Faculty of Environmental Management and Agriculture

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	BIOCHEMISTRY	Arkadiusz Telesiński	winter/summer	5	45
2	ECOTOXICOLOGY	Arkadiusz Telesiński	winter/summer	5	45
3	EDIBLE FLOWERS	Kamila Bojko	winter/summer	5	40
4	FRUIT-GROWING	Piotr Chełpiński	winter/summer	5	45
5	MATHEMATICAL MODELING	Arkadiusz Telesiński	winter/summer	5	40
6	MATHS	Arkadiusz Telesiński	winter/summer	5	45
7	MEDICINAL AND AROMATIC PLANTS	Kamila Bojko	winter/summer	5	45
8	NATURAL ANTIOXIDANTS IN HORTICULTURAL CROPS	Arkadiusz Telesiński	winter/summer	4	30
9	NON-AGRICULTURAL SOURCES OF BIOMASS	Grzegorz Jarnuszewski	winter/summer	1	12
10	PLANT TISSUE CULTURES	Danuta Kulpa	winter/summer	6	60
11	POSTHARVEST BIOLOGY AND TECHNOLOGY OF FRUITS AND VEGETABLES	Kamila Bojko	winter/summer	5	45
12	PROCESSING TECHNOLOGIES OF HERBAL PLANTS	Kamila Bojko	winter/summer	5	45
13	QUALITY ASSESSMENT OF SELECTED HORTICULTURAL CROPS	Kamila Bojko	winter/summer	4	30
14	WATER CHEMISTRY	Hanna Siwek	winter/summer	4	30

Course title	BIOCHEMISTRY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Arkadiusz Telesiński	**E-mail address to the person**	Arkadiusz.Telesinski@zut.edu.pl
Course code (if applicable)	WKSiR-3-1	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	The aim of Biochemistry is to understand life in molecular terms. The goal this course is possibility to describe the structure, organization, and functions of living matter in molecular terms. What are the chemical structures of the components of living matter? How do the interactions of these components give rise to organized supramolecular structures? How does living matter extract energy from its surroundings in order to remain alive? How are chemical reactions controlled inside living cells? There are the kinds of questions being answered by someone have been finished this course.The aim of Biochemistry is to understand life in molecular terms. The goal this course is possibility to describe the structure, organization, and functions of living matter in molecular terms. What are the chemical structures of the components of living matter? How do the interactions of these components give rise to organized supramolecular structures? How does living matter extract energy from its surroundings in order to remain alive? How are chemical reactions contr		
Entry requirements	To understand Biochemistry, one must first study basic chemistry and cell biology. In addition, an understanding of the basic thermodynamic principles is essential for learning how plants derive energy from sunlight and how animals derive energy from food.		
Course contents	Characteristic reactions of amino acids Characteristic reactions of proteins Characteristic reactions of nucleic acids Characteristic reactions of carbohydrates Characteristic reactions of lipids Determination of some oxidoreductases and hydrolases Determination of some vitamins Determination of plant secondary metatabolites: polyphenols and flavonoids Determination of plant secondary metabolites: alkaloids Two types nucleic acids (DNA and RNA), – propertis and functions nucleotides and nucleic acids (replication, transcription, translation). Proteins – (amino Acids, peptides and the peptide bonds, polipeptides). The primary level of protein structure. The three-dimensional structure of proteins. Carbohydrates (monosacharides, oligosacharides, polysacharides). Lipids, membranes, and cellular transport. Enzymes: biological catalysts (vitamins as procoenzymes, metals as enzymatic cofactors, classification of protein enzymes, regulation of enzyme activity). Introduction to metabolism. Carbohydrate metabolism I. Anaerobic processes in generating metabolic energy (Glycolysis – reactions and regulation). Metabolic fates of pyruvate. Oxidative processes: Citric Acid Cycle and Pentose Phosphate Pathway. Electron transport, oxidative phosphorylation, and oxygen metabolism. Carbohydrate metabolism II. Biosynthesis (gluconeogenesis, glikogen biosynthesis). Photosyntesis. Lipid metabolism: Fatty acids, triacylglicerols, and lipoproteins. Plant secondary metabolism		
Assessment methods	Lectures Laboratories Pass laboratory conspects Tests		
Recommended readings	1. Mathews C.K., van Holde K.E., Ahern K.G, Biochemistry 2. Stryer L., Biochemistry 3. Nelson D.L., Cox M.M., Lehninger Principles of Biochemistry		
Knowledge	The student knows the structure of macromolecules and can discuss their metabolism		
Skills	Student uses basic biochemical concepts and can assay of macromolecules		
Other social competences	Student can work in a team and demonstrate the ability to work in the laboratory division		

