

WNoŻiR



Faculty of Food Sciences and Fisheries

WEST POMERANIAN UNIVERSITY OF TECHNOLOGY
IN SZCZECIN, POLAND

THE OFFER FOR INTERNATIONAL STUDENTS
FOR THE YEAR 2021/2022
THIRD DEGREE

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
1	ALIEN WATER ANIMAL SPECIES – INTRODUCTION, CURRENT STATUS, PERSPECTIVES	Przemysław Czerniejewski	winter/summer	6	60
2	ANALYSIS OF LOCAL FISH MARKETS IN SELECTED COUNTRIES OF THE WORLD	Jolanta Kiełpińska	winter/summer	6	30
3	ANTARCTIC MARINE RESOURCES	Katarzyna Stepanowska	winter/summer	6	60
4	AQUACULTURE	Jacek Sadowski	winter/summer	6	60
5	AQUARIUM SCIENCE	Krzysztof Formicki	winter/summer	6	60
6	AQUATIC ECOTOXICOLOGY	Agata Witczak	winter/summer	6	60
7	AQUATOURISM	Katarzyna Stepanowska	winter/summer	6	60
8	BIOPROCESS AND MEMBRAN TECHNOLOGY	Agnieszka Tórz	winter/summer	6	60
9	BIOTECHNOLOGY IN MEAT PRODUCTION	Joanna Żochowska-Kujawska	winter/summer	6	60
10	CHEMICAL MONITORING OF FOOD AND ENVIRONMENT	Artur Ciemniak	winter/summer	6	30
11	CONSERVATION GENETICS	Remigiusz Panicz	winter/summer	6	60
12	CONSERVATION OF AQUATIC ANIMALS IN POLAND AND IN THE WORLD	Beata Więcaszek	winter/summer	6	60
13	DAIRY TECHNOLOGY	Izabela Dmytrów	winter/summer	6	60
14	DETECTION OF MISLABELED FISHERIES PRODUCTS	Jolanta Kiełpińska	winter/summer	6	60
15	EMBRYOPHYSIOLOGY AND COMPARATIVE ANATOMY OF FISHES	Krzysztof Formicki	winter/summer	6	60
16	ENZYMES IN FOOD PROCESSING	Mariusz Szymczak	winter/summer	6	60
17	FISH BIOLOGY	Przemysław Czerniejewski	winter/summer	6	60
18	FISH DISEASE AND DIAGNOSTIC	Jolanta Kiełpińska	winter/summer	6	60
19	FISHERIES MANAGEMENT AND NEW FISH CATCHING TECHNIQUES	Przemysław Czerniejewski	winter/summer	6	60
20	FISHES IN AQUACULTURE AND RECREATIONAL FISHING IN THE WORLD	Beata Więcaszek	winter/summer	6	60
21	FISHES IN ESTUARIES	Agnieszka Tórz	winter/summer	6	60
22	FISH INDUSTRY BY-PRODUCTS	Mariusz Szymczak	winter/summer	6	60
23	FISH TECHNOLOGY	Grzegorz Tokarczyk	winter/summer	6	60
24	FOOD ADDITIVES AND AUXILIARY SUBSTANCES	Mariusz Szymczak	winter/summer	6	60
25	FOOD MICROBIOLOGY	Elżbieta Bogusławska-Wąs	winter/summer	6	60
26	GENERAL MICROBIOLOGY	Elżbieta Bogusławska-Wąs	winter/summer	6	60
27	GENETIC CONTROL OF MEAT QUALITY TRAITS	Remigiusz Panicz	winter/summer	6	60

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
28	HATCHING PRACTISES AND STOCKING MATERIAL PRODUCTION	Krzysztof Formicki	winter/summer	6	60
29	HYGIENE AND TOXICOLOGY OF FOOD	Artur Ciemniak	winter/summer	6	60
30	HYGIENE IN FOOD INDUSTRY	Agata Witczak	winter/summer	6	60
31	INSTRUMENTAL ANALYSIS IN TOXICOLOGICAL STUDIES	Artur Ciemniak	winter/summer	6	45
32	INTRODUCTION TO CHEMICAL ANALYSIS	Agnieszka Tórz	winter/summer	6	60
33	ISOLATES, CONCENTRATES AND BIOPREPARATES FROM FISH	Katarzyna Felisiak	winter/summer	6	60
34	MEAT TECHNOLOGY	Małgorzata Sobczak	winter/summer	6	60
35	PESTS IN FOOD INDUSTRY AND THEIR CONTROL	Agata Witczak	winter/summer	6	45
36	PLANT TECHNOLOGY	Katarzyna Felisiak	winter/summer	6	60
37	PROCESSING OF BY-PRODUCTS	Małgorzata Sobczak	winter/summer	6	60
38	SELECTED TOXICOLOGY PARTS	Artur Ciemniak	winter/summer	6	60
39	SEMINAR THESIS	- Nauczyciel WNoŻiR	winter/summer	30	60
40	TECHNIQUES OF MOLECULAR BIOLOGY	Remigiusz Panicz	winter/summer	6	60
41	TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS	Katarzyna Felisiak	winter/summer	6	60
42	TECHNOLOGY OF SNACK AND CONVENIENCE FOOD BASED ON FISH AND SEAFOOD	Grzegorz Tokarczyk	winter/summer	6	60
43	TOXICOLOGICAL METHODS OF THE ENVIRONMENT QUALITY CONTROL	Artur Ciemniak	winter/summer	6	30
44	WASTE MANAGEMENT IN AQUACULTURE	Agnieszka Tórz	winter/summer	6	60

Course title	ALIEN WATER ANIMAL SPECIES - INTRODUCTION, CURRENT STATUS, PERSPECTIVES		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Przemysław Czerniejewski	E-mail address to the person	Przemyslaw.Czerniejewski@zut.edu.pl
Course code (if applicable)	WNoZiR-3-26	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	Students will explore the effects of invasive species, and see the basic methods of analysing biology of these species.		
Entry requirements	Knowledge about invasive species and the negative impact they can have on environment.		
Course contents	Analysis of alien animals in Poland. Ecology and population structures of alien animals. Catching of alien animals. Lectures		
Assessment methods	Lecture/Laboratory Lecture - exam Laboratory - grade		
Recommended readings	<ol style="list-style-type: none"> 1. Ernestine Sandoval, Aquatic Invasive Species: Federal Activities and Cost of Addressing Threats and Impacts, Marine Biology, 2016 2. Marie Zhuikov, Jeffrey L. Gunderson, Douglas A. Jensen, Jesse Anderson, A Field Guide to Fish Invaders of the Great Lakes Region, 2007 3. Christopher Makowski, Charles W. Finkl, Impacts of Invasive Species on Coastal Environments, Springer, 2018 		
Knowledge	After the course student will gain knowledge about the invention process, including researching an invasive species and designing their own invention to help deal with the problem.		
Skills	Ability to define alien water animal species		
Other social competences	Student will follow ethics rules		

