.edu.pl		
Skills	The student is able to organize a work station for himself and a group of people taking part in classes. He is able to assign tasks to individual team members in a proper way, he is able to organize work in a team and supervise it to realise the work schedule. He is aware of the benefits of constantly acquiring skills. Student properly uses the acquired knowledge while performing the tasks entrusted. He is able to solve problems arising during the implementation of tasks and to use appropriate methods and materials for this purpose. Able to use the available methods and equipment during food additives and processing of food raw material depending on its type.		
Other social competences			

	The student properly uses the acquired knowledge and skills in the implementation of the tasks entrusted to him. He can responsibly solve problems and tasks set before him. He independently makes decisions related to the implementation of tasks. He is creative and open to suggestions, follows ethical principles and is not afraid to express his opinion. He is aware of the need to constantly acquire knowledge.

Course title	FOOD MICROBIOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Elżbieta Bogusławska-Wąs	**E-mail address to the person**	Elzbieta.Boguslawska-Was@zut.edu.pl
Course code (if applicable)	WNoZiR-2-9	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	the objective is to make students: * understand microbes diversity and their role when becoming food contaminants, * be able to name microbes essential to food safety and quality, where they come from, what are their growth requirements and factors affecting their survival, methods of their isolation/ enumeration and identification. * know, products specificity and microbiological standards they are to meet.		
Entry requirements	basics in general microbiology biochemistry food technology		
Course contents	Quantitite methods applied in microbiological analysis of food and food processing enivronment (SPC, MPN, DMC). Food safety aspects: steps in testing food items for the presence of Salmonella and Listeria monocytogenes; metods of isolation and identification. Food safety aspects: steps in analysis of food samples towards bacteria of Bacillus cereus group and coagulase-positive staphylococci; isolation and identification procedures. Spoilage bacteria: changes in enzymatic activity and types of bacteria dominating on raw fish stored under ambient (room T) and cold (4C) temperatures. Indicator microbes in food quality assessment: Enterobacteriaceae, faecal coliforms; methods of enumeration and identification. Culturing and growth of microbes, selectve media; microscopy and staining in microbiological diagnostics Microbial diversity. Food as carrier to microbes of different signifcance Factors affecting microbial growth in food items; intrinsic factors (nutrients, pH and buffering capacity, redox potential, water activity), extrinsic factors (temperature, relative humidity, gaseous atmosphere) Bacterial growth; 1 generation time, practical aspect Food hazards; HACCP system and food safety Spore forming microbes and their significance in food Indicator microbes in food quality assessment Types of foodborne illness (infection, intoxication, toxicoinfection), cases-outbreaks, epidemiological statistics. Bacterial agents of foodborne diseases: Gram-negative foodborne pathogens (Salmonella, Shigella, Yersinia enterocolitica, E. coli, campylobacters, Vibrio spp.), Gram-positive foodborne pathogens (Bacillus cereus group, Listeria monocytogenes, Staphylococcus spp.) Emerging foodborne pathogens Microbes in food spoilage		
Assessment methods	lectures/ power point presentations practical work - microbiological analyses in the laboratory formative summarising		
Recommended readings	1. Jay J.M., M.J. Loessner, D.A. Golden, Modern Food Microbiology, Springer Sc.+ Business Media, Inc., USA 2. Ray B., Fundamental food microbiology, CRC Press, USA 3. Adams M.R., M.O. Moss,, Food microbiology, Univ. of Surrey,, Guildford, UK		
Knowledge	The student can choose the approriate techniques for examination and identifaction of bacteria and fungi		
Skills	The students uses skills on diagnostic of bacteria and fungi		
Other social competences	The students demonstrates responsibility and awareness of the decisions made during the conduct of microbiological tests		

Course title	GENERAL MICROBIOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Elżbieta Bogusławska-Wąs	**E-mail address to the person**	Elzbieta.Boguslawska-Was@zut.edu.pl
Course code (if applicable)	WNoZiR-2-16	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	the knowledge on: diversity of microorganisms, ways to control their growth, role microbes play in the environment, the practical skills in fundamental microbiological techniques.		
Entry requirements	biology, biochemistry, chemistry		
Course contents	Fundamental microbiological techniques, Microbial growth and metabolism, Methods of counting microbes. Types of microorganisms: bacteria, fungi, viruses, prions, Microorganisms and the environment – role they play, Microbial diversity, mutual relations, survival strategy, Bacterial cell structures and functions, Factors affecting growth and ways to control microorganisms,		
Assessment methods	Informative lectures with multimedia presentations Laboratory the final mark composed of marks for the exam (75%) and practical laboratory work (25%)		
Recommended readings	1. M.J. Leboffe and B.E.Pierce,, Microbiology: Laboratory Theory & Application, 2. K.R. Aneja,, A Textbook of Basic and Applied Microbiology., New Age Int.,, 2008		
Knowledge	The student can choose the appropriate techniques for examination and identification of bacteria and fungi.		
Skills	The student uses skills on diagnostics 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	GENETICS AND FISH SELECTION		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Remigiusz Panicz	**E-mail address to the person**	rpanicz@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-52	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The program focuses on broadening student's knowledge and understanding of the current technologies and processes in the genetic fish selection. Students in the programme will gain theoretical and practical competence within the broad field of fish genetics e.g. assessing of genetic variation, measuting changes of artificial selection in the hatchery, performing ploidy manipulation, genetic engineering and biological data processing.		
Entry requirements	Basic knowledge in biology and aquaculture is recommended		
Course contents	Smpling and DNA extraction Qualitative and quantitative assessment of DNA extracts Amplification of selected genome regions Sequencing techniques and raw data processing Sequence alignments and marker identification Estimation of allele frequencies Microsatellite markers and association studies Assesment of genetic variation based on single nucleotide polymorphisms (SNPs) Phylogenetic analyses Determination of ploidy level in fishes Genomics in aquaculture studies Basics of fish selection Former and current selection strategies Genetics and selective breeding in aquaculture and fisheries Relationship between genotype and phenotype Biochemical and molecular markers Application of molecular markers for population genetic analysis The concept of genetic variation Measuring genetics variation in aquaculture Applicability of quantitative trait loci (QTL) Marker-assisted selection (MAS) programs in aquaculture production Polyploidy, gynogenesis and androgenesis Basics and development of breeding programme Conservation of genetics resources (gen banking) Measuring and maintaining of genetic pools		
Assessment methods	Lecture, laboratory and practical classes Lecture and Laboratory Laboratory exercises and reports Exam 1 and 2 Continuous assessment (laboratory) Written exam (lecture)		
Recommended readings	1. Zhanjiang (John) Liu, Aquaculture genome technologies, Blackwell Publishing, Ames, 2007, I 2. Zhanjiang L, Aquaculture genome technologies, Wiley-Blackwell, 2007 3. Beaumont A.R., Hoare K., Biotechnology and genetics in Fisheries and Aquaculture, Blackwell Science, Oxford, 2003		
Knowledge	Student demonstrates basic knowledge regarding genetic programs of fish selection		
Skills	Is able to choose, prepare and applicate the proper selection program for aquacuture species		
Other social competences	Student is able to collect and interpret data from laboratory experiments and literature, prepare written experimental reports and present results of literature study using audiovisual ways.		