Course title	ECOTOXICOLOGY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Arkadiusz Telesiński	**E-mail address to the person**	Arkadiusz.Telesinski@zut.edu.pl
Course code (if applicable)	WKSiR-3-2	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	After finishing the course students should know basic principles of toxicology. Students have ability to describe adsorption, distribution, biotransformation and excretion of xenobiotics and also the influence of toxic agents on live organisms. Furthemore they should know the problems of the influence of the antropogenic pollution and accumulation of xenobiotics in environment. Students should have a knowledge about such pollutants as: nitric compounds, heavy metals, pesticides, fluoride and dioxin. Moreover student should be able to assess toxicity of xenobiotics with using of toxicity tests.		
Entry requirements	Basic knowledge about environmental protection and chemistry		
Course contents	Soil enzymatic activity as indicator of contamination with heavy metals Phytotoxicity tests Parameters of oxidative stress as response of plants to soil contamination Chromatographic metods to determine organic compounds in environmental samples Potentiometric methods to determine fluoride contents in environmental samples Basic principles of toxicology Problems of the industrial pollution effect on livestock and animals health as well as accumulation of the toxins in environment Influence of the intensive use of the fertilizers and pesticides on the toxicity of fed; toxicological analysis, toxicity tests, selected issues in ecotoxicology		
Assessment methods	Lectures Laboratories Pass laboratory conspects Test		
Recommended readings	1. Walker C.H., Hopkin S.P., Sibly R.M., Peakall D.B., Principles of ecotoxicology., CRC Press, 2005 2. Hoffman D.J. [eds.], Handbook of ecotoxicology., CRC Press		
Knowledge	Student has a basic knowledge of xenobiotics and their fate in the environment and the negative impact on man and the individual elements of ecosystems.		
Skills	The student can choose the basic measurement techniques for the assessment of ecotoxicity of various pollutants		
Other social competences	The student can work in a team and demonstrate the ability to work in the laboratory division		

Course title	EDIBLE FLOWERS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Kamila Bojko	**E-mail address to the person**	kamila-bojko@zut.edu.pl
Course code (if applicable)	WKSiR-3-3	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	40
Objectives of the course	Providing knowledge of edible flower species and methods of their cultivation Providing knowledge of biological value of edible flowers Providing knowledge of processing and storage methods of edible flowers		
Entry requirements	Basic knowledge of horticultural crops		
Course contents	Biologically active compounds of edible flowers. Methods of storage and processing edible flowers Characteristics of the main species of edible flowers Growing methods of edible flowers Methods of storage and processing edible flowers Culinary usage of edible flowers in different cuisines of the world		
Assessment methods	Lecture / multi-media presentation Discussion Completion of the assignments Laboratory exercises Interpretative analysis of the laboratory exercise results Project method / report Conversational lecture Demonstration - Presentation of the collection of edible flower species at the Department of Horticulture WUT Performance in lectures and laboratories Assessment of the participation in the conversational lecture Assessment of the participation in the discussion Written exam Assessment of the homework assignments Assessment of laboratory work skills Report		
Recommended readings	1. Creasy R., The edible flower garden, Periplus Editions (HK) Ltd., Boston, 1999 2. Roberts M., 100 Edible & Healing Flowers, Struik Nature, Cape Town, South Africa, 2014		
Knowledge	Student has knowledge of the main edible flower species, methods of their cultivation, storage and processing Student has knowledge of biological value of edible flowers		
Skills	Student has skills to adjust the specific methods of storage and processing to the particular species of edible flowers		
Other social competences	Student is aware of the importance of increasing the horticultural crop assortment and introducing new technologies supporting the nutritional and pro-health value of food		