Course title	ANALYSIS OF LOCAL FISH MARKETS IN SELECTED COUNTRIES OF THE WORLD		
Level of course	third cycle		
Teaching method	lecture		
Person responsible for the course	Jolanta Kielpińska	E-mail address to the person	Jolanta.Kielpinska@zut.edu.pl
Course code (if applicable)	WNoZiR-3-38	ECTS points	6
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. Thailand, 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	ANTARCTIC MARINE RESOURCES		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Katarzyna Stepanowska	E-mail address to the person	Katarzyna.Stepanowska@zut.edu.pl
Course code (if applicable)	WNoZiR-3-19	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	To provide students with basic courses of Antarctic marine resources and polar research.		
Entry requirements	Hydrobiology; Oceanography; Fish Systematics; Fish Biology		
Course contents	<p>Arctic versus Antarctica; Polar research; Polish Antarctic Station Henryk Arctowski; Antarctic Living Marine Resources (fishes, birds, mammals); Antarctic Treaty AT; Scientific Committee of Antarctic Research SCAR; Antarctic Treaty Consultative Meeting/The Committee for Environmental Protection ATCM/CEP Council of Managers of National Antarctic Programmes COMNAP; Standing Committee of Antarctic Logistics and Operations SCALOP Convention for the Conservation of Antarctic Marine Living Resources CCAMLR; Convention for the Conservation of Antarctic Seals CCAS; International Association of Antarctic Tour Operators IAATO; Antarctica - exploration or protection?</p> <p>Arctic versus Antarctica; Polar research; Polish Antarctic Station Henryk Arctowski; Antarctic Living Marine Resources (fishes, birds mammals); Antarctic Treaty AT; Scientific Committee of Antarctic Research SCAR; Antarctic Treaty Consultative Meeting/The Committee for Environmental Protection ATCM/CEP Council of Managers of National Antarctic Programmes COMNAP; Standing Committee of Antarctic Logistics and Operations SCALOP Convention for the Conservation of Antarctic Marine Living Resources CCAMLR; Convention for the Conservation of Antarctic Seals CCAS; International Association of Antarctic Tour Operators IAATO; Antarctica - exploration or protection?</p>		
Assessment methods	Lecture and Laboratory Grade Grade		
Recommended readings	1. di Prisco G., Pisano E., Clarke A., Fishes of Antarctica. A biological overview, Springer-Verlag Italia, Milano, 1998 2. Rakusa-Suszczewski S., The Maritime Antarctic Coastal Ecosystem of Admiralty Bay, Polish Academy of Sciences, 1993 3. Sahrhage D., Antarctic Ocean and Resources Variability, Springer-Verlag, Berlin, 1988		
Knowledge	Arctic versus Antarctica; Polar research; Polish Antarctic Station Henryk Arctowski; Antarctic Living Marine Resources (fishes, birds mammals); Antarctic Treaty AT; Scientific Committee of Antarctic Research SCAR; Antarctic Treaty Consultative Meeting/The Committee for Environmental Protection ATCM/CEP Council of Managers of National Antarctic Programmes COMNAP; Standing Committee of Antarctic Logistics and Operations SCALOP Convention for the Conservation of Antarctic Marine Living Resources CCAMLR; Convention for the Conservation of Antarctic Seals CCAS; International Association of Antarctic Tour Operators IAATO; Antarctica - exploration or protection?		
Skills	Arctic versus Antarctica; Polar research; Polish Antarctic Station Henryk Arctowski; Antarctic Living Marine Resources (fishes, birds, mammals); Antarctic Treaty AT; Scientific Committee of Antarctic Research SCAR; Antarctic Treaty Consultative Meeting/The Committee for Environmental Protection ATCM/CEP Council of Managers of National Antarctic Programmes COMNAP; Standing Committee of Antarctic Logistics and Operations SCALOP Convention for the Conservation of Antarctic Marine Living Resources CCAMLR; Convention for the Conservation of Antarctic Seals CCAS; International Association of Antarctic Tour Operators IAATO; Antarctica - exploration or protection?		

Other social competences

The student has the ability to demonstrate a conscious and ethical attitude in polar conditions.

Course title	AQUACULTURE		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Jacek Sadowski	E-mail address to the person	Jacek.Sadowski@zut.edu.pl
Course code (if applicable)	WNoZiR-3-21	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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Krzysztof Formicki	E-mail address to the person	Krzysztof.Formicki@zut.edu.pl
Course code (if applicable)	WNoZiR-3-31	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	<ul style="list-style-type: none"> - 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	<ol style="list-style-type: none"> 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's Educational 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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agata Witczak	E-mail address to the person	Agata.Witczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-3	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	<p>Health and safety in the lab and work organization</p> <p>Defensive reactions invertebrate animals to the xenobiotics</p> <p>Determination of LC50 selected toxic substances</p> <p>Research methodology in the case of mass poisoning of the environment</p> <p>Toxicity tests</p> <p>Analysis of selected poisons and pollutants in environmental samples and biological materials</p> <p>The delivery papers prepared on the basis of audit work. Final exam</p> <p>Development of toxicology, establishing of the aquatic ecotoxicology, its aims and tasks</p> <p>Classification and specification of poisons. Mechanisms of intoxication and its course, reactions of organisms and symptoms of poisoning.</p> <p>Abiotic and biotic factors deciding on the toxicity of xenobiotics and course of intoxication.</p> <p>Toxins absorption and metabolism in a body</p> <p>Methodology of examination of the environment contamination cases with particular emphasis on water environment.</p> <p>Establishing the maximum permissible concentrations and contents. Influence of oxidants, acids, bases and gaseous contaminants on the water and land organisms.</p> <p>Phenols, cyanides and their derivatives – sources and effects onto the water biocenoses</p> <p>Migration of heavy metals and other microelements in biosphere and the effects of their occurrence in the aquatic ecosystems</p> <p>Radioactive contamination of the environment and biocenoses</p> <p>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</p> <p>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)</p> <p>Plant and animal contamination as the indirect danger to human health</p>		
Assessment methods	<p>informative lecture</p> <p>laboratory</p> <p>Discussions</p> <p>checking preparation for classes</p> <p>final exam</p>		
Recommended readings	<p>1. Lam P., B. Richardson, R. Wu, Introduction to Ecotoxicology, Blackwell Science Ltd., London, 1999</p> <p>2. Walker C.H., R.M. Sibly, S.P. Hopkin, D.B. Peakall, Principles of Ecotoxicology, CRC Press, 2012, 4th ed., ISBN 9781439862667</p> <p>3. Aquatic Toxicology, 2011, JOURNAL</p>		
Knowledge	The student is able to define the basic concepts in the field of the 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 water 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	AQUATOURLSM		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Katarzyna Stepanowska	E-mail address to the person	Katarzyna.Stepanowska@zut.edu.pl
Course code (if applicable)	WNoZiR-3-21	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	To provide students with basic courses of diving, to summarize information from a range of sources and to engage the students' interest in the presented topics.		
Entry requirements	Hydrobiology; Oceanography; Fish Systematics; Fish Biology		
Course contents	<p>DIVER. Elements of human physiology. Buoyancy control. Diving accidents. First aid. Safety rules. DIVING EQUIPMENT. Masks, fins, snorkels. Regulators, jackets, suits (dry, winter, summer). Instruments (regulator, computer, watch, compass).</p> <p>WATER ENVIRONMENT. DIVING TECHNICS. Snorkelling, diving, using of decompression tables. Organization of diving in open water areas. Selected dive sites in the Word.</p> <p>DIVING IN FISHERIES. Divers in the aquaculture. The underwater monitoring.</p> <p>DIVER. Elements of human physiology. Buoyancy control. Diving accidents. First aid. Safety rules. DIVING EQUIPMENT. Masks, fins, snorkels. Regulators, jackets, suits (dry, winter, summer). Instruments (regulator, computer, watch, compass).</p> <p>WATER ENVIRONMENT. DIVING TECHNICS. Snorkelling, diving, using of decompression tables. Organization of diving in open water areas. Selected dive sites in the Word.</p> <p>DIVING IN FISHERIES. Divers in the aquaculture. The underwater monitoring.</p>		
Assessment methods	<p>Lecture and Laboratory</p> <p>Grade</p> <p>Grade</p>		
Recommended readings	<p>1. http://www.cmas.org/, 2015</p> <p>2. http://www.padi.com/Scuba-Diving/, 2015</p>		
Knowledge	<p>DIVER. Elements of human physiology. Buoyancy control. Diving accidents. First aid. Safety rules. DIVING EQUIPMENT. Masks, fins, snorkels. Regulators, jackets, suits (dry, winter, summer). Instruments (regulator, computer, watch, compass).</p> <p>WATER ENVIRONMENT. DIVING TECHNICS. Snorkelling, diving, using of decompression tables. Organization of diving in open water areas. Selected dive sites in the Word.</p> <p>DIVING IN FISHERIES. Divers in the aquaculture. The underwater monitoring.</p>		
Skills	Student can organize aquatic activity (e.g. plan of diving).		
Other social competences	Student has the ability to sustainable underwater activity.		