Course title	HATCHING PRACTISES AND STOCKING MATERIAL PRODUCTION		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Krzysztof Formicki	**E-mail address to the person**	Krzysztof.Formicki@zut.edu.pl
Course code (if applicable)	WNoZiR-2-30	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	TThe aim of the course is to acquaint students with the phenomena of hatching practices and practices and stocking material production of different species and aquatic invertebrates (particularly crayfish) as well as impact of environmental factors on embryonic and larval development and quality assessment of gametes.		
Entry requirements	Knowledge of biology fish		
Course contents	Methods for obtaining and selection of spawners (transport, maintenance, maturation control, anaesthethics) Gametes: quality assessment, maintenance, transport Eggs: conditions for incubation, maintenance, losses, transport Control of larval hatching processes Larvae and hatchlings: feeding, care, transport Legal regulations on production, trade, and release of stocking materials to open waters Methods for obtaining and selection of spawners (transport, maintenance, maturation control, anaesthethics) Natural and artificial spawning Production of salmonid, coregonid, and rheophilous cyprinid stocking materials Plant-feeding fishes: breeding and grow-out of fry Pike, zander, and other fish species: reproduction (and crayfish)		
Assessment methods	Lectures Consultation Seminars and group workshops Work in laboratories Design and field work Other exercises / practical classes Other methods / forms To complete the course, a student is required to successfully pass all written tests (2) and a test requiring practical knowledge on gamete quality assessment and controlled fish reproduction		
Recommended readings	1. Gilbert S., Developmental Biology,, Sinauer Associates Inc. 2. Bond C.E., Biology of Fishes, Saunders College publishing, 1996 3. Moyle P.B., Cecj Jr. J.J.: Fishes:, An Introduction to Ichthyology (5th Edition), Benjamin Cummings, 2003 4. Evans D.H., Claiborne J.B., Currie S., The Physiology of Fishes, Fourth Edition (CRC Marine Biology Series), CRC Press, 2013		
Knowledge	The aim of the course is to acquaint students with the knowledge on hatching practices and stocking material production of different species and aquatic invertebrates (particularly crayfish) as well as impact of environmental factors on embryonic and larval development and quality assessment of gametes.		
Skills	The student is able to use knowledge on hatching practices and stocking material production of different species.		
Other social competences	The student is aware of the responsibility for his own work and the principles of working in a team.		

Course title	HYDROCHEMISTRY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agnieszka Tórz	**E-mail address to the person**	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-2-28	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students should get acquainted with the basic factors and processes conditioning the proper functioning of aquatic ecosystems as a living environment for aquatic organisms		
Entry requirements	The basic knowlege of chemistry		
Course contents	Determination of oxygen curves along with determining the mixing regime on the basis of sample thermal-oxygen conditions in selected lakes Determination of vulnerability to lake water degradation Determination of selected forms of nitrogen and phosphorus (ammonium nitrogen, nitrite nitrogen (III), nitrate nitrogen (III), reacting phosphorus) in accordance with the adopted methodology Determination of organic matter in surface waters Determination of anions and cations responsible for the level of surface water mineralization Classification of surface waters with particular emphasis on lake ecosystems and dynamics of lake waters Thermal and oxygen conditions of lake waters – lake classifications: thermal, oxygen and mycetic divisions Physico-chemical properties of waters, circulation of elements including biogenic elements (nitrogen and phosphorus) The problem of surface water eutrophication Carbonate system for buffering properties The importance of organic matter in surface waters Mineralization of surface waters		
Assessment methods	lectures exercies (lab) An exam. 50% of total results for 3.0 Observation of students		
Recommended readings	1. Standards methods for examination of water and wastewater, Am. Publ. Health Ass., Washington, 1995 2. Kalff J., Limnology, New Jersey, USA, 2001		
Knowledge	The student knows the factors and processes conditioning the proper functioning of aquatic ecosystems		
Skills	The student knows the principles of laboratory work, knows the principles of instrumental analysis		
Other social competences	Students are able to cooperate and work in a group also as a team		