Course title	FRUIT-GROWING		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Piotr Chełpiński	**E-mail address to the person**	Piotr.Chelpinski@zut.edu.pl
Course code (if applicable)	WKSiR-3-4	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Getting to know the species and cultivars of fruit plants.Familiarization with the requirements and principles of cultivation of various species of fruit plants Getting Acquainted with modern technology fruit crops. Acquainted with modern models orchards and beries plantation and the functioning of modern fruit farms		
Entry requirements	Knowledge of morphology, anatomy and systematics of plants, knowledge of the regulation of life processes of plants, knowledge of pathogens on plants, basic physico-chemical properties of soils and fertilizers		
Course contents	Pomology. Pomology Models orchards and beries plantation Location orchards and plantations. Choosing a position, production rules. The assortment of species and functional characteristics of fruit (shape, size, color, destiny fruit). Principles of operation of the farm orchard T-A-1 Basics of regulating the growth and flowering and the protection of trees and shrubs.10 25 T-W-1 Requirements and cultivation of various species of trees and shrubs - the soil, mineral nutrition, irrigation. Location orchards and plantations. Choosing a position. Rules of production 25 T-A-1 Tree protection against external influences - hail, rain, birds.8 T-A-2 Pomology 7 T-W-1 Location orchards and plantations. Choosing a position, production rules.		
Assessment methods	Methods of feeding (lecture informative, conversational) Activating methods (didactic discussion related to the lecture) Methods exposing (figures, tables, photographs, collections of plants) practical methods (display) the Methods for evaluating (F - forming) FS-1 test F S-2 recognition of plants exam (summary form)		
Recommended readings	1. . T. Wallace & R.G. W. Bush., Modern Commercial Fruit Growing., 2009 2. . Adams C. K., Principles of Horticulture., Butterworth-Heinemann, 2008		
Knowledge	student has knowledge of species and cultivars of fruit and their requirements Student has knowledge about cultivation and production organization in fruit-growing.He has knowledge of species and varieties of fruit and their requirements Student knows the modern technologies of cultivation of trees and bushes		
Skills	The ability to identify species and varieties of fruit plants. The ability of cultivation of fruit trees and bushes The ability diagnostics hazards in the production process student has the basic ability to manage production orchard		
Other social competences	student is versed in current trends and production technologies jn fruit-growing student is aware of the production of high-quality fruit. student is able to organize work in a team		