Course title	BIOPROCESS AND MEMBRAN TECHNOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agnieszka Tórz	E-mail address to the person	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-7	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	<p>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.</p> <p>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.</p> <p>The influence of such factors as water temperature, solar radiation, accessibility of biogenic elements, on the accretion of microalgae biomass.</p> <p>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.</p>		
Assessment methods	Lecture and Laboratory (practical exercises) Continuous assessment		
Recommended readings	<ol style="list-style-type: none"> 1. Mukesh Doble, Anil Kumar Kruthiventi, Vilas Ganjanan Gaikar, Biotransformations and Bioprocesses, CRC Press, 2004 2. Alper, Hal S. (Ed.), Systems Metabolic Engineering, Humana Press, 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: <ul style="list-style-type: none"> • influence of biogenic elements on the growth of microalgae biomass, • membrane separation processes, 		
Skills	Student will be able to: <ul style="list-style-type: none"> • 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	third cycle		
Teaching method	lecture / workshop		
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-3-43	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	<p>Production technology for dry-cured meats</p> <p>Characteristics, classification and production technology of fermented sausages</p> <p>Use of selected enzymatic methods to modify the texture of meat</p> <p>Effect of raw material and salt addition on quality of dry-cured meats</p> <p>Production technology of fermented sausages. Effect of technological and raw material factors on product quality</p> <p>Production of other types of dry fermented products and assessment of their quality</p> <p>Use of selected enzymatic methods to modify the texture of meat</p>		
Assessment methods	<p>Lecture and discussion</p> <p>Laboratory exercises (experiment, observation), exercise report supported by conclusions</p> <p>Completing the workshop on the basis of reports</p> <p>Completing lectures based on the grade of the written exam with open questions</p> <p>Assessment of individual work</p>		
Recommended readings	<ol style="list-style-type: none"> 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	Student 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	third cycle		
Teaching method	laboratory course		
Person responsible for the course	Artur Ciemniak	E-mail address to the person	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-40	ECTS points	6
Semester	winter/summer	Language of instruction	polish
Hours per week	2	Hours per semester	30
Objectives of the course	<p>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</p> <p>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</p>		
Entry requirements	Knowledge base of food chemistry and ecotoxicology		
Course contents	<p>Knowledge of research methods used in monitoring food safety</p> <p>Downloading and preservation of environmental samples (water, sediments, plants) for the analysis of toxic compounds</p> <p>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</p> <p>Assessment of pollution of selected components of the environment based on the own students research results</p> <p>Knowledge of research methods used in monitoring of food safety</p> <p>Collecting and preservation of food samples (fish, bread, fruit and vegetables) for the analysis of toxic compounds</p> <p>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</p> <p>Estimation of the potential health hazard to the consumer based on the own students research</p>		
Assessment methods	<p>informative lecture</p> <p>practical exercises</p> <p>checking preparation for classes</p> <p>continuous assessment of laboratory work</p>		
Recommended readings	<p>1. Stine K.E.,T.M. Brown, Principles of Toxicology, CRC Press, 2006, 2nd edition</p> <p>2. Baltic Sea Environment Proceedings, HELCOM, 1986, 1990</p>		
Knowledge	<p>WM_1-??_W01</p> <p>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</p>		
Skills	<p>WM_1-??_U01</p> <p>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.</p>		
Other social competences	<p>WM_1-??_K01</p> <p>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</p>		

Course title	CONSERVATION GENETICS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Remigiusz Panicz	E-mail address to the person	rpanicz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-35	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>The Conservation Genetics subject aims to provide an opportunity to understand values of:</p> <ul style="list-style-type: none"> • 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	<p>During laboratory classes following topics will be discussed:</p> <ul style="list-style-type: none"> • Hardy-Weinberg principle, • Genetic drift, • Effective population size, • Population subdivision, • Quantitative genetics, • Molecular phylogenetics, • Evolutionary biology, • Heterozygosity, • Computer programs for population genetics data analysis, • . . . <p>During lectures following topics will be presented:</p> <ul style="list-style-type: none"> • 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	<p>Lectures and laboratory</p> <p>Lectures</p> <p>Laboratory classess</p> <p>Continuous assessment (laboratory)</p> <p>Written exam (lecture)</p>		
Recommended readings	<p>1. Hartl D.L., Principles of population genetics, Sinauer Associates, Sunderland, 2007, Fourth edition</p> <p>2. Słomski R. [Ed.], Restoration of endangered and extinct animals, Poznań University of Sciences, Poznań, 2010</p> <p>3. Conservation genetics, http://www.springer.com/life+sciences/ecology/journal/10592</p>		
Knowledge	<p>Upon completion of this course the students will know:</p> <ul style="list-style-type: none"> - basics and laws of the conservation genetics, - molecular methods related to the course topics; - sampling procedures, - define alien, rare and invasive species. 		
Skills	<p>Upon completion of this course the students will be able to:</p> <ul style="list-style-type: none"> - 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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Beata Więcaszek	E-mail address to the person	Beata.Wiecaszek@zut.edu.pl
Course code (if applicable)	WNoZiR-3-24	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>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.</p> <p>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</p>		
Entry requirements	Basic of anatomy and embryology of fishes, Biology of fishes, Fish taxonomy, Principles in the fishery law		
Course contents	<p>Fish species under protection in Poland - threats, characteristics of their habitat, status in IUCN and Polish Red Book</p> <p>Regional Inspectorate of Marine Fisheries in Szczecin - visiting the administration point and areas of its activity</p> <p>Cartilaginous fish species in the world - main threats, forms of conservation</p> <p>Methods of taxonomical status estimation of fish under protection - Gadus morhua morhua and G. morhua callarias in the areas of stocks mixing</p> <p>The most important anadromous teleost fish species under conservation - sturgeons and salmon; morphometric characters, habitat, threats and ways of protection</p> <p>Work in FishBase and NOBANIS website</p> <p>Instructions in legal instruments and regulations concerned the status of fish conservation in Polish marine waters and freshwaters.</p> <p>Habitat, biology and ecology and conservation status of fish in Poland, validated through IUCN procedures.</p> <p>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.</p> <p>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</p> <p>The international conventions concerned both the conservation and trade of the protected fish and its products. Some basic knowledge is presented on the marine mammals.</p>		
Assessment methods	<p>Lecture, workshop, working in the web-bases, work in laboratory, visiting the administration points</p> <p>Continuous assessment, multimedial presentation, grade</p>		
Recommended readings	<ol style="list-style-type: none"> 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 fish in Poland and in the world		
Skills	student protects fishes and environment		
Other social competences	Student is able to manage the fish and aquatic resources conservation process		

Course title	DAIRY TECHNOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Izabela Dmytrów	E-mail address to the person	Izabela.Dmytrow@zut.edu.pl
Course code (if applicable)	WNoZiR-3-10	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	<p>Raw milk - methods of evaluation of quality and technological usefulness</p> <p>Drinking milk, sour and sweet cream</p> <p>Fermented milk</p> <p>Butter</p> <p>Ice cream</p> <p>Spreads</p> <p>Evaluation of the quality and technological suitability of raw milk</p> <p>The physiology of lactation</p> <p>Drinking milk and cream</p> <p>Fermented milk</p> <p>Butter</p> <p>Casein and caseinates</p> <p>Spreads</p> <p>Ripening cheeses and tvarog</p> <p>Ice cream and frozen desserts</p>		
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	<p>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</p> <p>The student knows the methods of production of processed cheese and ice cream</p>		
Skills	Student will be able to run processes related to dairy technology		
Other social competences	Student will be able to use new knowledge in the work		

Course title	DETECTION OF MISLABELED FISHERIES PRODUCTS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Jolanta Kielpińska	E-mail address to the person	Jolanta.Kielpinska@zut.edu.pl
Course code (if applicable)	WNoZiR-3-22	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>After the course student will:</p> <ol style="list-style-type: none"> 1. understand problem of illegal product substitutions 2. know methods applied to identify fish products 3. be able to identify ways how selected fish products are substituted 4. be able (on its own) to assess risk of product substitutions in trade characteristic in selected geographic regions 		
Entry requirements	Student should have a basic knowledge about fish biology and physiology		
Course contents	<p>Practical classes will include introduction into molecular diagnostic methods applied to identification of fish product in the form of fresh, processed, semi-processed or preserved. All classes will be based on demonstration</p> <p>Student will be introduced into:</p> <ol style="list-style-type: none"> 1. problem of illegal product substitutions 2. methods applied to identify fish products 3. ways how selected fish products are substituted 4. risk assessment methods applied to product substitutions in selected geographic regions <p>During lectures student will be introduced into the problems of water-born product substitutions, mainly fish, with particular emphasis on the most important species. Topics will also encompass description of genetic system of fish labelling used for product tracing from catching site to the final consumer</p>		
Assessment methods	<p>The presentation, Discussion, Trip to a fisheries cooperative</p> <p>Class test</p> <p>Exam</p>		
Recommended readings	<ol style="list-style-type: none"> 1. Journal ; Food Chemistry 2. Journal: Marine Policy 		
Knowledge	The student will learn the possibilities of commercial substitutions and the effects of this precedent		
Skills	The student is able to use known fish trade exchanges and give their location		
Other social competences	The student is aware of this knowledge and skills and the possibilities of their use in research work.		