Course title	HYGIENE AND TOXICOLOGY OF FOOD		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Artur Ciemniak	**E-mail address to the person**	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-1	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The transfer to the student basic knowledge of hygiene and toxicology of food, and methods used in studies of safety and health quality of raw materials and foodstuffs		
Entry requirements	Knowledge base of inorganic and organic chemistry, biochemistry, ecology and environment protection		
Course contents	Health and safety in the lab and organization of work An introduction to the general principles of food research, methods of chemical analysis and instrumental. An introduction to the general principles of assessment and evaluation of sanitary-hygienic raw materials and food products. Biological contamination of food products - detection of storage pests Analysis of preservatives and other biologically active foreign substances in food Determination of toxic heavy metals and other trace elements in raw materials and food products Determination of Persistent organic pollutants (POP) in raw materials and food products The delivery papers prepared on the basis of audit work. Final exam Aims and tasks of hygiene and toxicology of food. Legislation and supervision over food in Poland and in the world. Anthropozoonoses. Warehouse pests Toxicology, its development and the establishing of food toxicology. Mechanisms of absorption, transport, metabolism and excretion of contaminants/poisons in a human body. Process of poisoning occurrence. Factors deciding on the toxicity of xenobiotics and course of intoxication. Principles of establishing the maximum permissible xenobiotics contents in food. Toxicological aspects of the application of additives in the food industry. Heavy metals and other microelements in the environment and food. Radioactive contamination of food. Pesticides, PCB, PCT and PAH in food. Dioxins in the environment and food. Natural harmful and toxic substances (mycotoxins, anti-nutritive substances, vegetable and animal poisons). The influence of farming (remnants of nitrates), rearing (antibiotics, hormones) and processing processes on the degree of food contamination. Evaluation methods of deleterious substance sampling against daily nutrition dose.		
Assessment methods	informative lecture laboratory Discussions checking preparation for classes final exam		
Recommended readings	1. 1. Conning D.M., A.B.G. Lansdown, Introduction to Food Toxicology, Springer-Verlag, New York Inc., US, 2012, ISBN-13: 978-1-4615-9771-1, ISBN: 1-4615-9771-4.2. 2. Schmidt R.H., G.E. Rodrick, Food Safety Handbook, John Wiley & Sons, Inc., 2003, Print ISBN: 97804712106413. 3. Takayuki Shibamoto, L.F. Bjeldanes, S. Taylor, Introduction to Food Toxicology, 2011, ISBN: 978-0-08-092577-6; Online ISBN: 9780471721598; DOI: 10.1002/047172159X		
Knowledge	Student is able to define basic concepts in the field of food hygiene and toxicology, can characterize organisms and dangerous substances that can occur in food, can indicate methods to prevent threats to the health of food		
Skills	Is able to use the proper terminology in the field of hygiene and food toxicology, choose reliable research methods to conduct research and assess the health quality of food.		
Other social competences	The student is creative, has a concern for self-education, taking care of effects of their work. The student follows the rules of professional ethics, he can work in a team.		

Course title	HYGIENE IN FOOD INDUSTRY AND INTEGRATED PEST CONTROL		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agata Witczak	**E-mail address to the person**	Agata.Witczak@zut.edu.pl
Course code (if applicable)	WNoZiR-1-42	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	polish
Hours per week	4	**Hours per semester**	60
Objectives of the course	Understanding the sanitary and hygienic requirements applicable in food industry plants, health and safety regulations		
Entry requirements	Knowledge of basic methods of chemical analysis, biology, food hygiene, toxicology and food technology		
Course contents	The substances intentionally added to food The control methods of environmental pollutants residues in food Hazardous substances in food of natural origin Detergents and disinfectants used in food processing plants. Research of the washing capability Mineral impurities. Presentation of the work prepared by students Detergents Definition and evolution of food hygiene Seurces of food contamination. Hygiene control measures in food processing. Future trends. The sanitary-hygienic requirements associated with designing and construction of food processing plants (impruving the hygienic design) The range of mocrobial and chemical risk in food processing. Hazardous substances in food of natural origin Cleaning agents and desinfectants used in food processing plants (CIP and COP). The use of standard operating procedures (SOPs) GMP and GHP in the food industry. Work safety.		
Assessment methods	informative lecture Laboratory Discussion checking preparation for classes final exam		
Recommended readings	1. Fundamentals of Food Hygiene for the Food Industry, Royal Society for the Promotion of Health, London, 2007, 2007 2. Edited by H. L. M. Lelieveld, M. A. Mostert and J. Holah,, Handbook of hygiene control in the food industry, Published by Woodhead Publishing Limited; CRC Press, England, USA, 2005, 2005 3. John Charlton, Isabel Sampson, Moray Anderson, Mike Rimmer, Pest control procedures in the food industry, England, 2009, 2009		
Knowledge	The student has knowledge of safety rules, regulations related to food safety and sanitary requirements in factories. Student has an advanced knowledge of technological design of production plants including aspects of hygiene. He has knowledge of the hygiene - sanitary conditions of production, transport, storage and distribution of food. He has a knowledge of hazardous substances presented in food and raw materials for its production, and dangerous substances occurring in materials in contact with food. He has knowledgeable about the laws concerning the organization of the national sanitary-hygienic supervision and rules dealing with waste		
Skills	The student can use a knowledge of safety rules, regulations related to food safety and sanitary requirements in factories. Student is able to use his knowledge of technological design of production plants including aspects of hygiene. He can detect and determine the contents of hazardous substances presented in food and raw materials for its production, and dangerous substances occurring in materials in contact with food		
Other social competences	The student is creative, has a concern for self-education, taking care of effects of their work. The student follows the rules of professional ethics, he can work in a team, he is able to assume the role of leader		