Course title	MATHEMATICAL MODELING		
Level of course	third cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Arkadiusz Telesiński	**E-mail address to the person**	Arkadiusz.Telesinski@zut.edu.pl
Course code (if applicable)	WKSiR-3-5	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	40
Objectives of the course	The aim of the course is to provide methods and tools for modeling and analysis of dynamic models described by ordinary differential equations and partial.		
Entry requirements	Basic knowledge of linear algebra, mathematical analysis and theory of probability		
Course contents	Introduction - purpose and scope of modeling, basic definitions. Stages of modeling. Formal description, assumption, model, scale, algorithm, simulation. Model verification Local and global formulation. Scale effect. Deterministic and random models. Static and dynamic models. Analytical and numerical methods of solving. Modeling with differential equations. Optimization methods in modeling. Sensitivity analysis. Reminder knowledge of differential and integral calculus. The concept of the model. Linear and nonlinear models. Static and dynamic models. Models of deterministic and non-deterministic. Models of continuous and discrete. Basic operators. Transform of Laplace, Fourier and Z. Modeling interference. The concept of stochastic processes. Smoothing, filtering and prediction. Ordinary differential equations. Uniqueness of solutions. Initial and boundary conditions. Linear equations. Bringing higher-order equations to a system of first order equations. Matrix derivatives. Compartmental models. Models with fixed parameters. The models of the first, second, third and fourth order. Examples of models of real systems. Properties of compartmental models. Tasks reverse. Traceability parametric models. Regularization. Problems properly defined. Sensitivity and conditioning tasks. The models in the form of state equations. The structure of the model. Partial differential equations. General solution. Initial and boundary conditions. Uniqueness of the solution. The most important types of partial differential equations of second order. General partial differential equation of second order. Classification of linear equations of second order. Basic methods of solving second-order equations: the method of characteristics, method of separated variables, examples. Basic numerical methods for solving linear partial differential equations: finite difference method, Galerkin method, finite element method. The use of Fourier transform for solving equations with boundary conditions. Application of the Laplace transform to solve equations with initial conditions.		
Assessment methods	Lectures Workshops Self solving mathematics tasks Evaluation of self solving mathematics tasks Test		
Recommended readings	1. R. Illner et al., Mathematical Modelling: A Case Studies Approach, AMS, 2005 2. E. Bender, Introduction to Mathematical Modelling, Dover, 2000 3. J. Kapur, Maximum-entropy Models in Science and Engineering, Wiley, 1989		
Knowledge	Student has basic knowledge of mathematics		
Skills	Student can solve mathematical modeling tasks		
Other social competences	Student is aware of the importance of mathematical modeling in life sciences		

Course title	MATHS		
Level of course	third cycle		
Teaching method	lecture / workshop		
Person responsible for the course	Arkadiusz Telesiński	**E-mail address to the person**	Arkadiusz.Telesinski@zut.edu.pl
Course code (if applicable)	WKSiR-3-6	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	The aim of the course is to acquaint the student with the basic methods of linear algebra and mathematical analysis appearing in the sciences of life. After the course the student should demonstrate: knowledge of basic operations on matrices, the ability to solve systems of equations for calculating the limits of sequences and functions, examination of a function and the calculation of basic integrals.		
Entry requirements	Basic mathematical knowledge		
Course contents	Complex numbers (basic algebraic properties, geometric interpretation of complex numbers) Elements of linear algebra (addition, multiplication, and matrix inversion, solving systems of linear equations) The definition of numerical sequence of numbers, basic operations on strings, over the border, series of numbers Continuity and derivative functions, properties and its use of derivative. Extremes function, the study of a function Indefinite and closed integrals Linear equations. Solving linear equations (Gauss-Jordan algorithm). Matrices. Equality of matrices. Addition of matrices. Scalar multiple of a matrix. Matrix product. Linear transformations. The identity matrix. Non–singular matrix. Symmetric and skew–symmetric matrix Determinants. Minors. Cramer’s rule. Complex numbers. Geometric representation of complex numbers. Complex conjugate. Modulus of a complex number. Ratio formulae. Argument of a complex number. De Moivre’s theorem. Function limits and continuity. Operations on limits. Rational functions. Monotone functions. Derivatives of functions of one real variable. L'Hopital’s rule. Function extremes. Study of function. Integrals. Indefinite integrals. Riemann's integrals.		
Assessment methods	Lectures Workshops Self solving mathematics tasks Evaluation of self solving mathematics tasks Test		
Recommended readings	1. Williams G., Linear algebra with applications, 2014 2. Malik S.C., Arora S., Mathematical analysis, 2009		
Knowledge	Student has knowledge about basics of linear algebra and analysis of one real variable functions		
Skills	Student can solve mathematics tasks		
Other social competences	Student is aware of the importance of mathematics in life sciences		