Course title	EMBRYOPHYSIOLOGY AND COMPARATIVE ANATOMY OF FISHES		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Krzysztof Formicki	E-mail address to the person	Krzysztof.Formicki@zut.edu.pl
Course code (if applicable)	WNoZiR-3-29	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	<p>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.</p> <p>Structure (cell membrane, mikropyle, egg membrane, periwitellar 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.</p>		
Assessment methods	<ul style="list-style-type: none"> - Lectures - Consultation - Seminars and group workshops - Work in laboratories <p>Estimation of work and presentation (50% estimation), estimation activity on classes (30%), estimation discipline - present on the classes and individual consultation (20% estimation concluding)</p>		
Recommended readings	<ol style="list-style-type: none"> 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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Mariusz Szymczak	E-mail address to the person	Mariusz.Szymczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-44	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>Getting to know with enzymes properties used in food technology.</p> <p>The transfer of utilized skills of enzymes to produce of food products and the use of various methods for this purpose.</p> <p>Learning self-solve complex problems related to the processing of food with using enzymes (food biotechnology).</p>		
Entry requirements	Basic knowledge of food chemistry and food technology		
Course contents	<p>Determination of enzymes activity</p> <p>Isolation and purification of hydrolases from by-products</p> <p>The use of enzymes in the dairy industry</p> <p>The use of enzymes in the plant industry</p> <p>The use of enzymes in the fish industry</p> <p>The use of proteolytic enzymes to improve protein raw materials</p> <p>The use of amylolytic enzymes to improve cereal products</p> <p>The use of hydrolytic enzymes to stabilize fermented beverages</p> <p>Enzymes in food technology</p> <p>Production of industrial enzymes</p> <p>Asparaginase - an enzyme for acrylamide reduction in food products</p> <p>Enzymes in dairy product manufacture</p> <p>Enzymes in bread making</p> <p>Enzymes in non-bread wheat-based foods</p> <p>Brewing with enzymes</p> <p>Enzymes in potable alcohol and wine production</p> <p>Enzymes in fish processing</p> <p>Enzymes in fruit and vegetable processing and juice extraction</p> <p>Enzymes in meat processing</p> <p>Enzymes in protein modification</p> <p>Starch-processing enzymes</p> <p>Lipases for the production of food components</p>		
Assessment methods	<p>Expository methods (lecture, explanation or clarification)</p> <p>Activity method (discussion related to the lecture)</p> <p>Exposing method (movie related to the lecture)</p> <p>Practical method (demonstration, workshop and laboratory)</p> <p>continuous assessment</p> <p>observation of students activity during laboratories</p> <p>written or oral exam</p>		
Recommended readings	<ol style="list-style-type: none"> 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	<p>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.mszywczyk.zut.edu.pl</p>		
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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Przemysław Czerniejewski	E-mail address to the person	Przemyslaw.Czerniejewski@zut.edu.pl
Course code (if applicable)	WNoZiR-03-39	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> - The Diversity of Fishes - Fishes and their Habitats - Food and Feeding of fish - Reproduction, and Life Histories - Behavior and Cognition <p>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</p>		
Assessment methods	Workshop/lecture Grade, essays, project work		
Recommended readings	<ol style="list-style-type: none"> 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 fish 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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Jolanta Kielpińska	E-mail address to the person	Jolanta.Kielpinska@zut.edu.pl
Course code (if applicable)	WNoZiR-3-32	ECTS points	6
Semester	winter/summer	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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Przemysław Czerniejewski	E-mail address to the person	Przemyslaw.Czerniejewski@zut.edu.pl
Course code (if applicable)	WNoZiR-3-27	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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Beata Więcaszek	E-mail address to the person	Beata.Wiecaszek@zut.edu.pl
Course code (if applicable)	WNoZiR-3-25	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	<p>Presentation of cartilaginous fish of great significance in the recreational angling</p> <p>Presentation of teleost fish of great significance in the recreational angling</p> <p>Visit in the Polish Angling Association - methods of working, area of research, fish reproduction</p> <p>Multimedial presentation on game-fish soecies from the students' country</p> <p>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.</p> <p>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.</p> <p>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.</p>		
Assessment methods	Lecture, workshop, working in the web-bases, work in laboratory, visiting the administration points Continuous assessment, presentation, grade		
Recommended readings	<p>1. 3. Reese J.T., World Record Fishes., IGFA,, USA, 2002, 2002</p> <p>2. Golani D., Ozturk B., Basusta N., F., ishes of the Eastern Mediterranean, Turkish Marine Research Foundation., Turkey., 2006, 2006</p>		
Knowledge	Student knows the principal regulations of fishing in Poland and in the world		
Skills	Student can name the most important fish species and forms of their protection in the world		
Other social competences	Student is able to evaluate the proper management in angling associations		

Course title	FISHES IN ESTUARIES		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agnieszka Tórz	E-mail address to the person	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-28	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	Acquire knowledge of estimation of environmental conditions of estuary		
Entry requirements	Basic knowledge of chemistry, ecology and working at laboratory		
Course contents	<p>Estimation of environmental conditions of the Odra river estuary</p> <p>Estimation of chosen hydrochemical factors (oxygen conditions, nitrogen, phosphorus, organic matter) in waters of the Odra river estuary</p> <p>Estimation of fish species in the Odra river estuary</p> <p>Preparation of particular paper of environmental conditions of the Odra river estuary</p> <p>Habitat use by fishes in estuaries and other brackish areas</p> <p>Recruitment and production of commercial species in estuaries</p> <p>Links between fish and other trophic levels</p> <p>Environmental quality of estuaries</p> <p>Field methods</p>		
Assessment methods	<p>lectures with multimedial instruments</p> <p>working at the chemical laboratory</p> <p>preparation of the paper</p> <p>observation of students activity during laboratories</p> <p>observation of students working in cooperation</p> <p>estimation of paper</p>		
Recommended readings	<p>1. Elliot M., Hemingway K.L., Fishes in estuaries, Blacwell Science, USA, 2002</p> <p>2. Scott D.B., Frail-Gauthier J., Mudie P.J., Coastal wetlands of the world, Cambridge University Press, Cambridge, 2014</p>		
Knowledge	Student will acquire knowledge about fish communities and its dynamics in estuaries		
Skills	Student will have ability to identify fish species existing in estuaries		
Other social competences	Student will obtain competences to perform experiments and identify species in estuaries		

Course title	FISH INDUSTRY BY-PRODUCTS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Mariusz Szymczak	E-mail address to the person	Mariusz.Szymczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-45	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>Getting to know with physico-chemical and technological suitability of fish, crustaceans and molluscs by-products.</p> <p>The transfer of processing skills of by-products from aquatic food and the use of various methods for this purpose.</p> <p>Learning self-solve complex problems related to the utilization of fish by-products and using to production of food and preparations, additives and nutraceuticals.</p>		
Entry requirements	Basic knowledge of food chemistry and food technology		
Course contents	<p>Analysis of by-products from marine and freshwater fish</p> <p>pH-shift recovery of proteins</p> <p>Technological properties of protein preparations</p> <p>Recovery of lipids and enzymes from soft by-products</p> <p>Utilisation of the brine waste from marinating and salting the fish</p> <p>Production of hydrolysates and fish silage</p> <p>Obtaining taste and flavour preparations, proteins and dyes from shrimp shells</p> <p>Novel foods based on fish by-products</p> <p>Characteristics by-products from the fish industry</p> <p>Utilization by-products after pre-treatment of fish</p> <p>Recovery and utilisation of enzymes from fish guts and muscles</p> <p>Preparation of proteins preparations</p> <p>Technological properties of proteins and their application</p> <p>By-products from the surimi industry and seafood processing</p> <p>By- products from the marinating and salting fish processing</p> <p>Obtaining lipids</p> <p>Obtaining fish collagen</p> <p>Production of fish hydrolysates</p> <p>Biologically active compounds obtained from fish by-products</p>		
Assessment methods	<p>Expository methods (lecture, explanation or clarification)</p> <p>Activity method (discussion related to the lecture)</p> <p>Exposing method (movie related to the lecture)</p> <p>Practical method (demonstration, workshop and laboratory)</p> <p>continuous assessment</p> <p>observation of students activity during laboratories</p> <p>written or oral exam</p>		
Recommended readings	<ol style="list-style-type: none"> 1. M. Sakaguchi, More efficient utilization of fish and fisheries products. Proceedings of the International Symposium on the occasion of the 70th anniversary of the Japanese Society of Fisheries, Science, held in Kyoto, Japan, 7-10 October 2001, 2004 2. George M. Hall, Fish Processing – Sustainability and New Opportunities., Blackwell Publishing Ltd., 2011 3. Colin Barrow, Fereidoon Shahidi, Marine Nutraceuticals and Functional Foods, CRC Press., 2008 4. Sikorski. Z.E & Kolakowska. A., Chemical and Functional Properties of Food Lipids., CRC Press, 2003 5. Rajni Hutti-Kaul and Bo Mattiasson, Isolation and purification of proteins., Marcel Dekker, Inc., 2003 6. V. Venugopal, Seafood Processing Adding Value Through Quick Freezing, Retortable Packaging, and Cook-Chilling., CRC Press., 2006 7. Zdzisław E. Sikorski, Chemical and Functional Properties of Food Components, Third Edition,, CRC Press., 2007 8. Jae W. Park, Surimi and Surimi Seafood, Second Edition,, CRC Press, 2005 		
Knowledge	<p>Student is able to recognize and characterize aquatic organisms by-products from food industry. Is able to properly choose the type of treatment, equipment and the method in order to recovery functional compounds. He can explain the processes occurring in the raw material and in by-products after treatment and during storage. 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</p>		