Course title	INSTRUMETAL ANALYSIS IN TOXICOLOGICAL STUDIES		
Level of course	second cycle		
Teaching method	laboratory class		
Person responsible for the course	Artur Ciemniak	**E-mail address to the person**	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-2	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	The student should know the theoretical and practical knowledge of analytical methods (analytical equipment, prepare sample, instrumental analysis and elaboration and discussion of results)		
Entry requirements	Knowlege of chemistry, biochemistry, analytical chemistry.		
Course contents	Introduction (health and safety, organization of exercises, requirements); Basic equipment and chemicals used in the laboratory. Preparation of solutions of a given concentration. Development and interpretation of measurement results. Quality issues in the analysis. Electrochemical methods in the laboratory Basics knowlege about spectrophotometry. UV-VIS spectra. Collecting spectra, comparing the spectra for solutions of selected substances, the choice of analytical wavelengths. Application in practice. Emission and absorption spectrometry. Heavy metals analysis in food and environment. Preparation of samples, and equipment. Preparation of the calibration curve. Quantitative analysis. Basic chromatographic methods. Sample preparation and analysis. Application in practice. The identification of unknown compounds. Presentation of projects (papers) on the analysis of toxic substances. (Discussion of the planned research methodology, selection of equipment, suppliers, chemicals, laboratory glassware, initial cost calculation). Construction and basic maintenance operations of analytical instruments. Examination		
Assessment methods	Practical exercises Continuous assessment Assessment of the students projects.		
Recommended readings	1. Holler, F. James; Skoog Douglas A; West Donald M., Fundamentals of analytical chemistry., Saunders College Pub, Philadelphia, 1996, ISBN 0-03-005938-0 2. Nieman Timothy A.; Skoog, Douglas A.;p Holler F. James, principles of instrumental analysis., Pacific Grove, CA: Brooks/Cole, 1996, ISBN 0-03-002078-6 3. Journals (for example: Analytical Ciemistry, Talanta, etc.		
Knowledge	Student will gain knowledge of selected methods of instrumental analysis (particularly elektrochemical , spectrophotometric, emission and absorption methods and chromathographic methods)		
Skills	Student is able to use the catalogs of equipment, instruments and reagents. He is able to design and conduct an analysis using instrumental techniques involving supervised. Student can, independently elaborate the results and formulate conclusions.		
Other social competences	He cares about the effects of their work. It is aware of the professional and ethical responsibility for the results of their analysis.		

Course title	INTRODUCTION TO CHEMICAL ANALYSIS		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agnieszka Tórz	**E-mail address to the person**	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-2-4	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Laboratory comprise of theoretical introduction to the topic (purpose of the experiment, the theory, methods, procedures, equipment used in the experiment) and experimental part (preparing the experiment setup, organizing the experiment flow and discussing results).		
Entry requirements	Students must have successfully completed organic and inorganic chemistry subjects (high school level).		
Course contents	The titrimetric analysis – acid-base titration, redox titration, complexometry. Instrumental analysis - spectrophotometry, UV-Vis, voltammetry. Chemical pulping and mineralisation of environmental samples (water, meat, plant products). Preparation of solutions of a given concentration. Measurement of density. Bing able to write stoichiometric equation of chemical reactions necessary to perform chemical determination. SI base units. Basic chemical laws e.g. the law of conservation of mass, mol. Chemical compounds nomenclature. The rules for notation of chemical reactions. The percentage concentration, the molar concentration and the normal concentration. The rules of work in chemical laboratory - industrial safety. Getting acquainted with the basic laboratory equipment - the rules of proper usage.		
Assessment methods	Lecture Laboratory classess Continuous assessment Exam		
Recommended readings	1. Daniel C. Harris, Quantitative Chemical Analysis, W.H. Freeman & Company, 1998 2. APHA, Standard Methods for the Examination of Water & Wastewater, American Public Health Association, 2005		
Knowledge	After the course student will gain knowledge of selected methods of analytical chemistry, particularly alkacymetry, redoxymetry, argenometry, complexometry and UV-VIS spectroscopy.		
Skills	Student will be able to design and conduct an experiment using titration and instrumental techniques.		
Other social competences	Students will be aware that chemistry laboratories contain materials which, if handled improperly, may be hazardous.		