Course title	MEDICINAL AND AROMATIC PLANTS		
Level of course	third cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Kamila Bojko	**E-mail address to the person**	kamila-bojko@zut.edu.pl
Course code (if applicable)	WKSiR-3-7	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Providing knowledge of types of herbal materials and their nomenclature Providing knowledge of the major species of medicinal and aromatic herbs - their cultivation methods and properties		
Entry requirements	Basic knowledge of agriculture/horticulture		
Course contents	Detailed characterisation of the main medicinal and aromatic plant species: Arnica montana L., Ocimum basilicum L., Sambucus nigra L., Artemisia dracunculus L., Satureja hortensis L., Hypericum perforatum L., Echinacea purpurea (L.) Moench. Detailed characterisation of the main medicinal and aromatic plant species: Valeriana officinalis L., Lavandula angustifolia Mill., Origanum vulgare L., Levisticum officinale W.D.J. Koch, Origanum majorana L., Melissa officinalis L. Detailed characterisation of the main medicinal and aromatic plant species: Mentha x piperita L., Calendula officinalis L., Digitalis lanata Ehrh., Silybum marianum (L.) Gaertn., Capsicum annuum L., Atropa belladonna L. Detailed characterisation of the main medicinal and aromatic plant species: Urtica dioica L., Althaea officinalis L., Rosa canina L., Chamomilla recutita (L.) Rauschert., Salvia officinalis L. Detailed characterisation of the main medicinal and aromatic plant species: Thymus vulgaris L., Tanacetum parthenium (L.) Sch. Bip., Hyssopus officinalis L., Taraxacum officinale Web., Oenothera biennis L. The history and importance of herbal plant cultivation Types of herbal materials and their nomenclature Biologically active compounds of medicinal and aromatic plants Principles of herbal plant cultivation methods General principles of collecting herbal plants from their native habitats		
Assessment methods	Lecture / multi-media presentation Project method Demonstration - Presentation of raw plant materials (fresh or dried) Performance in lectures and workshops Assessment of homework assignments Assessment of project work Written exam		
Recommended readings	1. Brill S., Dean E., Identifying and harvesting. Edible and medicinal plants, Happer, New York, 1994 2. Peter K.V., Handbook of herbs and spices. Vol. 1 & 2, CRS Press, Cambridge, England, 2001		
Knowledge	Student has basic knowledge of herbalism - types of herbal materials, their nomenclature and biological activity Student has knowledge of the major species of medicinal and aromatic herbs - their cultivation methods and properties		
Skills	Student has skills to recognize the main medicinal and aromatic plants and describe their properties		
Other social competences	Student is aware of the importance of herbs in medicine as well as in the human diet		

Course title	NATURAL ANTIOXIDANTS IN HORTICULTURAL CROPS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Arkadiusz Telesiński	**E-mail address to the person**	Arkadiusz.Telesinski@zut.edu.pl
Course code (if applicable)	WKSiR-3-8	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	After finishing the course students should have ability to describe reactive oxygen species, their formation and effect on cells. Students should have knowledge about structure and properties of low-molecular antioxidant compounds. Furthermore they should be able to choose horticulture crops, which have high concentration of antioxidants.		
Entry requirements	Basic knowledge about vegetables, fruits and herbs; principles of botany, plant physiology and biochemistry.		
Course contents	Datermination of flavonoids Determination of plyphenols Determination of L-ascorbic acid Determination of antioxidant activity Determination of antioxidant capacity Production of reactive oxygen species in environment and organisms. Effect of reactive oxygen species on organisms, oxidative stress, hipermetabolism, organism ageing. Methods of determination of reactive oxygen species, oxidative stress and antioxidants. Characteristics of low-molecular antioxidants: tocopherols, polyphenols, glutathione, ascorbic acid and others. Fruits, vegetables and herbs containing high concentration of antioxidants and their functions in dietetics and pharmacy.		
Assessment methods	Lectures Laboratories Pass laboratory outlines Tests		
Recommended readings	1. Kaeney J.F.Jr. [eds.]., Oxidative stress and vascular disease, Kluwer Academic Press, 2001 2. Packer L., Ong A.S.H. [eds.]., Biological oxidants and antioxidants: molecular mechanisms and health effects., FSTA Direct, 1998		
Knowledge	Student has knowleadge about reactive oxygen species and antioxidants		
Skills	Student can determine antioxidants in plant material		
Other social competences	Student can work in the team		