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 by-products 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 TECHNOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Grzegorz Tokarczyk	E-mail address to the person	Grzegorz.Tokarczyk@zut.edu.pl
Course code (if applicable)	WNoZiR-3-14	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	<p>The yield of total edible flesh from fish</p> <p>Heat treatment of fish, crustaceans and molluscs - physical and chemical changes</p> <p>Salted fish technology</p> <p>Marinated fish technology</p> <p>Technology of fishburgers</p> <p>Technology of canned fish and other aquatic organisms.</p> <p>Smoked fish technology.</p> <p>Technology of fish sausage</p> <p>Fish pastes technology</p> <p>Technology of snack foods using meat from aquatic organisms.</p> <p>Technology of minced meat</p> <p>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.</p> <p>Quality changes in aquatic food products</p> <p>Processing systems and unit processes</p> <p>Refrigerated processes</p> <p>Salted and marinated fish technology</p> <p>Heat processing</p> <p>Smoked fish technology.</p> <p>Technology of minced and comminuted fish flesh products.</p> <p>Aquatic organisms by-products</p> <p>The use of transglutaminase and proteolytic enzymes in the fish industry.</p> <p>The utilization of low value raw materials in fish processing.</p> <p>Technology of snack foods using meat from aquatic organisms.</p> <p>Designing of convenience, functional and fortified foods based on aquatic organisms.</p> <p>Optimization of technological processes used in fish processing.</p> <p>Traditional and regional foods made from aquatic organisms.</p>		
Assessment methods	<p>Expository methods (lecture, explanation or clarification)</p> <p>Activity method (discussion related to the lecture)</p> <p>Exposing method (movie related to the lecture)</p> <p>Practical method (demonstration, workshop and laboratory)</p> <p>formative - continuous assessment</p> <p>formative - observation of students activity during laboratories</p> <p>summarising - written or oral exam</p>		
Recommended readings	<p>1. I.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</p> <p>2. E. G. Bligh (Ed.), Seafood Science And Technology, Fishing News Books. Canadian Institute of Fisheries Technology. A division of Blackwell Scientific Publications Ltd, 1992</p> <p>3. Zdzislaw E . Sikorski, Chemical and Functional Properties of Food Components, CRC Press, 2006, Third Edition</p> <p>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</p>		

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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Mariusz Szymczak	E-mail address to the person	Mariusz.Szymczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-46	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>Getting to know with physico-chemical and technological suitability of food additives and auxiliary substances</p> <p>The transfer of skills of food additives utilization.</p> <p>Learning self-solve complex problems related to the using of food additives and auxiliary substances for food processing.</p>		
Entry requirements	Basic knowledge of organic and not organic chemistry, food chemistry		
Course contents	<p>Characteristics and correct use of preservatives and antioxidants</p> <p>Characteristics of natural and artificial dyes. Effect of technological and environmental factors on their stability.</p> <p>Taste and odour forming additives</p> <p>Texture shaping additives</p> <p>The polyphosphates</p> <p>Auxiliary raw materials</p> <p>Conformity assessment of use and information on food additives in products - practical tasks from industry</p> <p>General information on food additives</p> <p>Shelf life extension additives - preservatives</p> <p>Shelf life extension additives - antioxidants and synergists</p> <p>Technological functions and characteristics of added acids to food</p> <p>Natural dyes</p> <p>Organic and synthetic dyes</p> <p>Hydrocolloids</p> <p>Emulsifiers and polyphosphates</p> <p>Sweeteners</p> <p>Additives applied on the surface</p> <p>Enriching additives, auxiliaries, isolates, flavourings and enzymes</p> <p>Legislation and problems when using food additives</p>		
Assessment methods	<p>Expository methods (lecture, explanation or clarification)</p> <p>Activity method (discussion related to the lecture)</p> <p>Exposing method (movie related to the lecture)</p> <p>Practical method (demonstration, workshop and laboratory)</p> <p>continuous assessment</p> <p>observation of students activity during laboratories</p> <p>written or oral exam</p>		
Recommended readings	<ol style="list-style-type: none"> 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 differences 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.mszyczak.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	third cycle		
Teaching method	laboratory course / 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-3-9	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>the objective is to make students:</p> <ul style="list-style-type: none"> * 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	<p>basics in general microbiology</p> <p>biochemistry</p> <p>food technology</p>		
Course contents	<p>Quantitate methods applied in microbiological analysis of food and food processing environment (SPC, MPN, DMC).</p> <p>Food safety aspects: steps in testing food items for the presence of Salmonella and Listeria monocytogenes; methods of isolation and identification.</p> <p>Food safety aspects: steps in analysis of food samples towards bacteria of Bacillus cereus group and coagulase-positive staphylococci; isolation and identification procedures.</p> <p>Spoilage bacteria: changes in enzymatic activity and types of bacteria dominating on raw fish stored under ambient (room T) and cold (4C) temperatures.</p> <p>Indicator microbes in food quality assessment: Enterobacteriaceae, faecal coliforms; methods of enumeration and identification.</p> <p>Culturing and growth of microbes, selective media; microscopy and staining in microbiological diagnostics</p> <p>Microbial diversity. Food as carrier to microbes of different significance</p> <p>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)</p> <p>Bacterial growth; 1 generation time, practical aspect</p> <p>Food hazards; HACCP system and food safety</p> <p>Spore forming microbes and their significance in food</p> <p>Indicator microbes in food quality assessment</p> <p>Types of foodborne illness (infection, intoxication, toxicoinfection), cases-outbreaks, epidemiological statistics.</p> <p>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.)</p> <p>Emerging foodborne pathogens</p> <p>Microbes in food spoilage</p>		
Assessment methods	<p>lectures/ power point presentations</p> <p>practical work - microbiological analyses in the laboratory</p> <p>formative</p> <p>summarising</p>		
Recommended readings	<ol style="list-style-type: none"> 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 appropriate techniques for examination and identification 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	third cycle		
Teaching method	laboratory course / 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-3-16	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	GENETIC CONTROL OF MEAT QUALITY TRAITS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Remigiusz Panicz	E-mail address to the person	rpanicz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-6	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>Upon completion of a course student will possess following competences:</p> <ul style="list-style-type: none"> • Identify traits of economic importance in animal production (livestock, aquaculture) • Discuss/compare characteristics of diverse molecular markers • Apply appropriate molecular marker for selection of desired trait • Assess solutions to increase biodiversity • Work as a team member to achieve shared goals 		
Entry requirements	Students must have successfully completed basic genetics and meat science courses.		
Course contents	<p>Students will be taught various phenotypic and genetic selection methods and become familiar with selection of traits for livestock improvement. The course will also provide students with sources of molecular sources of meat defects and changes in musculoskeletal system. Particular attention will be paid to animal selection according to biodiversity reduction. Theoretical and practical classes will be based on cattle, pig, poultry, goat, sheep and fish examples.</p> <p>Students will be taught various phenotypic and genetic selection methods and become familiar with selection of traits for livestock improvement. The course will also provide students with sources of molecular sources of meat defects and changes in musculoskeletal system. Particular attention will be paid to animal selection according to biodiversity reduction. Theoretical and practical classes will be based on cattle, pig, poultry, goat, sheep and fish examples.</p>		
Assessment methods	<p>Lectures</p> <p>Laboratory classess</p> <p>Continuous assessment (laboratory)</p> <p>Written exam (lecture)</p>		
Recommended readings	<ol style="list-style-type: none"> 1. Hui Y.H., Hui Y.H., Meat science and applications, Marcel Dekker, Inc., New York, 2001 2. Feiner G, Meat products handbook: Practical science and technology, Woodhead Publishing Limited, 2006 3. Zhanjiang L, Aquaculture genome technologies, Wiley-Blackwell, 2007 		
Knowledge	<p>Upon completion of this course the students will know:</p> <ul style="list-style-type: none"> - basics of the animal genetics, - molecular markers used for animal selection, - molecular tools and softwares needed to perform trials, - distinguish breeds. 		
Skills	<p>Upon completion of this course the students will be able to:</p> <ul style="list-style-type: none"> - use molecular tools, - perform experiments, - calculate basci genetic indices, - generate reports. 		
Other social competences	Student will be able to use its competences in further self-study activities.		