Course title	INTRODUCTION TO HUMAN PHYSIOLOGY AND NUTRITION		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Joanna Sadowska	**E-mail address to the person**	Joanna.Sadowska@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-49	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	During the course student will acquire: - basic laws and principles of the functioning of the human organism. - ability to carry out basic physiological tests proving human health. - knowledge on the physiological role and metabolism of nutrients. - ability to formulate dietary recommendations as well as assess and correct the diet		
Entry requirements	Knowledge of organic chemistry, biochemistry and the basics of human anatomy		
Course contents	Study of human reflexes Determination of blood groups and interpretation of blood morphology and biochemistry The influence of various factors on the work of the heart and blood pressure Calculation of basal metabolic rate Principles of proper nutrition Principles of proper nutrition Rules for composing menus Basic physiological laws Functioning of the nervous system The cardiovascular system Respiratory system physiology Physiology of the excretory system The physiological role and metabolism of proteins, their sources and determinants of demand The physiological role and metabolism of fats, their sources and requirements The physiological role and metabolism of carbohydrates, their sources and requirements The role of vitamins and minerals in maintaining human health Blood composition as a reflection of nutritional status		
Assessment methods	Lecture Laboratory classes Continuous assessment Exam		
Recommended readings	1. Dee Silverthorn, Human Physiology: An Integrated Approach, Pearson, 2018 2. Geissler Catherine, Human Nutrition, Oxford University Press, 2017 3. MARTHA H. STIPANUK, MARIE A. CAUDILL, Biochemical, Physiological, and Molecular Aspects of Human Nutrition, Biochemical, Physiological, and Molecular Aspects of Human Nutrition, 2018		
Knowledge	The student knows and understands at an advanced level the principles of the functioning of systems and organs in the human body. Knows and understands the reasons for deviations from the regularities in the functioning of the organism.		
Skills	Student is able to perform basic physiological tests and interpret the results of basic blood counts and biochemistry.		
Other social competences	Students cares about the results of their work and are aware of the professional and ethical responsibility for the obtained results.		

Course title	MEAT TECHNOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Małgorzata Sobczak	**E-mail address to the person**	Malgorzata.Sobczak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-5	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Sharing the knowlege and skills related to breed of farm animals pre-/postsloughter handling. Sharing the knowledge and skills related to carcass evaluation and postmortem changes in muscles. Sharing the knowledge and skills related to principles of meat processing.		
Entry requirements	Student should know: basic of food technology, process engineering, chemistry, biochemistry and food analysis. Student can develop the results of an experiments and can look up and browse available literature resources.		
Course contents	Introductory classes Carcass dressing Selection and grading of raw material Defective meats Production of cooked meat sausages Effects of different technological factors on meat sausage quality Cooked ham production Production of precooked meat products Effects of heating methods on meat quality Summary Introduction of slaughter technics and post-slaughter handling Conversion of muscle into the meat Non-meat ingredients in meat processing Meat storage and preservation Categories of processed meat products Fermented sausages and dry cured ham Principles of production of cooked sausages, cooked hams, precooked meat products, ground meat products and canned products. Summary and exam		
Assessment methods	Lecture with comprehensive use of mulimedia. Laboratory practical classes in groups (experiment, observation), report from classes supported with conclusions. Credit for practical classes based on the grade from the tests reviewing the knowledge from each exercises, as well as participation in classes. Preparation of a report from practical classes supported with appropiate conclusions. Writing credit test with open questions concerning the content taught in classes. Assesment of group work.		
Recommended readings	1. Pisula A., Pospiech E. i in., Meat - the basics of science and technology (in polish), SGGW, Warszawa, 2011, 1 2. Prost E.K., Slaughter animals and meat - evaluation and hygiene (in polish), Lubelskie Towarzystwo Naukowe, Lublin, 2006 3. Varnam A.H., Sutherland J. P, Meat and meat products – technology, chemistry and microbiology, Chapman & Hall, 1995, London 4. Sikorski Z.E, Chemical and functional properties of food ingredients (in polish), WN-T, 1994 5. Price J.F., Schweigert B.S, The science of meat and meat products, Food & Nutrition Press, Westport, 2011, 3 6. Kołczak T, Biological basis of meat technology (in polish), skrypt AR Kraków, 1983 7. Pearson A.M., Gillett T.A., Processed meats, Chapman & Hall, New York, 1993		
Knowledge	Student has knowledge in meat characteristics and processing		
Skills	Student is able to characterize meat properties and indicate the directions of meat use		
Other social competences	Student is aware of the acquired knowledge, abilities and necessity of self-development. Student has competences to become a leader, since acquired professional entrepreneur skills and understand complex socioeconomical aspects.		

Course title	PLANT TECHNOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Katarzyna Felisiak	**E-mail address to the person**	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-8	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students know basics of chemical composition of vegetables and fruits, they know differences between technologies and they can choose the best one for desired product obtaining. Students become familiar with the raw material quality requirements for production of selected products. Students are able to determine the most important parameters of raw material and ready product.		
Entry requirements	Student should know the basics of food technology, chemistry and food analysis.		
Course contents	Introduction to laboratory exercises Effect of processing on color changes in selected vegetables. Production of French fries and potato chips. Production of jam and assessment of sensory properties Technology of compotes. Technology and sensory assessment of fruit and vegetable juices. Sensory assessment and determination of acidity and vitamin C content in soured cabbage. Technology of pickles. Technology of wheat bread. Sensory assessment of cocoa products and chocolates production. Chemical composition and nutritional value of fruits and vegetables and methods used for their determination. Classification of fruit and vegetable semi-products, the technology of their production. Methods of fruit and vegetables preservation. Potatoes classification and technology of fried potato products. Starch production and application in food technology. Production of jams with regard to the quality requirements for raw material and finished product. Technology of juices and their effects on human health. Technology of canned fruites and vegetables. Technology of pickles and soured vegetables. Technology of bakery products. Cocoa and chocolate technology.		
Assessment methods	lecture with use of multimedia, discussion project laboratory excercises test, reports continuous assessment of activity on classess project written exam		
Recommended readings	1. Li T.S.C., Vegetables and Fruits. Nutritional and Therapeutic Values, CRC Press, Boca Raton London New York, 2008 2. Chemical and Functional Properties of Food Components, CRC Press, Boca Raton London New York, 2007, 3, Ed. Z.E. Sikorski 3. Food Science and Food Biotechnology, CRC Press, Boca Raton London New York Washington D.C., 2011, ed. G.F. Gutiérrez-López, G.V. Barbosa-Cánovas		
Knowledge	Student has a basic knowledge of classification and chemical composition of plant materials,and their changes during processing. Student knows various vegetable and fruit products technologies and the raw material and product quality requirements.		
Skills	Student is able to determine the most important parameters of raw material and ready product. Student knows differences between technologies and can choose the best one for obtaining of desired fruit and vegetable product.		
Other social competences	Student understands the need of product high quality. Student can use the scientific literature to widen his knowledge.		