Course title	NON-AGRICULTURAL SOURCES OF BIOMASS		
Level of course	third cycle		
Teaching method	lecturing course / laboratory course / lecture		
Person responsible for the course	Grzegorz Jarnuszewski	**E-mail address to the person**	Grzegorz.Jarnuszewski@zut.edu.pl
Course code (if applicable)	WKSiR-3-9	**ECTS points**	1
Semester	winter/summer	**Language of instruction**	english
Hours per week	0	**Hours per semester**	12
Objectives of the course	Student has knowledge of waste management and the use of post-production and waste biomass Student can recognize and select apply technology of biomass for energy purposes Student is aware of further training and the need constantly expand knowledge on the use post-production and waste biomass.		
Entry requirements	Basic knowledge of waste management methods of their management and disposal with the possibility of energy recovery.		
Course contents	Physico-chemical properties and morphological composition of selected wastes as a criterion of their usefulness for combustion Practical presentation of waste processing technology (ZPOiPPA NewCo). Characterization, division and origin of wood waste, furniture, sewage sludge, food and pulp and paper industry. Methods of using biomass from waste from non-agricultural activities.		
Assessment methods	Lectures/Multimedia presentations Laboratories/demonstration, synopsis elaboration test		
Recommended readings	1. Khanal S.K., Surampalli R.Y., Zhang T.C., Lamsal B.P., Tyagi R.D., Kao C.M., Bioenergy and biofuela from biowastes and biomas, American Society of Civil Engineers, Reston, Virginia, 2010 2. Dahiya A., Bioenergy: biomass to biofuels, Elsevier, 2015, ISBN: 978-0-12-407909-0		
Knowledge	Student has knowledge of waste management and the use of post-production and waste biomass.		
Skills	Student can recognize and select apply technology of biomass for energy purposes.		
Other social competences	Student is aware of further training and the need constantly expand knowledge on the use post-production and waste biomass.		

Course title	PLANT TISSUE CULTURES		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Danuta Kulpa	**E-mail address to the person**	Danuta.Kulpa@zut.edu.pl
Course code (if applicable)	WKSiR-3-10	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Explain the various components of plant tissue culture media, e.g. minerals, growth factors, hormones, and what governs the choice of components, Explain the various steps taken to establish and optimise media for particular purposes in particular species, without the aid of texts Explain and perform some of the more advanced techniques, e.g. embryo rescue, and protoplasting. Establish and maintain plants in tissue culture and micropropagation, including morphogenesis Investigate and define a protocol to establish an unknown species and test its response Explain the various cell lines used in tissue culture and their origins and uses		
Entry requirements	Knowledge of plant anatomy and physiology would be advantageous.		
Course contents	Preparation of solid and liquid media. Preparation and sterilization of explants. Mass micropropagation of healthy plants. Callus and cell culture. Suspension cultures in bioreactor. Presentation from selective scientific papers. History of plant tissue cultures. Micropropagation (preparative stage, initiation of cultures, shoot multiplication, elongation and rooting, transfer to greenhouse condition). Somatic embryogenesis and artificial seeds. Callus and suspension cultures. Secondary product formation in suspension cultures. In vitro cultures in palnt breeding.		
Assessment methods	Lecture/multi-media presentation. Project method. Demonstration. project work essays		
Recommended readings	1. Bhojwani S.S., M. K. Razdan., Plant tissue culture: theory and practice., Elsevier science, 1996		
Knowledge	Students know the basic knowledge of plant tissue cultures.		
Skills	The student is able to prepare the media and set up a sterile culture in vitro.		
Other social competences	Student is able to work in a team of people growing plants in cultures in vitro.		