Course title	HATCHING PRACTISES AND STOCKING MATERIAL PRODUCTION		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Krzysztof Formicki	E-mail address to the person	Krzysztof.Formicki@zut.edu.pl
Course code (if applicable)	WNoZiR-3-30	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	The 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	<p>Methods for obtaining and selection of spawners (transport, maintenance, maturation control, anaesthetics) 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, anaesthetics) 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)</p>		
Assessment methods	<p>Lectures Consultation Seminars and group workshops Work in laboratories Design and field work Other exercises / practical classes Other methods / forms</p> <p>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</p>		
Recommended readings	<ol style="list-style-type: none"> 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	HYGIENE AND TOXICOLOGY OF FOOD		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Artur Ciemniak	E-mail address to the person	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-1	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	<p>Health and safety in the lab and organization of work</p> <p>An introduction to the general principles of food research, methods of chemical analysis and instrumental.</p> <p>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</p> <p>Analysis of preservatives and other biologically active foreign substances in food</p> <p>Determination of toxic heavy metals and other trace elements in raw materials and food products</p> <p>Determination of Persistent organic pollutants (POP) in raw materials and food products</p> <p>The delivery papers prepared on the basis of audit work. Final exam</p> <p>Aims and tasks of hygiene and toxicology of food. Legislation and supervision over food in Poland and in the world.</p> <p>Anthropozoonoses.</p> <p>Warehouse pests</p> <p>Toxicology, its development and the establishing of food toxicology.</p> <p>Mechanisms of absorption, transport, metabolism and excretion of contaminants/poisons in a human body.</p> <p>Process of poisoning occurrence.</p> <p>Factors deciding on the toxicity of xenobiotics and course of intoxication.</p> <p>Principles of establishing the maximum permissible xenobiotics contents in food.</p> <p>Toxicological aspects of the application of additives in the food industry.</p> <p>Heavy metals and other microelements in the environment and food. Radioactive contamination of food.</p> <p>Pesticides, PCB, PCT and PAH in food.</p> <p>Dioxins in the environment and food.</p> <p>Natural harmful and toxic substances (mycotoxins, anti-nutritive substances, vegetable and animal poisons).</p> <p>The influence of farming (remnants of nitrates), rearing (antibiotics, hormones) and processing processes on the degree of food contamination.</p> <p>Evaluation methods of deleterious substance sampling against daily nutrition dose.</p>		
Assessment methods	<p>informative lecture</p> <p>laboratory</p> <p>Discussions</p> <p>checking preparation for classes</p> <p>final exam</p>		
Recommended readings	<p>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.</p> <p>2. Schmidt R.H., G.E. Rodrick, Food Safety Handbook, John Wiley & Sons, Inc., 2003, Print ISBN: 97804712106413.</p> <p>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</p>		
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		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agata Witczak	E-mail address to the person	Agata.Witczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-42	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	<p>The substances intentionally added to food</p> <p>The control methods of environmental pollutants residues in food</p> <p>Hazardous substances in food of natural origin</p> <p>Detergents and disinfectants used in food processing plants. Research of the washing capability</p> <p>Mineral impurities. Presentation of the work prepared by students</p> <p>Detergents</p> <p>Definition and evolution of food hygiene</p> <p>Sources of food contamination. Hygiene control measures in food processing. Future trends.</p> <p>The sanitary-hygienic requirements associated with designing and construction of food processing plants (improving the hygienic design)</p> <p>The range of microbial and chemical risk in food processing.</p> <p>Hazardous substances in food of natural origin</p> <p>Cleaning agents and desinfectants used in food processing plants (CIP and COP).</p> <p>The use of standard operating procedures (SOPs)</p> <p>GMP and GHP in the food industry. Work safety.</p>		
Assessment methods	<p>informative lecture</p> <p>Laboratory</p> <p>Discussion</p> <p>checking preparation for classes</p> <p>final exam</p>		
Recommended readings	<p>1. Fundamentals of Food Hygiene for the Food Industry, Royal Society for the Promotion of Health, London, 2007, 2007</p> <p>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</p> <p>3. John Charlton, Isabel Sampson, Moray Anderson, Mike Rimmer, Pest control procedures in the food industry, England, 2009, 2009</p>		
Knowledge	<p>The student has knowledge of safety rules, regulations related to food safety and sanitary requirements in factories.</p> <p>Student has an advanced knowledge of technological design of production plants including aspects of hygiene.</p> <p>He has knowledge of the hygiene - sanitary conditions of production, transport, storage and distribution of food.</p> <p>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.</p> <p>He has knowledgeable about the laws concerning the organization of the national sanitary-hygienic supervision and rules dealing with waste</p>		
Skills	<p>The student can use a knowledge of safety rules, regulations related to food safety and sanitary requirements in factories.</p> <p>Student is able to use his knowledge of technological design of production plants including aspects of hygiene.</p> <p>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</p>		
Other social competences	<p>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</p>		

Course title	INSTRUMENTAL ANALYSIS IN TOXICOLOGICAL STUDIES		
Level of course	third cycle		
Teaching method	laboratory course		
Person responsible for the course	Artur Ciemniak	E-mail address to the person	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-2	ECTS points	6
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	Knowledge of chemistry, biochemistry, analytical chemistry Knowledge 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 knowledge 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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agnieszka Tórz	E-mail address to the person	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-4	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	<p>The titrimetric analysis - acid-base titration, redox titration, complexometry.</p> <p>Instrumental analysis - spectrophotometry, UV-Vis, voltammetry.</p> <p>Chemical pulping and mineralisation of environmental samples (water, meat, plant products).</p> <p>Preparation of solutions of a given concentration. Measurement of density.</p> <p>Bing able to write stoichiometric equation of chemical reactions necessary to perform chemical determination.</p> <p>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.</p> <p>The percentage concentration, the molar concentration and the normal concentration.</p> <p>The rules of work in chemical laboratory - industrial safety. Getting acquainted with the basic laboratory equipment - the rules of proper usage.</p>		
Assessment methods	<p>Lecture</p> <p>Laboratory classess</p> <p>Continuous assessment</p> <p>Exam</p>		
Recommended readings	<p>1. Daniel C. Harris, Quantitative Chemical Analysis, W.H. Freeman & Company, 1998</p> <p>2. APHA, Standard Methods for the Examination of Water & Wastewater, American Public Health Association, 2005</p>		
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	ISOLATES, CONCENTRATES AND BIOPREPARATES FROM FISH		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Katarzyna Felisiak	E-mail address to the person	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-11	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	Students know what products can be obtained from fish and fish by-products and how various protein products are made. They know differences between nutritional and functional values of the hydrolysates and isolates from various sources. Students become familiar with the raw material quality requirements for production of selected products, enzymes and conditions, and products application.		
Entry requirements	Student should know the basics of food technology, chemistry and biochemistry.		
Course contents	<p>Introduction to laboratory practice and research.</p> <p>Proteolytic enzymes preparations.</p> <p>Determination of proteolytic activity of fish flesh and fish viscera.</p> <p>Determination of protein hydrolysis products.</p> <p>Obtaining of fish protein isolates.</p> <p>Fish protein hydrolysates.</p> <p>Determination of antioxidant activity of fish protein hydrolysates.</p> <p>Fish lipids - recovery from fish liver and meat</p> <p>Properties of chitin and chitosan.</p> <p>Properties of raw materials used for fish preparations production</p> <p>Enzymes used for protein hydrolysis and for recovery of food components.</p> <p>Technology of fish protein isolates.</p> <p>Protein and amino acids concentrates from fish.</p> <p>Bioactive peptides obtaining from fish waste.</p> <p>Enzymes received from marine sources.</p> <p>Application of protein isolates and concentrates in food industry.</p> <p>Technology of fish lipids concentrates.</p> <p>Chitosan obtaining from fish.</p> <p>Properties and the application of biopreparates from fish.</p> <p>Determination of quality parameters of preparations obtained from fish.</p> <p>Selection of processing method depending of raw material.</p>		
Assessment methods	<p>lecture with use of multimedia, discussion</p> <p>project</p> <p>project</p> <p>written exam</p>		
Recommended readings	<ol style="list-style-type: none"> 1. Marine Nutraceuticals and Functional Foods, CRC Press, Boca Raton London New York, 2008, Ed. C. Barrow, F. Shahidi 2. Seafood Enzymes, Marcel Dekker Inc., New York, 2000, Ed. N.F. Haard, B.K. Simpson 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 4. Chemical and Functional Properties of Food Components, CRC Press, Boca Raton London New York, 2007, 3, Ed. Z.E. Sikorski 		
Knowledge	Student know the basics of chemical composition, functional and nutritional properties of fish derived preparations. Student knows production methods of isolates, concentrates and biopreparates from fish and their application in industry.		
Skills	Student is able to choose appropriate technology and enzymes for protein hydrolysis and for recovery of food components.		
Other social competences	Student is able to design the methods of biopreparates from fish production depending of raw material, including recovery of value constituents from fish waste.		