Course title	PROCESSING OF BY-PRODUCTS		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Małgorzata Sobczak	**E-mail address to the person**	Malgorzata.Sobczak@zut.edu.pl
Course code (if applicable)	WNoZiR-2-11	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Knowledge and skills related to processing of seafood by-products		
Entry requirements	The basic knowledge of seafood raw materials characterization The student is able to make an experiment, perform simple analyzes and describe the results of the experiment. The student can use professional literature and IT tools		
Course contents	Introduction, occupational health and safety in the laboratory. Characterization and production of meals from seafood by-products Characterization and production of protein products from seafood by-products Characterization and production of hydrolysates from seafood by-products Passing the practical part of the course Aim of subject. Course syllabus Classification of seafood by-products Characterization of seafood by-products Exam		
Assessment methods	Lecture Practise, work in groups, lab reports. Exam Test Assessment of lab reports and student activity		
Recommended readings	1. Se-Kwon Kim, Seafood processing by-products. Trends and applications, Springer, 2014		
Knowledge	Student has knowledge of classification and characterization of seafood by-products. Student knows basic methods, techniques, tools and materials used for solving simple engineering tasks within the scope of processing of seafood by-products.		
Skills	Student is able to plan and conduct seafood by-products process experiments, including measurements, interpretation the obtained results and draw conclusions. Student is able to use analytic, numerical and experimental methods to formulate and solve engineering tasks.		
Other social competences	Student understands the need of learning and raising professional and personal competences, motivating other colleagues. Is able to cooperate and work in a group. Is able to perform the function of a team leader; is able to estimate the time necessary to accomplish the assigned task.		

Course title	SEMINAR THESIS		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	- Nauczyciel WNoŻiR	**E-mail address to the person**	a@b
Course code (if applicable)	WNoZiR-2-37	**ECTS points**	30
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The aim of this course is to improve student's knowledge and skills in performing experiments and writing thesis.		
Entry requirements	Basic knowledge in food sciences and fisheries		
Course contents	Laboratory classes will include field work, experimenta and results analysis related to the topic (field of study) represented by the student. Depending on students profile and interest (filed of study) an appropriate supervisor will be selected to succesfully accomplish all tasks related to the stuednt's thesis.		
Assessment methods	Lectures Laboratory classess Continuous assessment Exam		
Recommended readings	1. Rowena Murray, How to write a thesis, Open University Press, Berkshire, 2002		
Knowledge	Uppon completion of SEMINAR THESIS the student will improve their knowled related to the represented field of study		
Skills	Uppon completion of this course the student will have ability to write sound and interesting thesis, perform analysis and identify apprpriate literature.		
Other social competences	Students are aware of continuous self-improvement		

Course title	STATISTICS FOR BIOLOGICAL SCIENCES		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agnieszka Strzelczak	**E-mail address to the person**	Agnieszka-Strzelczak@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-51	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Acquiring knowledge in basics of mathematics and statistics Practical use of mathematical and statistical concepts		
Entry requirements	Basic knowledge of mathematics Basic knowledge of probability calculus		
Course contents	Rational numbers, Geometrical representations, Irrational number, Real number represented as point on aline — Linear Continuum. Acquaintance with basic properties of real number Derivative - its geometrical and physical interpretation. Sign of derivative-Monotonic increasing and de-creasing functions. Relation between continuity and derivability. Differential - application in finding approximation. Evaluation of definite integrals. Working knowledge of double integral. Basic statistic Probability Testing of normality of data distribution Parametric and non-parametric testing of hypotheses Pearson's correltion, Spearman's rank correlation Linear regression analysis Differential calculus Geometrical application of differential calculus Integral Calculus Multiple Integrals Probability and theoretical distributions Testing of hypothesis Correlation and regression Statistical quality control		
Assessment methods	Interactive lecture Interactive auditory classes Inter-term exams (2) Exam		
Recommended readings	1. Robert Nisbet, John Elder IV, Gary Miner, Statistical analysis and data ining application, Elsevier, 2009		
Knowledge	Basics of advanced math and statistics		
Skills	Ability to perform statistical analyses on experimental data		
Other social competences	Student is able to analyze results of statistical data		