Course title	POSTHARVEST BIOLOGY AND TECHNOLOGY OF FRUITS AND VEGETABLES		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Kamila Bojko	**E-mail address to the person**	kamila-bojko@zut.edu.pl
Course code (if applicable)	WKSiR-3-11	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Providing knowledge of storage methods of horticultural crops Providing knowledge of appropriate postharvest handling techniques for various fruit and vegetable species Shaping student ability to link quality changes in stored products with the methods and conditions of their storage		
Entry requirements	Basic knowledge of biochemistry, plant physiology, vegetable and fruit crops		
Course contents	Storage parameters for horticultural crops Changes occurring during storage - physical, chemical, biological, enzymatic and textural Changes in nutritional quality of fruits and vegetables during storage Quality characteristics of common fruits and vegetables according to their storage ability Storage methods / Controlled and modified atmospheres Chemical and physical treatments enhancing postharvest quality of fruits and vegetables Edible coatings Packing and packaging materials used for fruits and vegetables		
Assessment methods	Lecture / multi-media presentation Discussion Laboratory exercises Completion of the assignments Project method / report Performance in lectures and laboratories Assessment of the participation in the discussion Assessment of the homework assignments Assessment of laboratory work skills Report Final written exam		
Recommended readings	1. Paliyath G., Murr D., P., Handa A.K., Lurie S., Postharvest Biology and Technology of Fruits, Vegetables and Flowers, Wiley-Blackwell Publishing, USA, 2008 2. Wills R., McGlasson B., Graham D., Joyce D., Postharvest, UNSW Press, Syndney, Australia, 2007, 5th Ed.		
Knowledge	Student has knowledge of postharvest plant physiology, storage conditions and storage methods Student has knowledge of the treatments enhancing postharvest quality of horticultural crops and methods of preparing them for marketing		
Skills	Student has skills to adjust the specific methods and parameters of storage to the particular species of fruits and vegetables Student is able to assess the impact of the activities carried out during the storage process of horticultural crops		
Other social competences	Student is aware of the responsibility of high quality food production		

Course title	PROCESSING TECHNOLOGIES OF HERBAL PLANTS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Kamila Bojko	**E-mail address to the person**	kamila-bojko@zut.edu.pl
Course code (if applicable)	WKSiR-3-12	**ECTS points**	5
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Providing knowledge of herb drying technologies according to the quality of the final herbal product Providing knowledge of the major herb products Shaping student ability to implement methodologies for the evaluation of quality and traceability of medicinal and aromatic plants		
Entry requirements	Student is expected to have laboratory practices and knowledge base about plant raw materials (biochemistry, microbiology)		
Course contents	Quality estimation of medicinal and aromatic plants according to pharmacopoeial requirements – organoleptic evaluation Quality estimation of medicinal and aromatic plants according to pharmacopoeial requirements – macroscopic evaluation Quality estimation of medicinal and aromatic plants according to pharmacopoeial requirements – microscopic evaluation Quality estimation of medicinal and aromatic plants according to pharmacopoeial requirements – physicochemical evaluation Preparation of raw plant material for drying process Parameters and methods of the drying process of herbs The effect of the drying process on the biologically active compound content Production of plant extracts Essential oil production Forms of herbal medicines		
Assessment methods	Lecture / multi-media presentation Laboratory exercises Completion of the assignments Project method / report Performance in lectures and laboratories Assessment of homework assignments Assessment of laboratory work skills Essay Report Written exam		
Recommended readings	1. Barnes J., Anderson L.A., Philipson J.D., Herbal Medicines, Pharmaceutical Press, London, Chicago, 2007, 3rd Edition 2. Handa S.S., Khanuja S.P.S., Longo G., Rakesh D.D., Extraction Technologies for Medicinal and Aromatic Plants, International Centre for Science and High Technology, Trieste, 2008		
Knowledge	Student has a knowledge of herb drying technologies - the methods and their influence on the quality of the final herbal product Student has knowledge of the major herb products - their production methods and properties Knowledge and understanding the European legislation involved		
Skills	Student is able to implement methodologies for the evaluation of quality and traceability of medicinal and aromatic plants		
Other social competences	Student is aware of the importance of different herb processing methods on the quality and medicinal properties of the final product		