Course title	MEAT TECHNOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Małgorzata Sobczak	E-mail address to the person	Malgorzata.Sobczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-5	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	<p>Sharing the knowlege and skills related to breed of farm animals pre-/postslaughter handling.</p> <p>Sharing the knowledge and skills related to carcass evaluation and postmortem changes in muscles.</p> <p>Sharing the knowledge and skills related to principles of meat processing.</p>		
Entry requirements	<p>Student should know: basic of food technology, process engineering, chemistry, biochemistry and food analysis.</p> <p>Student can develop the results of an experiments and can look up and browse available literature resources.</p>		
Course contents	<p>Introductory classes</p> <p>Carcass dressing</p> <p>Selection and grading of raw material</p> <p>Defective meats</p> <p>Production of cooked meat sausages</p> <p>Effects of different technological factors on meat sausage quality</p> <p>Cooked ham production</p> <p>Production of precooked meat products</p> <p>Effects of heating methods on meat quality</p> <p>Summary</p> <p>Introduction of slaughter technics and post-slaughter handling</p> <p>Conversion of muscle into the meat</p> <p>Non-meat ingredients in meat processing</p> <p>Meat storage and preservation</p> <p>Categories of processed meat products</p> <p>Fermented sausages and dry cured ham</p> <p>Principles of production of cooked sausages, cooked hams, precooked meat products, ground meat products and canned products.</p> <p>Summary and exam</p>		
Assessment methods	<p>Lecture with comprehensive use of mulimedia.</p> <p>Laboratory practical classes in groups (experiment, observation), report from classes supported with conclusions.</p> <p>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 appropriate conclusions.</p> <p>Writing credit test with open questions concerning the content taught in classes.</p> <p>Assesment of group work.</p>		
Recommended readings	<ol style="list-style-type: none"> 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	PESTS IN FOOD INDUSTRY AND THEIR CONTROL		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agata Witczak	E-mail address to the person	Agata.Witczak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-15	ECTS points	6
Semester	winter/summer	Language of instruction	polish
Hours per week	3	Hours per semester	45
Objectives of the course	Theoretical and practical study the problems related with the presence of pests. Learning about preventive methods and methods of control		
Entry requirements	Knowledge of biology, rudiments of hygiene and toxicology, food technology		
Course contents	<p>safety in the lab and organization of work</p> <p>food testing for the presence of pests</p> <p>Typical damage of plant materials caused by pests</p> <p>Examples of food-borne illness in which an indirect role played by storage pests</p> <p>The determination of biocids impact on pests</p> <p>Examine the contents of certain products of pests metabolism in raw materials and foodstuffs. The estimation results of this research in terms of health hazard to the consumer</p> <p>Presentation of reports and project. Discussion. Examination</p> <p>Pests typical for raw material and foodstuff warehouses and fodder storage facilities</p> <p>Quantitative and qualitative losses in food infested by pests</p> <p>Plant protection in agriculture and the adequate warehouse protection against pests.</p> <p>Methods of pest control</p> <p>Identification of pests and parasites present in food. Identification of pests by the type of damages resulting from their activities</p> <p>Knowledge of means applied in control of warehouse pests</p>		
Assessment methods	<p>informative lecture</p> <p>Laboratory</p> <p>Discussion</p> <p>checking preparation for classes</p> <p>final exam</p>		
Recommended readings	<p>1. John Charlton, Isabel Sampson, Moray Anderson, Mike Rimmer, Pest control procedures in the food industry, England, 2009, 2009</p> <p>2. 1. Hill D.S., Pests of Stored Foodstuffs and Their Control, Springer Netherlands, 2002, ISBN: 978-1-4020-0735-4. DOI 10.1007/0-306-48131-6, 2002</p>		
Knowledge	Theoretical study the problems related with the presence of pests. Learning about preventive methods and methods of control		
Skills	Practical study the problems related with the presence of pests. Learning about preventive methods and methods of control		
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	PLANT TECHNOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Katarzyna Felisiak	E-mail address to the person	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-8	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	<p>Introduction to laboratory exercises</p> <p>Effect of processing on color changes in selected vegetables.</p> <p>Production of French fries and potato chips.</p> <p>Production of jam and assessment of sensory properties</p> <p>Technology of compotes.</p> <p>Technology and sensory assessment of fruit and vegetable juices.</p> <p>Sensory assessment and determination of acidity and vitamin C content in soured cabbage.</p> <p>Technology of pickles.</p> <p>Technology of wheat bread.</p> <p>Sensory assessment of cocoa products and chocolates production.</p> <p>Chemical composition and nutritional value of fruits and vegetables and methods used for their determination.</p> <p>Classification of fruit and vegetable semi-products, the technology of their production.</p> <p>Methods of fruit and vegetables preservation.</p> <p>Potatoes classification and technology of fried potato products.</p> <p>Starch production and application in food technology.</p> <p>Production of jams with regard to the quality requirements for raw material and finished product.</p> <p>Technology of juices and their effects on human health.</p> <p>Technology of canned fruites and vegetables.</p> <p>Technology of pickles and soured vegetables.</p> <p>Technology of bakery products.</p> <p>Cocoa and chocolate technology.</p>		
Assessment methods	<p>lecture with use of multimedia, discussion</p> <p>project</p> <p>laboratory excercises</p> <p>test, reports</p> <p>continuous assessment of activity on classess</p> <p>project</p> <p>written exam</p>		
Recommended readings	<p>1. Li T.S.C., Vegetables and Fruits. Nutritional and Therapeutic Values, CRC Press, Boca Raton London New York, 2008</p> <p>2. Chemical and Functional Properties of Food Components, CRC Press, Boca Raton London New York, 2007, 3, Ed. Z.E. Sikorski</p> <p>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</p>		
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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Małgorzata Sobczak	E-mail address to the person	Malgorzata.Sobczak@zut.edu.pl
Course code (if applicable)	WNoZiR 3	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	SELECTED TOXICOLOGY PARTS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Artur Ciemniak	E-mail address to the person	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-41	ECTS points	6
Semester	winter/summer	Language of instruction	polish
Hours per week	4	Hours per semester	60
Objectives of the course	Acquiring the knowledge of the recent toxicological research and the applied modern methods of instrumental analysis		
Entry requirements	Knowledge of the rudiments of Biology, Biochemistry, Food Toxicology, Food Technology, Nutrition Physiology		
Course contents	<p>Practical knowledge of methods of the instrumental analysis and their significance in the modern toxicology</p> <p>Determination some compounds in tap water - as a source of toxins and deleterious substances.</p> <p>Detection and determination toxins of plants and animals</p> <p>Toxicological assessment of packaging materials and other materials in contact with food.</p> <p>Analysis of toxic compounds contents changes during the food processing and warehousing and the possibilities of deleterious substances occurrence.</p> <p>The significance of the analysis quality control in the toxicological research.</p> <p>Methods of the instrumental analysis and their significance in the modern toxicology. 2</p> <p>Tap water as a source of toxins and deleterious substances.</p> <p>Toxins of plants and animals.</p> <p>Toxicology of medicines and drugs.</p> <p>Toxicological assessment of packaging materials and other materials in contact with food.</p> <p>The transformations of the level of toxic compounds contents during the food processing and warehousing and the possibilities of deleterious substances occurrence</p>		
Assessment methods	<p>Informative lecture</p> <p>Discussion</p> <p>Laboratory</p> <p>Oral or written exam</p> <p>Continuous assessment of laboratory work</p>		
Recommended readings	<p>1. Klassen C.D., J.B.Watkins, Essentials of Toxicology, McGraw-Hill Publishing Company 2011; 2nd Edition. ISBN-13: 978-0071622400, 2011</p> <p>2. Nieman, Timothy A.; Skoog, Douglas A.; Holler, F. James, Principles of instrumental analysis, Pacific Grove, CA: Brooks/Cole. ISBN 0- 03-002078-6.Journals,, 1998</p> <p>3. Acta Scientiarum Polonorum - Technologia Alimentaria,, 2011, Journal</p> <p>4. Archiv of the Environmental Contamination and Toxicology, 2011, Journal</p>		
Knowledge	The student should be able to: describe the impact of conditions in food processing plants on the level of concentration of harmful substances in manufactured foods; identify and characterize addictive substances; select appropriate analytical methods and apply them in accordance with safety rules		