Course title	TECHNIQUES OF MOLECULAR BIOLOGY		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Remigiusz Panicz	**E-mail address to the person**	rpanicz@zut.edu.pl
Course code (if applicable)	WNoZiR-2-36	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	This course is an introduction to the fundamental principles of molecular biology techniques. Students will be introduced to the study of genetics, nucleic acids and interpret primary data from current research.		
Entry requirements	Students should have completed biology course. Mathematics can also be helpful to candidates in completing this course.		
Course contents	Sampling, sample preservation and safe storage Extraction of DNA Extraction of RNA Assessment of the quality and quantity of DNA and RNA Gel electrophoresis Polymerase Chain Reaction (PCR) Real-time polymerase chain reaction Application of restriction enzymes Sequencing and raw reads processing Bioinformatic data analysis Development of molecular markers Structure and function of biologically important molecules including DNA, RNA and proteins, From DNA to RNA: the structure and function of the gene, promoters and terminators. From DNA to RNA: transcriptional initiation, elongation and termination, RNA polymerases. Structure, function and biochemical properties of RNA From RNA to Protein: the genetic code, codons & anticodons, the ribosome & translation, cDNA and genomic cloning, Gene expression in Prokaryotes and Eucaryotes PCR – the gold standard in molecular biology, Methods for measuring gene expression, Application of next generation sequencing methods Bioinformatic tools		
Assessment methods	Lectures Laboratory classess Continuous assessment (laboratory) Exam		
Recommended readings	1. Green M.R., Sambrook J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, 2012, 4th edition		
Knowledge	Uppon completion of this course students will be familiar with: - molecular tools, - bioinformatic (computation) methods, - laboratory workflow, - sampling and sample preservation.		
Skills	Uppon completion of this course the students will be able to: - perform laboratory analyses with molecular tools, - run bioinformatic calculations, - collect and preserve samples, - analyses results from molecular studies.		
Other social competences	Student will be aware to continually improve knowledge and skills.		

Course title	TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Katarzyna Felisiak	**E-mail address to the person**	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-47	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students know basics of chemical composition of raw materials and bakery and confectionery products, they know differences between technologies and they can choose the best one for desired product obtaining. Students become familiar with the raw material quality requirements for production of selected products. Students are able to determine the most important parameters of raw material and ready product.		
Entry requirements	Student should know the basics of food technology, chemistry and food analysis.		
Course contents	Raw materials in bakery and confectionary products technology Bread production The effect of flour type on the properties of pastry Sponge cakes technology Fillings and icing Technology of cream puffs Properties of chocolate Comparison of commercial and homemade halva Sugar free sweets Vegetable cakes Introduction. Characteristics of raw materials used for bakery and confectionary goods production Technology of bread production Technology of cakes Technology of candies Bakery and confectionery products popular in the world Trends in bakery and confectionery products. Sugar replacements Technology of chocolate and chocolate products		
Assessment methods	lecture with use of multimedia, discussion project laboratory practices test, reports continuous assessment of activity on classess project written exam		
Recommended readings	1. Chemical and Functional Properties of Food Components, CRC Press, Boca Raton London New York, 2007, 3, Ed. Z.E. Sikorski 2. Beckett S.T., The Science of Chocolate, RSC Publishing, Cambridge, 2008 3. Science and Technology of Enrobed and Filled Chocolate, Confectionery and Bakery Products, Woodhead Publishing, 2009, Ed. G. Talbot 4. Bakery Products Science and Technology, Wiley & Sons, 2014, Eds. W. Zhou, Y.H. Hui, I. De Leyn, M.A. Pagani, C.M. Rosell, J.D. Selman, N. Therdthai 5. Food Science and Food Biotechnology, CRC Press, Boca Raton London New York Washington D.C., 2011, ed. G.F. Gutiérrez-López, G.V. Barbosa-Cánovas		
Knowledge	Student has a basic knowledge of classification and chemical composition of raw materials and their changes during processing. Student have knowlegde about various technologies of bakery and confectionery products and the effect of raw materials on the product quality.		
Skills	Student is able to determine the most important parameters of raw materials and ready products. Student knows differences between technologies and can choose the best one for obtaining of desired bakery and confectionery product.		
Other social competences	Student understands the need of product high quality. Student can use the scientific literature to widen his knowledge.		

Course title	TECHNOLOGY OF SNACK AND CONVENIENCE FOOD BASED ON FISH AND SEAFOOD		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Grzegorz Tokarczyk	**E-mail address to the person**	Grzegorz.Tokarczyk@zut.edu.pl
Course code (if applicable)	WNoŻiR-2-48	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Getting to know with physico-chemical and technological suitability of fish, crustaceans and molluscs. The transfer of processing skills of aquatic food products and the use of various methods for this purpose. Learning self-solve complex problems related to the processing of edible fish and aquatic invertebrates for food.		
Entry requirements	Basic knowledge of fish and seafood technology		
Course contents	Technology of fish chips Technology of fish crackers Technology of fish sticks -a new type of snack Technology of fish extrusion products Technology of canned fish and vegetable salad Technology of canned fish and other aquatic organisms. Technology of tempura products Technology of dumplings stuffed with fish The use of seafood for the production of convenience food Fish as a potential source for snack and convenience food technology Heat processing in snack and convenience food technology Technology of snack foods using meat from aquatic organisms Technology of fish chips Technology of fish crackers Technology of fish stick - a new kind of snack Technology of extrusion products with fish meat Technology of convenience food Technology of fish and vegetable salads. Technology of canned fish products Designing of convenience, functional and fortified foods based on aquatic organisms.		
Assessment methods	Expository methods (lecture, explanation or clarification) Activity method (discussion related to the lecture) Exposing method (movie related to the lecture) Practical method (demonstration, workshop and laboratory) formative - continuous assessment formative - observation of students activity during laboratories summarising - written or oral exam		
Recommended readings	1. E.W. Lucas, L.W. Rooney (Eds.), Snack Food Processing, CRC Press LLC, Boca Raton, 2001 2. 1.R. E. Martin, E. P. Carter, G. J. Flick, Jr., L. M. Davies (Eds.)., Marine & Freshwater Products Handbook, Technomic Publishing Company, Inc., 851 New Holland Avenue, Box 3535, Lancaster, PA 17604, USA, 2000 3. E. G. Bligh (Ed.), Seafood Science And Technology, Fishing New Books. Canadian Institute of Fisheries Technology. A division of Blackwell Scientific Publications Ltd, 1992 4. Venugopal V. (Ed.), Seafood Processing. Adding Value Through Quick Freezing, Retortable Packaging, and Cook-Chilling, CRC Press Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, 2006		
Knowledge	Student is able to choose and characterize aquatic organisms used in the snack and convenience food technology. Is able to properly choose the type of pre-treatment the raw material against deterioration. He can explain the processes occurring in the raw material after its acquisition, before and after the processing. He can propose the appropriate technological process depending on the type of raw material and its properties.		
Skills	The student is able to organize a work station for himself and a group of people taking part in classes. He is able to assign tasks to individual team members in a proper way, he is able to organize work in a team and supervise it to realise the work schedule. He is aware of the benefits of constantly acquiring skills. Student properly uses the acquired knowledge while performing the tasks entrusted. He is able to solve problems arising during the implementation of tasks and to use appropriate methods and materials for this purpose. Able to use the available methods and equipment for treatment and processing of fish raw material depending on its type.		