Course title	QUALITY ASSESSMENT OF SELECTED HORTICULTURAL CROPS		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Kamila Bojko	**E-mail address to the person**	kamila-bojko@zut.edu.pl
Course code (if applicable)	WKSiR-3-13	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Providing knowledge of organoleptic and laboratory methods of horticultural crop quality assessment Shaping student skills to assess the quality of fruits and vegetables according to the current standards		
Entry requirements	Basic knowledge of biochemistry, vegetable and fruit crops		
Course contents	Chemical analyses of selected horticultural crops Classification (botanical and horticultural), origin, structure, and quality standards of main horticultural crops Quality features (appearance, texture, flavour, nutritive value and safety) of fruits, vegetables and herbs.		
Assessment methods	Lecture / multi-media presentation Laboratory exercises Completion of the assignments Project method / report Performance in lectures and laboratories Assessment of the homework assignments Assessment of laboratory work skills Report Test		
Recommended readings	1. Preece J.E., Read P.E., The biology of horticulture, John Wiley & Sons, Inc., USA, 2005 2. Picó Y., Chemical analysis of food. Techniques and applications, Elsevier, USA, 2012, 1st Ed.		
Knowledge	Student has knowledge of organoleptic and laboratory methods of horticultural crop quality assessment Student has knowledge of legal regulations applied for the quality estimation of horticultural products		
Skills	Student has skills to assess individually the quality of fruits and vegetables and give the conclusions of obtained results according to the current standards		
Other social competences	Student is aware of the influence of different internal and external factors on the quality of food		

Course title	WATER CHEMISTRY		
Level of course	third cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Hanna Siwek	**E-mail address to the person**	Hanna.Siwek@zut.edu.pl
Course code (if applicable)	WKSiR-3-14	**ECTS points**	4
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To introduce the student to a knowledge of physical and chemical parameters of water and processes that control the composition of water in environments. To illustrate elementary chemical water analysis and to provide the student with a knowledge of data interpretation.		
Entry requirements	Taken at least one undergraduate course in general chemistry; Taken at least one undergraduate course in physics; Comfort with doing some math		
Course contents	Environmental sampling of water Basic characteristics of water: turbidity, pH, conductance The properties of buffer solutions Acid-base indication of water alkalinity and acidity. Indication of corrosivity of waters. Determination of Water Hardness using Complexometric titration Spectrophotometric determination of nutrients: nitrogen (ammonia, nitrate, nitrite) and phosphorus compounds in water Interpretation of chemical analyses Physical chemistry of water. Hydrogen bonds. Physical states and properties of water. Chemical properties of water. Mineral and gas solubility. Environmental water buffers. Physical and chemical characteristics of water. Standard methods of water analysis. Kinds of environmental waters and their essential characteristics.		
Assessment methods	multimedia lecture practical exercises Continuous asssessment, reports test discussion during the classes		
Recommended readings	1. Mark M. Benjamin, Water Chemistry, Waveland Press, New York, 2014 2. Patrick Brezonik, William Arnold, Water chemistry, Oxford University Press, xford, 2011		
Knowledge	Student has the knowledge of basic processes in natural waters and the ability to assess the usage of surface waters in particular purpose based on results of chemical analysis		
Skills	Student has a working knowledge in hydrochemical laboratory and establishes the basic physical-chemical parameters in water		
Other social competences	Student understands water pollution issues in a global and societal context and collaborates and solves problems in group.		