Skills	The student knows how to find, analyze and interpret information, formulate and justify conclusions. He can develop and implement the work schedule, knows how to develop and submit it in writing or verbally in English		
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	SEMINAR THESIS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	- Nauczyciel WNoZiR	E-mail address to the person	a@b
Course code (if applicable)	WNoZiR-3-37	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	TECHNIQUES OF MOLECULAR BIOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Remigiusz Panicz	E-mail address to the person	rpanicz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-36	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, proteins, 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	<p>During laboratory classes following topics/experiments will be discussed/performed:</p> <ul style="list-style-type: none"> • Isolation of nucleic acids, • Protein isolation, • Gel electrophoresis, • PCR and real-time PCR • Restriction enzymes • Bioinformatic data analysis • Sequencing. <p>During lectures following topics will be presented:</p> <ul style="list-style-type: none"> • Structure and function of biologically important molecules including DNA, RNA and proteins, • cDNA and genomic cloning, • Expression of cloned DNA • PCR - the gold standard in molecular biology • Next generation sequencing • Bioinformatics • Epigenetics • . . . 		
Assessment methods	<p>Lecture and laboratory</p> <p>Lectures</p> <p>Laboratory classess</p> <p>Continuous assessment (laboratory)</p> <p>Continuous assessment (laboratory)</p> <p>Exam</p>		
Recommended readings	1. Green M.R., Sambrook J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, 2012, 4th edition		
Knowledge	<p>Upon completion of this course students will be familiar with:</p> <ul style="list-style-type: none"> - molecular tools, - bioinformatic (computation) methods, - laboratory workflow, - sampling and sample preservation. 		
Skills	<p>Upon completion of this course the students will be able to:</p> <ul style="list-style-type: none"> - 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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Katarzyna Felisiak	E-mail address to the person	Katarzyna.Felisiak@zut.edu.pl
Course code (if applicable)	WNoZiR-3-47	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	<p>Raw materials in bakery and confectionary products technology</p> <p>Bread production</p> <p>The effect of flour type on the properties of pastry</p> <p>Sponge cakes technology</p> <p>Fillings and icing</p> <p>Technology of cream puffs</p> <p>Properties of chocolate</p> <p>Comparison of commercial and homemade halva</p> <p>Sugar free sweets</p> <p>Vegetable cakes</p> <p>Introduction. Characteristics of raw materials used for bakery and confectionary goods production</p> <p>Technology of bread production</p> <p>Technology of cakes</p> <p>Technology of candies</p> <p>Bakery and confectionery products popular in the world</p> <p>Trends in bakery and confectionery products. Sugar replacements</p> <p>Technology of chocolate and chocolate products</p>		
Assessment methods	<p>lecture with use of multimedia, discussion</p> <p>project</p> <p>laboratory practices</p> <p>test, reports</p> <p>continuous assessment of activity on classess</p> <p>project</p> <p>written exam</p>		
Recommended readings	<p>1. Chemical and Functional Properties of Food Components, CRC Press, Boca Raton London New York, 2007, 3, Ed. Z.E. Sikorski</p> <p>2. Beckett S.T., The Science of Chocolate, RSC Publishing, Cambridge, 2008</p> <p>3. Science and Technology of Enrobed and Filled Chocolate, Confectionery and Bakery Products, Woodhead Publishing, 2009, Ed. G. Talbot</p> <p>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</p> <p>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</p>		
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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Grzegorz Tokarczyk	E-mail address to the person	Grzegorz.Tokarczyk@zut.edu.pl
Course code (if applicable)	WNoZiR-3-48	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	<p>Technology of fish chips</p> <p>Technology of fish crackers</p> <p>Technology of fish sticks -a new type of snack</p> <p>Technology of fish extrusion products</p> <p>Technology of canned fish and vegetable salad</p> <p>Technology of canned fish and other aquatic organisms.</p> <p>Technology of tempura products</p> <p>Technology of dumplings stuffed with fish</p> <p>The use of seafood for the production of convenience food</p> <p>Fish as a potential source for snack and convenience food technology</p> <p>Heat processing in snack and convenience food technology</p> <p>Technology of snack foods using meat from aquatic organisms</p> <p>Technology of fish chips</p> <p>Technology of fish crackers</p> <p>Technology of fish stick - a new kind of snack</p> <p>Technology of extrusion products with fish meat</p> <p>Technology of convenience food</p> <p>Technology of fish and vegetable salads.</p> <p>Technology of canned fish products</p> <p>Designing of convenience, functional and fortified foods based on aquatic organisms.</p>		
Assessment methods	<p>Expository methods (lecture, explanation or clarification)</p> <p>Activity method (discussion related to the lecture)</p> <p>Exposing method (movie related to the lecture)</p> <p>Practical method (demonstration, workshop and laboratory)</p> <p>formative - continuous assessment</p> <p>formative - observation of students activity during laboratories</p> <p>summarising - written or oral exam</p>		
Recommended readings	<p>1. E.W. Lucas, L.W. Rooney (Eds.), Snack Food Processing, CRC Press LLC, Boca Raton, 2001</p> <p>2. I.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</p> <p>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</p> <p>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</p>		
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	third cycle		
Teaching method	laboratory course		
Person responsible for the course	Artur Ciemniak	E-mail address to the person	Artur.Ciemniak@zut.edu.pl
Course code (if applicable)	WNOZIR-3-17	ECTS points	6
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 Fizzology of Fish		
Course contents	<p>Principles of safety and health at work and the organization of exercises.</p> <p>The reaction hydrobiont to toxic substances contained in the water. The research methodology of poisoning incidents on the aquatic environment</p> <p>Breeding test organisms, the terms and conditions</p> <p>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</p> <p>Analysis of the concentration of selected xenobiotics in biotic and abiotic elements of aquatic ecosystems. Methods of chemical analysis and instrumental.</p>		
Assessment methods	<p>Practical exercises</p> <p>Continous assesment</p>		
Recommended readings	<p>1. Lander L., Chemicals in the aquatic environment: Advanced Hazard Assesement, Springer-Verlag, Berlin Heidelberg, 1989</p> <p>2. Lam P., B. Richardson, R. Wu, Introduction to Ecotoxicology, Blackwell Science Ltd., London, 1999</p>		
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	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Agnieszka Tórz	E-mail address to the person	Agnieszka.Torz@zut.edu.pl
Course code (if applicable)	WNoZiR-3-18	ECTS points	6
Semester	winter/summer	Language of instruction	english
Hours per week	4	Hours per semester	60
Objectives of the course	Acquire knowledge of estimation of chemical conditions of the waters of Recirculated Aquaculture Systems (RAS). Acquire knowledge of aquaponic and using microalgae for waters purification.		
Entry requirements	Basic knowledge of biology, chemistry and ecology		
Course contents	<p>Preparation of Recirculated Aquaculture System with chosen fish species</p> <p>Estimation of waters conditions in Recirculated Aquaculture System (estimation of oxygen conditions, concentrations of biogenic compounds, concentration of organic matter)</p> <p>Estimation of efficiency of nitrification process</p> <p>Preparation of Recirculated Aquaculture System with plants (purification of waters in Aquaponic System)</p> <p>Estimation of waters conditions in Aquaponic System (estimation of oxygen conditions, concentrations of biogenic compounds, concentration of organic matter)</p> <p>Preparation of particular paper of waters conditions in RAS and Aquaponic System</p> <p>Basic knowledge of law regulations in waste water management in aquaculture</p> <p>Kinds of waste in aquaculture</p> <p>Biological methods of waste water purification (process of carbon, nitrogen and phosphorus elimination)</p> <p>Aquaponic Systems as a kind of waters savings</p> <p>Kinds of Aquaponic Systems</p> <p>Using microalgae in purification of waste waters in Recirculated Aquaculture Systems</p>		
Assessment methods	<p>lectures with multimedial instruments</p> <p>working at the chemical laboratory</p> <p>preparation of the paper</p> <p>observation of students activity during laboratories</p> <p>observation of students working in cooperation</p> <p>estimation of paper</p>		
Recommended readings	<ol style="list-style-type: none"> 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	Student will get knowledge how to design and perform experiments, including results analysis.		