Other social competences	The student properly uses the acquired knowledge and skills in the implementation of the tasks entrusted to him. He can responsibly solve problems and tasks set before him. He independently makes decisions related to the implementation of tasks. He is creative and open to suggestions, follows ethical principles and is not afraid to express his opinion. He is aware of the need to constantly acquire knowledge.

Course title	TOXICOLOGICAL METHODS OF THE ENVIRONMENT QUALITY CONTROL		
Level of course	second cycle		
Teaching method	laboratory class		
Person responsible for the course	Monika Rajkowska-Myśliwiec	**E-mail address to the person**	Monika.Rajkowska@zut.edu.pl
Course code (if applicable)	WNOZIR-2-17	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	polish
Hours per week	2	**Hours per semester**	30
Objectives of the course	Issues related to the contamination of the hydrosphere and its effects on aquatic organisms.		
Entry requirements	Knowledge of Ecology, Hydrobiology, Biology and Fizjology of Fish		
Course contents	Principles of safety and health at work and the organization of exercises. The reaction hydrobiont to toxic substances contained in the water. The research methodology of poisoning incidents on the aquatic environment Breeding test organisms, the terms and conditions Determination of LC50 / EC50 / IC50 biocides. Tests based on the use of aquatic plants (for example duckweed) and shellfish to evaluate the toxicity of water and wastewater. Methods of bioindication of water status Analysis of the concentration of selected xenobiotics in biotic and abiotic elements of aquatic ecosystems. Methods of chemical analysis and instrumental.		
Assessment methods	Practical exercises Continous assesment		
Recommended readings	1. Lander L., Chemicals in the aquatic environment: Advanced Hazard Assessement, Springer-Verlag, Berlin Heidelberg, 1989 2. Lam P., B. Richardson, R. Wu, Introduction to Ecotoxicology, Blackwell Science Ltd., London, 1999		
Knowledge	The student is able to define the basic concepts in the subject. He knows the dangers presents in the environment. He can select tests useful in the study of environmental contamination. He can determined the necessary laboratory equipment to perform these tests. Student can explain the test results and recognize the degree of risk ecosystems by toxic substances		
Skills	The student knows how to find, analyze and interpret information. He is able to organize and carry out laboratory tests. He can draw the results. On this basis, student can assess the risks and toxicity of materials and a threat to the environment and human		
Other social competences	The student understands the need for continuous self-education. The student is aware of the risk and responsibility for executed tasks is creative and can to popularize their knowledge		

Course title	WASTE MANAGEMENT IN AQUACULTURE		
Level of course	second cycle		
Teaching method	laboratory class / lecture		
Person responsible for the course	Agnieszka Tórz	**E-mail address to the person**	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-2-18	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Acquire knowlege of estimation of chemical conditions of the waters of Recirculated Aquaculture Systems (RAS). Acquire knowlege of aquaponic and using microalgae for waters purification.		
Entry requirements	Basic knowlege of biology, chemistry and ecology		
Course contents	Preparation of Recirculated Aquaculture System with chosen fish species Estimation of waters conditions in Recirculated Aquaculture System (estimation of oxygen conditions, concentrations of biogenic compounds, concentration of organic matter) Estimation of efficiency of nitrification process Preparation of Recirculated Aquaculture System with plants (purification of waters in Aquaponic System) Estimation of waters conditions in Aquaponic System (estimation of oxygen conditions, concentrations of biogenic compounds, concentration of organic matter) Preparation of particular paper of waters conditions in RAS and Aquaponic System Basic knowlege of law regulations in waste water management in aquaculture Kinds of waste in aquaculture Biological methods of waste water purification (process of carbon, nitrogen and phosphorus elimination) Aquaponic Systems as a kind of waters savings Kinds of Aquaponic Systems Using microalgae in purification of waste waters in Recircultated Aquaculture Systems		
Assessment methods	lectures with multimedial instruments working at the chemical laboratory preparation of the paper observation of students activity during laboratories observation of students working in cooperation estimation of paper		
Recommended readings	1. Lekang O.J., Aquaculture engineering, Wiley, 2013 2. Brummett R.E., Aquaculture technology in developing countries, Taylor and Francis, 2013 3. Perumal (Eds.), Advances in marine and brackishwater aquaculture, Springer, 2014 4. VanderZwaag D.L., Chao G., Aquaculture law and policy: towards principled access and operations, Taylor and Francis, 2012		
Knowledge	Knowledge of waste water management techniques		
Skills	Student will get abilities in laboratory analyses related to the waste water management		
Other social competences	Stdent will get knowledge how to design and perform experiments, including results analysis.		